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under the theme "Inclusive, innovative and sustainable societies"

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Preface

The Research Summit 2023 took place on 12-14th July, under the theme *Inclusive, innovative and sustainable societies*.

It serves as a venue for stimulating meaningful discussion among the University of Aveiro's research community and fostering increased collaboration, which advances the state of the art and strengthens campus research initiatives.

Based on the assumption of a greater return to academia, Research Summit 2023 adopts a face-to-face model on the first day (plenary) as well as a face-to-face model on the following days (presentations by PhD students and 1st and 2nd cycle students).

This Book of Abstracts and Proceedings, of the Research Summit 2023, is the result of remarkable contributions from young scientists and PhD students working on the topics of the Doctoral Programmes of the University of Aveiro. Although the Research Summit 2023 is aimed at young researchers, senior researchers have also contributed to the success of the conference through their contributions, fostering discussion and collaboration in the research papers included in the book of abstracts and proceedings. The presence of senior scientists and PhD supervisors is very fruitful for all participants and it is hoped that young researchers and PhD students will benefit from this experience.

The organisers hope that this Research Summit 2023 was a remarkable opportunity for a fruitful exchange of ideas between the participants and a milestone in the history of the Forums at the University of Aveiro.

Artur M.S. Silva
A. Gil Andrade-Campos

Aveiro, Portugal, July 2023.

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Research Summit 2023
Research Forum of the University of Aveiro
$12–14^{th}$ July 2023, Aveiro. Portugal

Walking trails for people with chronic respiratory diseases: embracing inclusive societies

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Abstract. Walking trails can embrace different physical activity (PA) facilitators, such as, close proximity to their homes, easy accessibility, and flexibility to accommodate those with timetable constraints. In addition, by modifying elements like distance, inclusion of stairs/ramps, or altering the surface type, walking trails can be tailored and adjusted to suit the individual needs and capabilities of people with chronic respiratory diseases (CRD). Thus, walking trails offer a promising and inclusive community-based approach to enhance PA in the people with CRD. The CENTR(AR) project has created 70 urban and rural walking trails with different intensity levels, specifically designed for individuals with chronic obstructive pulmonary disease (COPD) at various disease severity levels. This study aimed to validate walking trails of light, moderate, and vigorous intensities in people with COPD and to explore their perception and experiences during the trails. This cross-sectional analysis included people with COPD who walked in pre-determined trails of light, moderate and vigorous intensity. To classify light, moderate, and vigorous PA intensity we used the modified Borg scale to assess dyspnoea and fatigue, the SenseWear to collect energy expenditure (EE), and the Polar heart rate (HR) monitor to assess HR. Quantitative differences among walking trails were explored using repeated-measures ANOVA or Friedman tests. Differences between PA intensity categories were explored using Cochran's Q test. Semi-structured interviews were conducted throughout the walking trails with all participants. Interviews were audio recorded, transcribed in full and analysed by deductive and thematic analysis. 20 people with COPD (71±7 years old, 80% male, FEV1 66.1±12.2%predicted) were included. Whereas dyspnoea (2.3± 1.5 vs. 2.7±1.6 vs. 2.6±1.4, p=0.13), HR (92.48±11.06 vs. 93.72±18.36 vs. 95.36±15 bpm, p=0.63), and EE (5.07±0.80 vs. 4.93±0.48 vs. 4.64±0.78 METs, p=0.05) were similar across walking trails, fatigue differed significantly among trails (2.9±1.2 vs. 3.4±1.4 vs. 3.1± 1.2, p=0.01). When considering intensity criteria altogether, all walking trails were considered safe and of moderate intensity for people with COPD. Participants experiences and perceptions towards the walking trails were very positive, as evidenced by the following quotes: "I feel good, it's a beautiful area, we have water, we have trees, we have greens, benches to rest and I see people and even some friends... I think it's great! It was a great thing to do these walks!"; "At weekends when I'm bored at home I come to the park, take the route most suitable for me, and breathe. And there's plenty of shade. We have water... and I always meet people. And when I'm a little tired or short of breath I can sit down. I feel really good!".
The walking trails developed under the CENTR(AR) project were deemed safe, valid and pleasant and can promote the practice of moderate physical activity in people with COPD. These trails are a promising inclusive strategy to maintain a physically active behaviour on a long-term. Expansion for a (inter)national cover is now warranted.

Keywords: *Walking trails, chronic respiratory diseases, inclusive societies.*

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Sustainability, inclusion and innovation: around vital teacher education pathways

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Abstract. Education for sustainability has privileged environmental education, ending up not achieving the intended goals. In this sense, it is important to educate for sustainability with other perspectives and ideas, ensuring an inclusive and quality education, creating "lifelong learning opportunities for all"(Goal 4 - Sustainable Development Goals), specially for teachers. This intervention presents the development and results of the TEDS project - Teachers educating for sustainability - , a partnership coordinated by the University of Aveiro with 5 institutions in different countries (Finland, France, Lithuania, Malta and Portugal) and which has been developed on the assumption that education for sustainability (EduS) must take on more holistic, comprehensive forms, linking issues of environmental education and attention to natural resources with issues of promoting equity and solidarity between individuals and communities, paying attention to linguistic and cultural diversity, inclusion and preparation for global dialogue, passing by aspects.
To move forward to the field work with teachers, TEDS team analysed the curricula of different countries to systematise the educational discourse on EduS, conceived and developed different teacher education programs and tried to focus on teaching professional knowledge about EduS.
The analysis of the data collected during the development of the TedP (questionnaires; individual written reflections; group reports; and projects developed with learners in schools; as well as multimodal case studies on teacher education for EduS) shows that participants gain a more holistic and critical conception of EduS, trying to innovate their teaching practices and taking into account a transformative and inclusive dimension of education.
In general, the results of the project indicate that the integration of EduS in teacher education contexts implies the construction of flexible teacher education scenarios, which can be built on the ten education principles: promote articulation with other types of education; promote the work in contexts; promote commitment and engagement; promote autonomy; conceived in an inter/multi/and transdisciplinary way; based on research and including it; integrate theory and practice; develop in a collaborative way; develop in a recursive and cyclical way; and promote future thinking.

Keywords: *Education for sustainability; teacher education programs teaching professional development.*

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Circular Polymers: contributions to a more sustainable society!

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Abstract. Polymeric materials, commonly known as plastics, are ubiquitous in our daily lives. They can be used in making simple household objects as food packages and on more sophisticated materials among biomedicine or electronics. Despite their exceptional properties (e.g., lightweight, durability, and versatility), they are predominantly synthesised from fossil resources, they are overused, and, moreover, they commonly have a non-circular fate after use, hence, raising severe pollution and climate changes issues [1]. In this context, Sousa team started a burgeoning surge for more sustainable approaches to polymers, both in terms of their i) origin by turning into renewable-based polymers [2] and ii) fate via (bio)degradation as well as by developing greener chemical recycling approaches [3].

In particular our group focused on the exploration of biomass derived key building-block chemicals such as, for example, the 2,5-furandicarboxylic acid (FDCA), in polymer synthesis and on their recycling. This work is on the spotlight and attracted EU funding through the COST Action FUR4Sustain (CA18220). In particular, our group demonstrated the potential of urea:zinc acetate deep eutectic solvent (DES) to assist the continuous, eco-friendly and closed-loop approach for recycling polyesters into virgin-quality recycled polymers [3].

Keywords: *Circularity, polymers, sustainable society.*

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Inclusive, Innovative and Sustainable Societies – Some Contributions from Extended Reality

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Abstract. Extended Reality (XR) is an umbrella term referring to Augmented Reality (AR), Virtual Reality (VR), and Mixed Reality (MR); it can be considered a form of computer-mediated reality (adding to, subtracting information from, or otherwise manipulating one's perception of reality through the use of computing technology) aiming to combine or simulate the physical world with a "digital twin world".
XR has been rapidly evolving and applied in a wide range of areas such as healthcare, science and engineering, education and training, remote work, etc. directly contributing to several United Nations sustainable development goals (such as # 3, 4, 8, 9). Lately, it has become more affordable and thus viable in many more use cases; yet, there are still many challenges, nonetheless providing great opportunities, some more related to the technology, but others related to their usage by humans (either at individual or social level). This presentation focuses on three recent works conducted at IEETA regarding AR for collaboration, MR for Industry and VR for Stroke rehabilitation.
The first work is more conceptual and consisted in proposing a taxonomy for AR-based remote collaboration, having for instance a remote expert supporting the field work of less experienced workers, increasing effectiveness and efficiency, allowing savings in travel time and expenses, and thus more sustainable solutions. On a more applied perspective, remote collaboration applied to maintenance scenarios has been studied and novel methods proposed.
The second work is an application of MR to manufacturing fostering the increase in productivity by decreasing time and errors, as well as waist, and speeding up new workers training. The picking use case, a typical use case where a worker may be supported by an MR application while gathering parts, has been studied and an application developed to support the workers' task. this type of application involves a previous configuration phase to place virtual objects in real world locations allowing their later visualization to support workers' tasks through content visualization, which can be done using different devices. A human-centred design approach was used, starting from the analysis of the problem including the users' needs, encompassing several design, evaluation and implementation cycles, including a field evaluation with real target users. The third work is about using VR-based serious games in post-stroke rehabilitation, an ever more relevant topic as stroke is a leading cause for disability worldwide and its prevalence is increasing as life expectancy increases. Stroke may leave many handicaps having a major impact in the life quality of the survivors and VR may provide multiple stimuli that can motivate and engage the survivors motivating them follow their rehabilitation programs. Yet developing such applications is very complex as if not properly designed and implemented they may jeopardize users' health and safety, moreover in this case the target users may have many limitations. Thus, a human-centred design approach is more important than ever, and a thorough study of the users and their needs is pivotal. Several VR-based serious games have been developed emulating daily life activities usually performed in the traditional stroke rehabilitation therapy, including the possibility of virtual mirror therapy, allowing patients practice movements with the non-affected limb while watching its mirror image and helping the brain rewire itself and strengthen the pathways that control hand function. These games have been tested by patients, survivors and health professionals and will be evaluated in a longitudinal study at the rehabilitation centre. In a nutshell, XR is evolving, it still has great challenges, yet offers great opportunities to contribute to Inclusive, Innovative and Sustainable Societies.

Keywords: *Extended Reality, Inclusivity, Innovation, Sustainable Societies*

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Music within everyone's reach: a transdisciplinary experience of expression and artistic co-creation as a way to combat the stigma of mental illness

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Abstract. Music and the arts have played a significant role in addressing social exclusion, particularly through what is defined as community art or participatory arts practices. The present study, in line with this philosophy and also with the artistic research or practice-based research, focuses on the stigma of mental illness and seeks to contribute to the development of literacy around this form of exclusion. It is associated to the project Paluí, está aqui? Histórias sonoras para cantos interiores (which is one of the several transdisciplinary studies, derived from the original musical work Paluí, developed by teachers and researchers of University of Aveiro) and aimed at: 1) the invention and conception of a musical and transdisciplinary show that, from an artistic and social point of view, would enable the construction, among all participants, of a common cultural project based on experiences of collaborative, performative, expressive and aesthetic involvement, in a dynamic of collective and inclusive creation and artistic interpretation; 2) the musical study of Paluí, the original work, and forms of scenic treatment, with a view to its: i) creative transformation into a unique artistic show; ii) possibility to be built, performed and created by all; iii) capacity to agglutinate, in a coherent whole, areas such as Drama, Dance, Video and Handicrafts. Music students, teachers and researchers of music, design and visual arts from Department of Communication and Art of University of Aveiro, Polytechnic Institut of Porto, a musician from Casa da Música, a group of children from a school of Aveiro (CIAQ) and users and patients from the Magalhães Lemos Hospital (Porto), a total of 129 elements, participated in the creation and realization of the show, which was presented at Ao Alcance de Todos festival, at Casa da Música (Porto), in 2019. The artistic results, materialized in improvisations and compositions of sound/music, drama, choreography, videography, scenic scripts, artifacts and instruments, interpretations and performances are realized and demonstrated throughout the collective process (about 6 months) and, especially, in two concerts recorded and published in two films (2020). Since the stigma of mental illness is a dimension and a perception of social exclusion, what is artistically realized by all participants, and the way how they achieved, also suggests interpreting the experience performed as a path of social construction and inclusion through musical and transdisciplinary imagination. Experiences like these, despite not being sufficient to eliminate or extinguish the stigma of mental illness, especially in the long term, seem to enable environments that are particularly significant and conducive to the construction of identity among people where positive and inclusive perceptions and attitudes also germinate. Thinking about the broader social meaning: even as a small contribution to the development of literacy in mental illness, what we managed to experience, feel and achieve allows us to reinforce that music and the arts, when governed by humanist values and social purposes, can constitute effective and meaningful paths for the construction of more inclusive, just, wise, creative and democratic societies.

Keywords: *Mental illness stigma, social inclusion, transdisciplinar show, musical cocriation, participatory arts practices, artistic research.*

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Design for Human-Centered Societies: Changing Societies into Preferred Ones & Relational antagonism: aesthetics for inclusive, innovative and sustainable societies

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Abstract. In 1971, Victor Papanek defended the idea that we all have in us the tools to design a better world since "All men are designers."In the same vein and a few years later (2015), this concept is further developed by Ezio Manzini, who suggests that "In a changing world, everybody designs."Within the scientific field of Design, it is agreed that at a certain level, we all do Design. However, does that mean that we are all designers?

We may all have the resources, but the activity of a designer (to be a designer) is mainly associated with the conscious that combines skills, thinking, and experience – the way we relate, practice and apply Design knowledge. According to Katja Thoring, it's on the 4 levels of Design knowledge – Artifact Knowledge, Design Intuition, Design Language, and Design Theories – that designers' activity is developed, especially in the transition between them. In this perspective, instead of stating that we are all designers, it would be more reasonable to clarify the role each stakeholder plays when assuming a human-centered design perspective in the redesign of "Inclusive, innovative, and sustainable societies."

In this presentation, we will address some of the possibilities of using our creative resources to design – or, as in Herbert Simon's (1996) words, "change existing situations into preferred ones."

In the era of the "sacredness of authenticity"(Gilles Lipovetsky), we not only value the uniqueness of subjects; we also value the uniqueness of artefacts. The (not so new) technologies have democratized production, generating the conviction that we are all capable of making. This leads us to a paradigm shift for science – the idea of "Enlivenment" (Andreas Weber), that "acknowledges the deeply creative, poetic and expressive processes embodied in all living organisms" (2013:7).

In this context, we argue that the relational antagonism present in some of the contemporary illustration can have a socio-plastic effect (Stépanhe Vial), as it reinvents worlds, transforms ways of doing and contributes to changing behaviors – thus educating for a more sensitive society, more inclusive and more receptive to the otherness.

Keywords: *Design, Human-Centered, Societies.*

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Linguistic perspectives on inclusive naming practices in Portugal

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Abstract. The process of assigning names in Portugal is strictly regulated. According to the law, first names must be of Portuguese origin, selected from the national onomastics or phonetically adjusted to suit the Portuguese language. The primary objective is to avoid any ambiguity regarding gender. However, the law does not offer explicit technical criteria for name adaptation or provide clear definitions of what constitutes a Portuguese name.
The Portuguese Institute of Registries and Notary frequently seeks assistance from linguists at CLLC to validate adaptations of foreign names and names that lack strong gender markers. Through an interdisciplinary study of inclusive naming practices, linguists can offer valuable insights and recommendations to policymakers, organizations, and communities. Their expertise can contribute to the development of naming guidelines that are inclusive, respectful, and representative of the diverse society.

Keywords: *Linguistic perspectives, inclusive, naming practices, Portugal.*

Food additives: friends or foes in a sustainable society?

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Abstract. Food additives are substances added intentionally to foodstuffs to perform certain technological functions (European Union, 2008). Only the substances listed in Annex II of that regulation may be placed on the market. The positive list of food additives approved consider their safety under a continuous re-evaluation process considering the new scientific knowledge and the population intake habits (European Union, 2010). In Europe, the safety in the food chain, from farm to fork, is assured by the European Food Safety Authority (EFSA) and ASAE is the authority in Portugal.
Many food additives have also been reported to have positive health effects for humans and animals when ingested in moderate and safe amounts. Examples are the colourant curcumin (E 100), the preservative propionic acid (E 280), the emulsifier lecithin (E 322), the antioxidant citric acid (E 330), and the sweetener xylitol (E 967). Because some food additives have been associated with allergies and discomfort when intaken, new quality related ingredients, formulations, and technologies are under development by a straight collaboration between academia and food industry. Processed foods tend to be healthy, tastier, affordable, and appealing, following concepts like "right for me" personalized food, food oriented to specific genders, ages, or lifestyle markets. The clean Label concept targets a total transparency labelling of food products, with less ingredients, minimization of the use of synthetic food additives, minimally processed foods, no allergen warnings, and no genetically modified organisms. LAQV-REQUIMTE has been involved in several projects with food industry seeking for clean label solutions by substituting synthetic additives by natural food ingredients. Examples are the development of polysaccharide films to produce sulfur dioxide free wines (Nunes et al., 2016) and vinegar; brewers spent yeast glucans and mannoproteins as emulsifiers in vegan mayonnaises (Reis et al., 2023); inulin-rich tuberous roots and derived fructooligosaccharides able to replace sucrose added in processed jams for use in dairy products; and gelatinized starch derivatives as replacers of titanium dioxide in candies and other white foods.
As a conclusion, this talk is a demonstration that research, innovation, and a balanced and varied diet allow to promote the better use of food additives, mitigating their presence when not necessary.

Keywords: *Food additives, sustainable society, health effects, LAQV-REQUIMTE.*

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Laser Processing as a Tool Towards Responsible Electronics

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Abstract. In recent years, the field of electronic device production has witnessed a paradigm shift towards sustainable practices. As the demand for electronic devices is expected to rise exponentially in the next few decades, fueled by the internet-of-things, and the environmental concerns grow accordingly, the industry and academic players are focusing on the development of new materials and processes that limit environmental impact. This emerging field is broadly denominated as "responsible electronics" and aims to eliminate or partially reduce the reliance on traditional unsustainable materials and processing techniques, such as clean-room processing, looking for sustainable alternatives that ensure social and environmental responsibility throughout the entire lifecycle of electronic devices. Responsible electronics envisages a significant decrease in energy consumption, waste generation and greenhouse gas emissions and offers opportunities to improve the recyclability and reusability of electronic devices, fostering a circular economy. Nevertheless, extensive research and development is still needed in order to ensure the mandatory performance, reliability and scalability of new sustainable technologies for successful integration into electronic manufacturing.
Laser processing techniques are already playing a significant role in responsible electronics due to their precision, contact-free operation, energy and resource efficiency, versatility and flexibility. Presently, they are mainly used in the electronics industry for cutting, engraving and etching operations. Nevertheless, laser techniques also offer the possibility to produce and process new sustainable functional (nano)materials for electronic device production. They can be used with a wide range of materials, namely metals, ceramics, polymers and organic compounds, which in many cases are not compatible with the traditional clean-room processing techniques. Yet, many of those materials are an integral part of the (responsible) electronics of the future.
This presentation aims to give an introductory view on the field of responsible electronics and on the role that laser processing techniques can play towards that goal. Case studies [1-7] with prototype devices produced via laser processing at i3N - namely in the Laser Processing Laboratory of the Physics of Advanced Materials and Devices (PAMD) group - are presented and briefly discussed.

Keywords: *Laser Processing, Tool, Responsible Electronics.*

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From Accessibility to Autonomy: Exploring the Potential of Assistive Technologies in Creating Inclusive, Innovative and Sustainable Societies

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Abstract. Around 15% of the world's population lives with disabilities, making it necessary to create a more accessible world to promote their effective inclusion (ITU, 2021). Accessibility is critical to enabling people with disabilities to live independently and participate actively in various aspects of life. This includes physical accessibility, such as buildings and transportation, and access to information and communication, including in the digital domain (Kulkarni, 2019).
Despite progress, people with disabilities still encounter numerous barriers to using digital technologies due to various factors. For example, people with visual impairments struggle with inadequate image descriptions, complex website navigation, and inaccessible video content. People with physical disabilities have difficulties using websites that do not allow full control of the keyboard, do not integrate well with different assistive technologies, or impose inappropriate time limits for completing tasks. Similarly, people with hearing difficulties face obstacles related to limited transcription, the absence of subtitles for audio content, and challenges in using voice-dependent digital tools and services. People with cognitive and neurological impairments face obstacles due to complex website navigation, long and complex sentences, and content without images.
Assistive technologies can help people with disabilities overcome daily obstacles in navigating difficulties in communicating and accessing environments, education, work, and living independently (Tymoshchuk et al., 2022).
To address the pressing issue of digital accessibility, the eHealth and Wellbeing group of the DigiMedia Research Centre has run several projects. Its latest initiative, "Espaço Inclui"(Space Includes), is a collaborative effort between the University of Aveiro and the Altice Foundation. The project aims to create a Center for testing, training, and using assistive technologies, promoting accessibility for students, teachers, and the community in general.
The "Espaço Inclui"project has received several assistive technologies, including eye and head movement-based computer access equipment and alternative keyboards and mice for individuals with physical limitations. These technologies are currently used in accessibility testing, workshops, and digital accessibility classes for students.
To be inaugurated next academic year, the physical space "Espaço Inclui"will give greater visibility to the inclusive projects developed by the University of Aveiro. By fostering research, knowledge sharing on assistive technology solutions, the initiative aims to enable people with disabilities to live fully autonomous lives, including education, culture, leisure, and tourism.

Keywords: *Accessibility, Autonomy, Assistive Technologies, Inclusive, Innovative and Sustainable Societies.*

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From Accident Prevention to Clinical Treatment: Dual Approaches to Spinal Cord Injury Research

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Abstract. This presentation focused on spinal cord injuries, a devastating pathology that can strike at any time. One of the leading causes of this disease is traffic accidents. The presentation focused on the research being conducted at the TEMA research unit on this topic, which employs two distinct strategies: prevention and repair.
The best course of action is always prevention. The projects dedicated to research on mobility led by Margarida Coelho were highlighted, namely road safety: focus on vulnerable road users. However, if prevention fails, the person may become paraplegic or tetraplegic, depending on the severity and location of the lesion. Unfortunately, there is no cure for this disease. In this context, Paula Marques presented the European project NeuroStimSpinal (A step forward to spinal cord injury repair using innovative stimulated nanoengineered scaffolds)

Keywords: *Accident Prevention, Clinical Treatment, Spinal Cord Injury Research.*

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Boosting mental health: the contribution of fundamental and translational neuroscience

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Abstract. Mental disorders are a leading cause of disability worldwide (World Health Organization [WHO], 2022), which can severely impact the overall health and well-being of those affected by them. Mental health is a part of the 2030 Agenda for sustainable development goals (SDGs) from the United Nations (United Nations Foundation[UNF], 2022), namely for goal number 3, and if people with mental, intellectual and psychosocial disabilities are taken into account, then mental health is also important for goals 4, 8, 10, and 11.
In recent years, the prevalence of mental health issues is steadily increasing all around the world (WHO, 2022). This can be especially important, as mental disorders often impose a "silent burden" over the individuals that are afflicted by them, to significant others, caregivers, and to society in general by loss of working hours, need for costly treatments, among others.
The standard treatment options to those suffering from mental illnesses are medication and/or psychotherapy. However, despite recent advances on the treatment of these conditions, numerous studies show that 30 to 40
Thus, it is of upmost importance to develop new treatment options from those suffering from mental health issues. In this sense basic and translational neuroscience studies have greatly contributed to the development of new treatment options for mental health, as well as for the understanding of the underlying mechanism of the condition. For instance, there is evidence from neuroimaging and electrophysiological studies about the underlying neuronal correlates of mental health conditions. There is also evidence from noninvasive brains stimulation (NIBS) studies that established new treatment options based on well-studied biomarkers.
In this presentation I will be discussing the contributions of both basic and translational neuroscience to mental health. I will also be discussing the evidence based contribution of NIBS for several disorders, as well as data from two clinical trials (on Tourette syndrome and depression). Finally, I´ll be discussing the implications of these studies for improving our knowledge about the underlying mechanisms and the potential biomarkers that can be useful for developing new or optimizing existing interventions, and as such how basic and translational neuroscience can contribute for the SDGs.

Keywords: *mental health, 2030 Agenda, social sustainability, NIBS, Neuroscience.*

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Accounting

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The level of compliance to the accrual-based IPSAS: evidence in the local government of Ghana

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Abstract. Governments around the world are implementing accounting reforms to improve transparency and accountability over the management of public resources to provide better stewardship and accountability (Christiaens et al., 2014 and 2015; Brusca et al., 2015; Salato et al., 2022; Tickell 2010). Developing countries require public sector institutional capability for creating and implementing public policy to accomplish ambitious socioeconomic goals, which necessitates government accounting reforms (Salato et al., 2022). As a result, the social value of government accounting reform lies in its support of development goals, such as poverty reduction. International and multilateral lenders and funders have endorsed International Public Sector Accounting Standards (IPSAS) for adoption by developing nations based on this rationale. IPSAS can be more beneficial in government accounting reform in underdeveloped countries if it focuses on ensuring financial integrity and shifts to accruals (Tawiah, 2023; Chan, 2008). However, in Africa, most government accounting changes are not implemented and operated as intended (Salato et al., 2022). Over the years, the public sector has been under intense pressure to be transparent, effective, efficient, and accountable in how it uses its resources. In the Ghanaian public sector, there have been numerous breaches in fund management and application. The literature on public-sector accounting has mainly focused on developed economies (Goddard, 2010; Christiaens et al, 2015, Brusca et al, 2015, Polzer et al., 2021). Research is still scarce in the context of African countries, specifically in the context of Ghana. Against this background, this research explores the compliance level of local government financial statements in Ghana about the accrual-based IPSAS. The purpose of this research is to determine whether MMDA of Ghana's financial statements and accounts are prepared in accordance with accrual-based IPSAS by analyzing their levels of compliance and the reasons for irregularities. The paper aims to answer the following research question: What is the level of compliance of the annual financial statements of MMDA in Ghana under IPSAS implementation? Our main findings are that the financial statements of MMDA in Ghana are not fully compliant with accrual-based IPSAS. Considering the five IPSAS selected for this work, IPSAS 2 revealed the lower compliance level of 48.57 percent while IPSAS 14 has the highest compliance level of 100 percent. In this study, we try to explain the reasons for the increasing trend in the non-compliance level among local governments in Ghana.

Keywords: *Compliance Level, Accrual-Based, IPSAS, Local Government, Ghana*

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O desenvolvimento profissional contínuo e a aprendizagem ao longo da vida na área da Contabilidade: O papel do ensino superior em Portugal

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Abstract. O desenvolvimento profissional contínuo e a aprendizagem ao longo da vida na área da Contabilidade: O papel do ensino superior em Portugal.Este estudo aborda a importância do desenvolvimento profissional contínuo e da aprendizagem ao longo da vida na área da Contabilidade em Portugal. Através da análise da Norma Internacional de Educação 7 (IES 7) Desenvolvimento Profissional Contínuo e de diversos artigos, o objetivo será identificar os determinantes da motivação pessoal no trabalho e na vida profissional, assim como a necessidade de manter atualizados a nível intelectual os atuais e futuros profissionais de Contabilidade.

O projeto da IES 7 pretende aumentar a consistência, qualidade e relevância do Desenvolvimento Profissional Contínuo, no entanto, o papel do ensino superior, o papel da formação interna e das Associações ou Ordens profissionais, verificou-se que ainda não estão a potenciar o desenvolvimento de competências em alunos e em adultos, sobre o uso de softwares a incorporação de sistemas de Inteligência Artificial (IA), sistemas de análise e interpretação de dados e de conhecimento sobre Big Data, será necessário um reforço, em especial da academia, no desenvolvimento de competências sobre as novas tecnologias.

Neste estudo, a recolha de dados será efetuada através de um inquérito por questionário aos estudantes finalistas dos cursos de Contabilidade e aos Contabilistas Certificados. Serão também efetuadas entrevistas Reitores das Universidades e aos Presidentes dos Institutos Politécnicos, das instituições de ensino superior que lecionem cursos de Contabilidade em conformidade com a lista de cursos da Agência de Avaliação e Acreditação do Ensino Superior. Serão utilizadas técnicas de análise quantitativa e qualitativa para investigar as perceções e opiniões dos participantes, permitindo uma compreensão mais completa e profunda das experiências e diversidade de opiniões dos envolvidos nos processos.

Espera-se que este estudo contribua para uma melhor compreensão do desenvolvimento profissional contínuo e da aprendizagem ao longo da vida, considerando que estas são fundamentais para o sucesso na carreira profissional e para manter a competitividade no mercado de trabalho, especialmente na área da contabilidade. Com os resultados deste estudo, esperamos envolver as instituições de ensino superior, as ordens profissionais e as associações e as empresas, para potenciar o desenvolvimento de competências nesta área, em particular no que diz respeito às novas tecnologias.

Keywords: *IES 7 - Desenvolvimento Profissional Contínuo, aprendizagem ao longo da vida, ensino superior, ensino em contabilidade, competências.*

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Divulgação dos ODS de sustentabilidade no Relato Integrado, no contexto angolano.

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Abstract. Resumo
Dessa forma, a contribuição de estruturas de relatórios, como GRI e IIRC, para cumprir os Objetivos de Desenvolvimento Sustentável (ODS) afeta o envolvimento empresarial e inclusão dos stakeholders, dessas metas adotadas mundialmente. Assim, a presente pesquisa tem como objetivo identificar quais seriam o impacto se as empresas no contexto angolano optassem em divulgar os (ODS) de sustentabilidade no Relato Integrado. O estudo empírico abrange apenas o contexto angolano sem evidenciar um horizonte temporal. Os dados foram coletados a partir da comissão de mercado de capitais caso das empresas quotadas em bolsas e pelo website de cada empresas que não estão quotadas em bolsa. Quanto a metodologia usamos uma abordagem mista, ou seja, qualitativa quando analisamos a leitura de cada relatório técnico e conta de forma a evidenciar as empresas que emitem relatórios de sustentabilidade e quantitativa para quantificar as variáveis em estudo. Também analisamos que algumas empresas não emitem o de sustentabilidade por intermedio de falta de capacitação do pessoal e outras não emitem por não ser uma exigência por parte do legislador. Outro cenário é que muitas das empresas que analisamos não optam em incrementar os ODS no "relato integrado" por desconhecer essa ferramenta que tem sido usado já em 70 países. A teoria da agência permite com que as empresas tomam decisões em função dos interesses de forma particular, ela permite que os interesses da governança corporativa estejam em primeira instância já a teoria do stakeholder ela anui que as empresas devem alinhavar os seus interesses para com de todas as partes interessadas de forma a agregar valor acrescentado para o bom funcionamento e empenho das organização e doutro lado a teoria institucional que visa com que as organizações tomam decisão em função da mudança politica e social, esta teoria esta atrelada as decisões do legislador. Essa investigação pode ser útil tanto para gestores quanto para a comissão de mercado de capitais (CMC) que visam apoiar as organizações na contribuição ou na elaboração dos relatórios integrado de forma a mudar a imagem das organizações perante o stakeholder.

Keywords: *ODS; relatório de sustentabilidade; relatório integrado; Angola.*

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Business intelligence e balanced scorecard em sociedades de advogados

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Abstract. O business intelligence é um conjunto de técnicas, ferramentas e tecnologias usadas para transformar grandes quantidades de dados em informações úteis e significativas para a tomada de decisão (Alnoukari ; Hanano, 2017; Appelbaum et al., 2017; Żółtowski, 2022).
O balanced scorecard inclui um conjunto de indicadores interrelacionados que permitem pilotar uma empresa financeira e operacionalmente, permitindo aos gestores uma reflexão regular sobre a missão e a estratégia da organização (Kaplan ; Norton, 2005). Lea et al. (2018) referem que as ferramentas dashboard-based construídas com ferramentas de business intelligence, de visualização, orientadas pelo balanced scorecard, apresentam uma nova maneira de identificar padrões de dados e de apresentá-los em modo user-friendly.
Allan et al. (2019) identificam que métricas contabilísticas e financeiras ou key performance indicators introduzidos para disciplinar o desempenho dos sócios das sociedades de advogados podem criar um estado de insegurança (medo e ansiedade), trigger para a adoção de estratégias de proteção individual que resultam em lógicas profissionais indesejadas e perversas. As sociedades de advogados são, de facto, organizações muito particulares que se caracterizam, à semelhança de outras sociedades de profissionais, pelo facto dos donos do negócio serem, ao mesmo tempo, gestores e executantes.
No entanto, as sociedades de advogados precisam de instrumentos de acompanhamento da sua performance, que permitam monitorizar a missão e a estratégia e tomar decisões atempadas, com base em volumes de dados cada vez maiores e de enorme granularidade, e num mundo em constante mudança e cada vez mais real time. Este é, assim, o problema de investigação que se pretende resolver, tendo-se estabelecido a seguinte metodologia para este projeto de tese:- Primeiro ensaio para resumir o estado da arte, identificar eventuais lacunas de investigação e preparar a base para a aplicação de um método misto, o que se conseguiria através de uma revisão sistemática da literatura;- Segundo ensaio para validar um conjunto de questões, analisar resultados e preparar a base para a aplicação de um método experimental ou estudo de caso, o que se conseguiria através de um modelo sequencial explanatório; e- Terceiro ensaio para desenvolver um balanced dashboard específico para sociedades de advogados, o que se conseguiria através da prototipagem em ambiente de estudo de caso.Pretende-se e espera-se, portanto e em resumo, contribuir para o aprofundamento do conhecimento científico numa área muito recente, com pouca investigação científica registada e num setor de atividade pouco explorado.

Keywords: *Business intelligence, dashboard, balanced scorecard, key performance indicators, sociedades de advogados*

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Accountability no planejamento e execução do orçamento público: um estudo nas políticas públicas de assistência social dos municípios da Amazônia legal brasileira

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Abstract. Contextualização: A pesquisa será desenvolvida através da produção de 4 artigos científicos que abordarão a temática do planejamento e orçamento público das polítcas públicas de assistência social da amazônia legal brasileira. As bases teóricas serão: Teoria da Agência e Teoria da Escolha Pública.Justificativa: A pesquisa na área das políticas públicas de assistência social na amazônia legal se justifica porque, segundo dados da Superintendência do Desenvolvimento da Amazônia/SUDAM (2020), a Amazônia legal ocupa uma área de 5 milhões de quilômetros quadrados (59,1% de toda região geográfica do país) e possui uma população de 28,1 milhões de habitantes, correspondendo a 13,3% de toda a população do Brasil. Mesmo possuindo uma densidade demográfica baixa e uma vasta gama de recursos naturais, a região apresenta os piores índices de Desenvolvimento Humano (IDH-M).Problema e Objetivo da pesquisa: a questão geral da pesquisa: Os gestores estão cumprindo suas propostas de governo perante a sociedade no momento do período eleitoral? Tendo como objetivo geral analisar como está ocorrendo o processo de accountability no planejamento e execução do orçamento das políticas públicas de assistência social dos municípios da Amazônia legal brasileira.Artigo 1: questão de pesquisa: como está a produção científica sobre planejamento e orçamento público? O objetivo será apresentar a produção científica brasileira e internacional sobre planejamento e orçamento público. Quando a metodologia, será feito uma revisão sistemática.Artigo 2: questão de pesquisa: qual o nível de aderência entre as propostas de governo e o planejamento orçamentário das políticas públicas de Assistência Social? O objetivo será analisar se as promessas de campanha dos gestores públicos, para as políticas públicas de assistência social, estão sendo contempladas no planejamento orçamentário. A metodologia empregada será mista.Artigo 3: questão de pesquisa qual o índice de cumprimento da execução da despesa pública com Assistência Social prevista no orçamento público? O objetivo é apresentar a relação entre o previsto no planejamento orçamentário e o que foi efetivamente realizado durante a execução do orçamento. A metodologia empregada será a quantitativa.Atigo 4: questão de pesquisa quais os condicionantes para a eficiência da gestão pública quanto as políticas de assistência social na relação entre o prometido, o planejado e o realizado? Já o objetivo será identificar os fatores que levaram a uma maior eficiência entre o prometido, o planejado e o executado das políticas de assistência social. A metodologia empregada será a qualitativa.Palavras-chave: Accountability. Planejamento e Execução do Orçamento Público. Assistência Social.

Keywords: *Accountability. Planejamento e Execução do Orçamento Público. Políticas Públicas de Assistência Social. Amazônia Legal Brasileira.*

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Competências em Contabilidade: Perceções dos estudantes finalistas e das entidades empregadoras

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Abstract. Introdução: a literatura prévia tem evidenciado uma discrepância entre as competências desenvolvidas pelos estudantes do ensino superior em contabilidade e as expectativas das entidades empregadoras (Carvalho ; Almeida, 2022; Dolce et al., 2020), o que pode levar a dificuldades de inserção no mercado de trabalho e à necessidade ajustar os currículos das instituições de ensino superior que ministram cursos nesta área. A principal contribuição desta investigação é a análise das competências adquiridas e as desejáveis, a partir de duas perspetivas: estudantes e entidades empregadoras, com o objetivo de analisar em que medida as competências adquiridas pelos estudantes são as exigidas, verificando se há diferenças significativas de opiniões, contribuindo para uma formação mais adequada dos futuros profissionais.
Problema abordado: académicos e investigadores têm vindo a constatar que existe uma lacuna de expectativas entre as competências que os estudantes adquirem no ensino superior e aquelas que seriam desejáveis para o desenvolvimento de cargos profissionais na área. Este desalinhamento pode, por vezes, ser a causa das dificuldades encontradas pelos diplomados aquando da sua inserção no mercado de trabalho.
Solução sugerida para o problema: a recolha de dados será efetuada através da aplicação de um inquérito por questionário dirigido aos estudantes finalistas inscritos nos cursos de contabilidade do ensino superior português e outro às entidades empregadoras de diplomados desta área. Os questionários serão elaborados com base na revisão da literatura, abordando as competências adquiridas pelos estudantes durante a sua formação académica, bem como as competências consideradas desejáveis pelas entidades empregadoras. Pretende-se incluir as competências gerais e específicas da área contabilística, bem como as competências tecnológicas.
Metodologia e materiais utilizados ou a utilizar: os dados recolhidos serão analisados através de estatística descritiva. Para verificar se existem diferenças significativas nas perceções dos estudantes e das entidades empregadoras, propõe-se a utilização de testes não paramétricos.
Resultados: a identificação da existência de discrepâncias entre as competências desenvolvidas pelos estudantes e as expectativas do mercado de trabalho pode desencadear medidas tais como o ajustamento nos currículos das instituições de ensino superior nesta área e nas metodologias de ensino (Maali ; Al-Attar, 2020). Espera-se que os resultados deste estudo forneçam insights importantes para garantir que os futuros profissionais estejam adequadamente preparados para o mercado de trabalho.
Conclusão: a relevância do tema e a necessidade de informação atualizada, no contexto português, permitirá corroborar ou não o desalinhamento das competências evidenciadas na literatura, permitindo identificar mecanismos corretivos a introduzir nas instituições de ensino superior.

Keywords: *Ensino Superior; Ensino em Contabilidade; Competências tecnológicas; Estudante de Contabilidade.*

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Corporate Governance, Desempenho e Valor das Empresas na Península Ibérica

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1. DEGEIT

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Abstract. Corporate governance, desempenho e valor das empresasna Península IbéricaResumo:O objetivo central do presente estudo é analisar a relação entre as práticas de corporate governance, o desempenho e o valor de empresas com valores cotados em Portugal e em Espanha, designadamente analisar o impacto da estrutura do conselho de administração, das políticas de gestão de risco e de compliance, no desempenho e na maximização do valor das empresas.
Este estudo adota uma abordagem empírica visando investigar o impacto das práticas do corporate governance no desempenho e valor das empresas. A metodologia utilizada nesta dissertação consiste na análise de regressão múltipla, nomeadamente o método dos mínimos quadrados (regressão linear múltipla) a qual permite avaliar a influência das práticas do corporate governance no desempenho e valor das empresas. A informação financeira e a informação relativa ao governo das sociedades são obtidas no sitio da Comissao do Mercado de Valores Mobiliarios (CMVM) - Portugal e Espanha - na Internet, onde constam os relatórios anuais de prestação de contas e informação sobre as práticas de governo de sociedades. Na análise o impacto das práticas do corporate governance no desempenho e valor das empresas são utilizados dados conjuntos relativos ao período de 2017 a 2021 para empresas portuguesas e espanholas com valores cotados no mercado de cotações oficiais.
Os resultados deste estudo serão integrados em três artigos que terão por base as práticas do corporate governance, designadamente a análise do cumprimento das recomendações evidenciadas no código do governo das sociedades e sua relação com o desempenho e valor da empresa. O primeiro estudo visa analisar as práticas do corporate governance e sua relação com os indicadores de desempenho e valor das empresas em Portugal e Espanha. O segundo, terá como objetivo analisar até que ponto as políticas de gestão de risco e de compliance impactam na confiança dos investidores. Atendendo à premissa de que os ativos intangíveis são fonte de vantagem competitiva e precursores do aumento do valor da empresa, o terceiro artigo irá analisar a influência do Conselho de Administração na divulgação desses ativos e no valor da empresa. De uma forma global é esperada uma relação positiva entre as práticas do corporate governance, o desempenho e o valor da empresa.

Keywords: *Corporate Governance; Desempenho; Valor da Empresa; Península ibérica*

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Theoretical Approaches in Empirical Research on ESG and Market Value: A Systematic Review

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Abstract. The purpose of this systematic literature review (SLR) is to investigate the most commonly used theoretical approaches in empirical research on the relationship between ESG factors and market value, examine the differences in underlying assumptions and implications for interpreting research findings among these approaches, and evaluate the extent to which empirical research findings on ESG and market value support or challenge different theoretical approaches.
The study employs the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines in an extensive literature review of empirical investigations pertaining to the nexus between ESG and market value.
The study conducted a content analysis of 18 academic articles on the relationship between ESG and firm value, focusing on articles with over 40 citations. The three main theories discussed were stakeholder, legitimacy, and agency theories. Findings indicate a positive relationship between ESG and firm value, explained by these theories. The study concludes that the theories provide a comprehensive view of the relationship between ESG and firm value, highlighting the importance of further understanding their implications and limitations for advancing ESG and market value research.
The research limitations of this study include the possibility of bias in the systematic review's literature selection and the potential for generalization of findings to other contexts or industries. However, this review can provide a theoretical foundation for understanding the diversity of theories used in empirical research on ESG and corporate value. Additionally, it may open new avenues to enhance empirical research on emerging issues related to ESG that can contribute to sustainable solutions to global challenges.

Keywords: *Systematic review, ESG, Market value, Empirical research, Theoretical approaches*

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Fatores determinantes da adoção do modelo anglo-saxónico em Portugal

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Abstract. Os modelos de governo das sociedades (GS) têm-se desenvolvido em ritmos e sistemas diferenciados, inclusivamente em países e mercados economicamente mais evoluídos, não só devido a variáveis históricas, políticas, sociais e económicas, mas também, e principalmente, a variáveis legais e regulamentares. Estas últimas variáveis, ao condicionarem a forma como as empresas são geridas nos diversos países, influenciam significativamente os diferentes modelos de GS.

O modelo anglo-saxónico, caracterizado pela sua orientação para o mercado de capitais de elevada liquidez, conduziu a um grande desenvolvimento e relevância dos mercados de capitais nos países anglo-saxónicos. Não foi, por isso, surpresa, que as primeiras tentativas de regulamentação em matéria de GS tenham tido a sua génese nestes países (Santos, 2009).

No sentido de acompanhar os desenvolvimentos dos últimos anos em matéria de GS, foi introduzido no ordenamento jurídico português o Decreto-Lei n.º 76-A/2006, de 29 de Março, visando a atualização do Código das Sociedades Comerciais (CSC), em vigor desde 1986, de forma a adaptar os modelos societários previstos, e colocar Portugal a par dos sistemas jurídicos europeus mais avançados, no âmbito do direito das sociedades.

Assim, com o objetivo de promover a competitividade, transparência e eficiência das sociedades anónimas portuguesas, foram introduzidas alterações ao CSC, que se concretizaram com a introdução de um novo modelo de GS, típico das sociedades anglo-saxónicas.

É sobre esta alteração legislativa, que afeta a estrutura e os processos de GS, que nos vamos debruçar, com o objetivo de, com base na teoria institucional, identificar os fatores determinantes na adoção do modelo anglo-saxónico.

De facto, o elevado número de empresas com valores cotados na bolsa de valores no Reino Unido e nos EUA, é visto como um sinal de superioridade do seu sistema de GS (Gilson, 2001), o que pode levar as empresas portuguesas, pelo reconhecimento de benefícios associados ao modelo anglo-saxónico, a alterarem a sua estrutura de GS.

A metodologia adotada para atingir o objetivo acima exposto consiste numa análise de regressão logística, onde são utilizados dados conjuntos relativos ao período de 2006 a 2021 das empresas portuguesas com valores cotados no mercado Euronext Lisbon.

Com este estudo esperamos contribuir para uma melhor compreensão do GS, acrescentando à literatura uma melhor compreensão dos processos de mudança institucional, sendo expectável que as empresas portuguesas adotem o modelo anglo-saxónico, pelo reconhecimento de benefícios a ele associados, independentemente de saberem, se essas práticas são eficazes no seu ambiente institucional.

Keywords: *Governo das sociedades, Modelo anglo-saxónico, Regressão logística, Empresas portuguesas com valores cotados no mercado Euronext Lisbon*

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Ensaios sobre Relato Integrado nas Empresas com valores cotados na Península Ibérica

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Abstract. Com o desenrolar do ano 2020, o Mundo foi devastado pela pandemia do novo coronavírus COVID-19, com efeitos catastróficos nas empresas globais e na vida quotidiana. É evidente que a maioria das empresas foi apanhada desprevenida e não disponha de uma estratégia para lidar com uma interrupção da atividade de tal magnitude. Apanhados de surpresa, pergunta-se se uma pandemia era razoavelmente previsível e se deveria ser divulgada como um risco potencial, para que as partes interessadas pudessem tomar decisões mais informadas sobre a potencial criação de valor.Assim, este trabalho visa fazer um levantamento do estado da arte, no âmbito da divulgação não financeira pelas empresas com valores cotados na Bolsa de valores da Península Ibérica, ou seja, na "Euronext Lisbon" e na "IBEX 2020", no período compreendido entre 2018 a 2023, para análise do impacto da pandemia covid-19, na divulgação do risco.

Keywords: *Relato Integrado, Impression Management, Divulgação*

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O papel da transformação digital no desenvolvimento da dialogic accounting: estudo de caso num governo local

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Abstract. Nos últimos anos, a contabilidade pública tem assinalado uma significativa evolução quer a nível nacional como também a nível internacional fruto das sucessivas reformas implementadas como é o exemplo do Plano Oficial de Contabilidade Pública (POCP), em 1997 e do Sistema de Normalização Contabilística para as Administrações Públicas SNC-AP, em 2015 que sucederam a fim de responder às necessidades e exigências da New Public Management (NPM).
A Administração Pública (AP), no seguimento do que se tem sucedido na realidade empresarial, encontra-se volvida numa série de desafios contabilísticos e financeiros obrigatórios bem como não financeiros de carácter voluntário. Desta forma, e por tudo o que tem ocorrido, a AP deve melhorar a sua transparência para com os cidadãos, assim como, deve cumprir com os objetivos de gestão e responsabilização. Para que os cidadãos confiem nos seus governos, os mesmos devem aumentar a sua credibilidade através de divulgações sobre a sua responsabilidade social e corporativa, ambiente e sustentabilidade (Relatos de Sustentabilidade e Integrado) e até mesmo quanto à possibilidade de elaborar relatórios mais curtos (Popular Reporting - PR) entendíveis à diversidade de stakeholders (por exemplo cidadão), para efeitos das exigíveis transparência e accountability (Montesinos e Brusca, 2019).
De forma que se promova maior transparência bem como accountability pública, a contabilidade é desafiada a desenvolver novas ferramentas de produção de informação e de sustentabilidade bem como capaz de estabelecer diálogos com múltiplos stakeholders. Assim, para que haja a promoção de melhores serviços públicos e valores públicos a transformação digital está-se a tornar uma realidade crescente na gestão pública (Guthrie ; Martin-Sardesai, 2020). Seguindo esta abordagem teórica, assume-se que a digitalização facilitará a avaliação e medição do desempenho público, tanto em termos financeiros como não financeiros, e acelerará a implementação de novas ferramentas de accountability. A literatura recente pede mais investigação sobre as implicações da
digitalização para reforçar a dialogic accounting e melhorar a accountability em sociedades democráticas, cada vez mais digitais (Agostino et al., 2021; Guthrie ; Martin-Sardesai, 2020).
Neste contexto, com este projeto pretende-se contribuir para colmatar estas lacunas, centrando-se no contexto particular dos municípios. Os municípios operam muito próximo dos cidadãos e estão orientados para as suas necessidades específicas e onde a utilização de plataformas digitais se tornou habitual na relação com os diferentes stakeholders (Royo et al., 2020).

Keywords:

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O efeito das Fusões e Aquisições no retorno acionista e no desempenho financeiro das empresas

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Abstract. All companies have as main objective to maximize their value and, consequently, the shareholder or partner wealth.Thus, it becomes essential the decision-making by companies, which may opt for internal growth or, on the other hand, opt for external growth, through mergers and acquisitions (M;A) operations (Jain et al., 2018; Talreja et al., 2020). M;As are processes by which two or more companies combine into a single entity, or one company acquires a stake in another.These are very complex restructuring operations that have been prevalent in recent years and can have significant effects on shareholders and investors, as share prices can change and on the financial and operational performance of the companies involved and of competing companies (Martynova ; Renneboog, 2008; Murthy et al., 2020). Through M;A transactions, companies can diversify their business portfolio, become stronger and more competitive and enter different markets from those in which they operate (Lobo ; Gomes, 2022; Ranju ; Mallikarjunappa, 2019).This project aims to investigate the effects of M;A transactions in the short term (on shareholder returns) and in the long term (on firms' financial performance). Three trials will be conducted with firms that have recently undergone M;A transactions.To answer the general objective, the first trial will analyze the capital market reaction to the announcement of M;A transactions, the second will investigate whether the financial performance of firms improves after the transactions and the third will investigate the adjacent effect of M;A announcements on the rival firms of the firms involved in the transactions.The selected companies will be those with listed values on the Euronext and New York Stock Exchange market.The methodology used in the tests will be quantitative, being that in the first and third test the methodology of the study of events will be used and in the second test the financial data of the companies before and after the M;A operations will be used to analyse their performances in the long term.M;A transactions and their announcement dates will be extracted using the Zephry and Orbis M;A databases.Company and market share prices will be extracted with the help of the Eikon/Datastream database.It is expected that this project will contribute to the deepening of knowledge on the effects of M;A operations on the financial market and financial performance of companies, providing relevant information for investors, market analysts, managers and government agencies.In addition, it may be a source of inspiration for future research.

Keywords: *Fusões e Aquisições, Retorno Acionista, Desempenho Financeiro, Euronext, New York Stock Exchange*

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Integração de sistemas de Business Intelligence com a construção de um Balanced Scorecard

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Abstract. Resumo: O exponencial crescimento de volume de dados oriundos de inúmeras fontes, quer internas quer externas, que as empresas necessitam de tratar, as rápidas mudanças nos ambientes, quer internos quer externos, assim como a integração de todos os processos, manter-se competitivo significa a análise e tratamento de todos os dados e transformação em informação de gestão útil e em tempo real. Assim, a motivação para o estudo da integração de sistema de Business Intelligence (BI) na construção de um Balanced Scorecard (BSC), na área da contabilidade de gestão, resulta da necessidade das empresas em transformar dados, tendo em vista a obtenção de informação constante, proveniente de todas as fontes, internas e externas, por forma a que os utilizadores possam tomar as suas decisões estratégicas o mais acertadas e em tempo real.
Com esta investigação pretende-se alargar o estudo científico sobre os seguintes pontos: 1. Quais os benefícios que os controllers de gestão encontram na utilização de sistemas de BI na construção de um BSC e 2. Qual a aceitação por parte dos controllers de gestão, na utilização de sistemas de BI na construção de um BSC.

Keywords: *Balanced Scorecard, BSC, Business Intelligence, BI*

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Conciliação da vida profissional e pessoal dos Contabilistas Certificados e a qualidade dos serviços prestados

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Abstract. A conciliação da vida profissional e pessoal, reconhecida no Pilar Europeu dos Direitos Sociais como uma das condições justas de trabalho, tem vindo a ganhar, nos últimos anos, uma maior importância na sociedade.
O desequilíbrio entre trabalho e vida pessoal diminui a qualidade de vida, estando mesmo associado ao aumento de situações de stress e burnout (Anderson, et al., 2002). Além disso, o dispêndio de um maior número de horas de trabalho, com sacrifício da vida familiar, pode significar a diminuição da qualidade do serviço prestado (Khavis ; Krishnan, 2021).
A profissão de Contabilista Certificado (CC), atendendo aos conhecimentos técnicos que lhe são exigidos e à sua importante influência na economia, fornece evidências interessantes das implicações do seu envolvimento no trabalho, podendo ser aplicadas a outras categorias profissionais (Palumbo, 2022).
Em face do exposto, a tese terá como objetivo estudar a satisfação dos Contabilistas na conciliação das suas vidas profissional e pessoal, e a influência que aquela conciliação tem na qualidade dos serviços que presta no âmbito da sua atividade.
A tese será desenvolvida em três artigos: revisão sistemática da literatura, estudo da satisfação e conciliação da vida profissional e familiar dos CC e implicações práticas dos estudos.
Com os estudos que se pretendem realizar, o equilíbrio entre trabalho e vida pessoal não estará entre os fatores mais importantes associados à satisfação geral dos contabilistas, mas um melhor equilíbrio entre trabalho e vida pessoal estará, no entanto, associado a uma maior qualidade do serviço prestado (Khavis ; Krishnan, 2021).
A investigação a realizar aportará importantes contributos para a teoria e a prática. O estudo contribuirá para a literatura na medida em que permitirá melhor compreender as razões do potencial desequilíbrio encontrado na conciliação da vida pessoal e profissional dos CC. Por outro lado, os resultados da investigação contribuirão para se refletirem e desenvolverem estratégias e mecanismos para os Contabilistas equilibrarem os seus objetivos económicos com os seus interesses pessoais e dos seus colaboradores (Baudot, et al., 2022).

Keywords: *Equilíbrio trabalho vida, qualidade de vida, stress, qualidade dos serviços, contabilista, contabilidade*

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A importância, determinantes e consequências económicas dos benefícios fiscais nas empresas portuguesas

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Abstract. Apresenta-se neste documento o projeto tese, no qual se descreve o objetivo e a estrutura do trabalho de investigação a desenvolver para a tese de doutoramento sobre o tema "A importância, determinantes e consequências económicas dos benefícios fiscais nas empresas portuguesas". O principal objetivo desta investigação consiste em perceber a importância dos benefícios fiscais nas decisões dos órgãos de gestão das empresas, em particular no mercado português. Pretendemos aferir se essas decisões são influenciadas pelos efeitos que os benefícios fiscais possam vir a provocar em determinado enquadramento.
Para atingir o objetivo proposto serão realizados três estudos, com três questões de investigação.
O primeiro estudo da Tese consistirá numa revisão sistemática de literatura, com os objetivos de, em primeiro lugar clarificar o conceito de benefício fiscal que verificamos existir uma vasta abrangência na aplicação do termo e em segundo lugar, expor o estado da arte sobre os estudos efetuados relativamente ao uso dos benefícios fiscais por parte das empresas, ou seja, por um lado, evidenciar os contributos existentes e, por outro lado, identificar as lacunas que possam ser exploradas.
O segundo estudo terá como objetivo perceber que fatores determinam o recurso aos benefícios fiscais por parte das empresas portuguesas. Este estudo seguirá uma metodologia quantitativa, onde serão definidas variáveis e recolhidos dados para a respetiva construção, sendo depois estudadas aplicando os métodos estatísticos mais adequados. Os dados das variáveis serão recolhidos utilizando a base de dados disponibilizada pela autoridade tributária portuguesa relativamente aos benefícios fiscais, em cruzamento com dados obtidos das bases de dados empresariais que contêm informação disponibilizada pelas empresas.
O terceiro estudo da Tese, terá como objetivo perceber as consequências económicas do uso dos benefícios fiscais pelas empresas portuguesas, nomeadamente ao nível do impacto nas suas rentabilidades. Este estudo seguirá uma abordagem metodológica semelhante ao segundo estudo, ou seja, será também um estudo quantitativo, com recolha de dados nas mesmas fontes, embora com variáveis diferentes.
Espera-se que ao responder às questões de investigação colocadas nos estudos realizados nesta investigação dar resposta ao objetivo principal da Tese e desta forma dar um contributo positivo para o desenvolvimento da investigação na área fiscalidade, em concreto nos benefícios fiscais. Pensamos que este trabalho vem preencher uma lacuna existente e que será útil para os utilizadores que procuram perceber aquilo que determina o uso dos benefícios fiscais pelas empresas portuguesas e o impacto económico provocado.

Keywords: *benefícios fiscais, determinantes, otimização fiscal*

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Estudos sobre a divulgação de informação nas IPSS portuguesas

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Abstract. O crescimento elevado do Terceiro Setor, no caso particular das IPSS, tem levado à realização de estudos sobre a importância da informação financeira e não financeira divulgada por estas organizações. Apesar de se constituírem com um carácter social e não lucrativo, tem interesse estudar se elas atingem os seus objetivos no âmbito da sua missão. Assim, este trabalho visou fazer um levantamento do estado da arte, no âmbito da divulgação de informação pelas IPSS portuguesas, tendo em vista a satisfação dos interesses das várias partes interessadas, tais como os doadores individuais, privados e públicos. Um sistema de gestão de compliance que seja eficaz para uma organização como um todo, terá de demonstrar o seu compromisso com o respeito pelos normativos em vigor, pelos padrões de boa governança, as boas práticas, a ética e as expectativas dos stakeholders.
A responsabilização (accountability) nestas organizações sugere que devem prestar contas seguindo um modelo holístico. A avaliação da conformidade no cumprimento das normas contabilísticas no terceiro setor, é de extrema importância, para a prevenção de fraudes e desvio de ativos, como a manipulação das demonstrações financeiras.
A divulgação de informação é um dos meios que estas organizações utilizam para a prestação de contas à suas partes interessadas, que se materializam em informação financeira e não financeira, sendo ambas fundamentais para a governação das organizações do Terceiro Setor. A governação implica a conceção de procedimentos que propiciem aos gestores o trabalho conjunto para um objetivo comum. No presente trabalho pretende-se fazer uma reflexão e mensuração sobre o impacto que a divulgação da informação tem no Terceiro Setor, e na prossecução dos seus objetivos.

Keywords: *governação; divulgação de informação; terceiro setor; responsabilização; conformidade.*

Acknowledgements. governação; divulgação de informação; terceiro setor; responsabilização; conformidade.

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A divulgação do capital intelectual: evidências do estágio, tendências, fatores determinantes e influência sobre a fidelização de clientes em duas economias emergentes

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Abstract. Contexto: A divulgação do capital intelectual, apesar de ser um tópico com relativo extenso debate na literatura e relativa afirmada prática em países desenvolvidos, continua sendo escassa a sua exploração em economias emergentes. Objetivo: Com vista contribuir para a redução desta lacuna, pretende-se realizar um estudo, inserido no âmbito da tese de doutoramento, em economias emergentes africanas, concretamente nos países da SADC, com o objetivo de analisar o estado da prática de divulgação empresarial do capital intelectual e os fatores que justificam esta prática. Metodologia: O estudo será conduzido através de três ensaios, o primeiro de natureza teórica e os dois outros de natureza empírica, cobrindo um período de 6 anos, entre 2016 e 2021: (i) o primeiro far-se¬-á através de uma revisão sistemática da literatura, sobre a divulgação do capital intelectual; (ii) no segundo far-se-á colheita dos relatórios e contas das grandes empresas dos 16 países da SADC e, com base no método de análise de conteúdo e calculando o seu índice de divulgação do capital intelectual, feita uma análise da extensão e qualidade do relato do capital intelectual; e (ii) no terceiro ensaio, com base na regressão linear múltipla, utilizando os fatores que já a literatura levantou como influenciando a divulgação do capital intelectual, será feita a avaliação da significância estatística dos fatores que determinam a prática de divulgação do capital intelectual nas empresas selecionadas dos 16 países da SADC. Resultados esperados: Em geral, dado o crescente debate pelo reconhecimento da importância do capital intelectual na economia baseada no conhecimento, espera-se encontrar nas empresas práticas de divulgação crescentes, conducentes à sua cada vez elevada valorização, bem como espera-se conhecer o contributo de cada fator dos levantados na literatura para justificar essas práticas.

Keywords: *capital intelectual, divulgação, influência, fidelização de clientes*

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Efeitos da transparência fiscal nos riscos reputacionais das empresas

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Abstract. Como resposta às discussões sobre as estratégias de planeamento fiscal das grandes empresas multinacionais, os legisladores de todo o mundo adoptaram numerosas legislações para aumentar significativamente a transparência fiscal das empresas, nomeadamente através da prestação de informações detalhadas sobre as estratégias e posições fiscais das mesmas.
A informação fiscal, pelas suas características, é uma matéria sensível, muitas vezes de complexa interpretação e que poderá conduzir a interpretações e conclusões erróneas por parte dos vários interessados nas empresas. É certo que os efeitos desta divulgação mandatória ou voluntária serão diversos nos diferentes interessados e que as suas reações serão certamente dispares e com diferentes graduações. É o impacto desta divulgação no risco reputacional das empresas que se pretende analisar.
O nosso objetivo é estudar a reacção do mercado de capitais através do preço das acções das empresas cotadas às informações divulgadas pelas empresas referentes à sua estratégia fiscal e à agressividade fiscal da mesma. Estudos anteriores apontam que que as reações do mercado de capitais ao aumento da transparência fiscal dependem fundamentalmente da conceção e do objetivo exatos da iniciativa. Pretendemos assim analisar qual comportamento o mercado de capitais adota face à divulgação de informações de cariz estratégico-fiscal e que tipologia de informações são essas, tentando concluir se o aumento da divulgação poderá contribuir positiva ou negativamente para o risco reputacional das grandes empresas.

Keywords: *Planeamento fiscal, divulgação, transparência, risco reputacional, preço das ações*

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Inteligência artificial no ERP: aceitação da tecnologia pelos contabilistas e o seu efeito no engagement e intraempreendedorismo

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Abstract. A transformação digital é uma realidade à qual não podemos fugir. As tecnologias de informação (TI) são essenciais para a construção do sucesso organizacional (Jackson et al., 2023). A literatura existente, com foco no impacto da adoção da inteligência artificial (IA) no setor de contabilidade ainda é escassa (Lee ; Tajudeen, 2020). É evidente a lacuna entre as expetativas e a realidade, no que toca às novas tecnologias nesta área (Afifa et al., 2022).

O objetivo geral deste projeto de tese é avaliar a aceitação das funcionalidades de IA nos sistemas Enterprise Resource Planning (ERP) por parte dos contabilistas certificados em Portugal e perceber como é que este influencia o seu engagement no trabalho e intraempreendedorismo. Neste sentido, no final deste trabalho pretende-se responder à seguinte questão de investigação: Qual o nível de aceitação da IA nos sistemas ERP pelos contabilistas e como é que este influencia o seu engagement e intraempreendedorismo?

O projeto de tese pressupõe a realização de 3 ensaios. O primeiro estudo pretende analisar os sistemas ERP utilizados pelos contabilistas em Portugal e quais as funcionalidades de IA utilizados nestes. O segundo estudo pretende estudar a aceitação das funcionalidades de IA por parte dos contabilistas em Portugal, com recurso à Unified theory of acceptance and use of technology (UTAUT). Por sua vez, o terceiro estudo pretende avaliar se a intenção do uso da tecnologia influencia a orientação para o intraempreendedorismo e o engagement/envolvimento do contabilista.

No final deste trabalho espera-se contribuir para o aumento da literatura sobre a aceitação das TI pelos contabilistas e validar o seu impacto no engagement no trabalho e intraempreendedorismo, através da validação de dois modelos adaptados a esta realidade capazes trazer implicações práticas ao dia a dia dos contabilistas.

Keywords: *Inteligência artificial, Enterprise Resource Planning, contabilidade, contabilista, aceitação da tecnologia, engagement, intraempreendedorismo*

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Contabilidade de gestão aplicada às empresas do setor da restauração

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Abstract. O foco de estudo são as empresas do setor da restauração, célula social importante para o turismo. O objetivo deste estudo consiste na criação e validação de um modelo de contabilidade de gestão baseado no balanced scorecard, prática com elevada relevância mundial, aplicável em diferentes indústrias e países.
O estado da arte sobre práticas de contabilidade de gestão e de indicadores de desempenho será reforçado, destacando-se a investigação sobre o balanced scorecard (medição/gestão de desempenho) e a sua acessibilidade às operações de restauração.
O estudo contribuirá para o apoio aos gestores na crise económica global com o aprofundamento da investigação em contabilidade de gestão na restauração, que se encontra ainda no início.
As contribuições focam-se na gestão financeira, nos processos internos, na aprendizagem e crescimento e na satisfação do cliente; o que permitirá o desenho de um guia de apoio à tomada de decisão, através da consciencialização da importância da contabilidade, potenciando o crescimento económico na restauração.
Palavras-chave: modelo de contabilidade de gestão; restauração; USAR; sistema uniforme de contas aplicado aos restaurantes; sistema contabilístico; micro e pequenas empresas.

Keywords: *contabilidade de gestão; restauração; balanced scorecard; USAR; sistema uniforme de contas aplicado aos restaurantes; sistema contabilístico.*

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Capital intelectual no relatório integrado: artifício contabilístico

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Abstract. O objetivo deste trabalho é analisar a divulgação do capital intelectual (CI) no relatório integrado e perceber de que modo essa divulgação complementa a informação contabilística das empresas. O estudo é baseado na revisão sistemática de literatura para definir os conceitos e as lacunas existente seguido da análise de conteúdo a uma amostra dos relatórios integrados de uma base de dados disponíveis para o efeito e por fim identificação de determinantes da informação sobre o CI e a relação da medida da divulgação com o valor contabilístico da empresa contra o valor do mercado. A evidência empírica mostra que o relatório integrado é o caminho para a divulgação de CI nas empresas e que é possível verificar diferenças (positivas ou negativas) de valor nas empresas que divulguem o seu CI nos relatórios integrados.

Keywords: *Contabilidade, capital intelectual, relatório integrado, intangíveis, inovação*

Applied Mathematics

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Investigação em algumas conjecturas sobre matrizes ideais

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Abstract. The thesis work with my advisor and co-advisor has been developed around the topic "Ideal Matrices". It is a topic of Combinatorial Optimization in the theme of "Packing and Covering". There has been some effort to study the envelopment of the conjectures (3 or 4, I cited one where we have now worked initially) motivated by work circumstances. In this way, we are very well situated and prepared in the theme, the topic, the state of the art and the international scientific community that produces the most in these conjectures. Other open problems are, for example, the following:
1) Every thin (d=1) Lehman matrix is the core of some mni matrix. There is an inclination to find a counterexample proving that the conjecture is false... Perhaps with the improvement of the catalogs of mni matrices and their cores through computer programs.
2) Every ideal mnp clutter has a transversal of size 2.
It is called the T (Greek letter tau) conjecture; the development of the theory of Cuboids since +/- 2018 has allowed at least to develop a general and accessible "language"for ideal clutters. An "attack"on the conjecture is probable and is expected.
3) A clutter with the packing property has the Max Flow-Min Cut (MFMC) property.In the same article where the conjecture referred to in the initial (and now corrected) Abstract (Cornuéjols, Guenin and Margot, 1998) is located, it is proved that the Conjecture T implies this conjecture, called the Replication Conjecture. The scientific community believes that the T Conjecture will be true and therefore also the Replication Conjecture.
4) Is F7 the unique finite non degenerate projective plane (PPFND) wich is the core of some mni matrix.Computational work shows that the core matrices (of mni matrices, it is implied) are Lehman matrices with d=1,2 and no core with d>2 is known. Since the Lehman matrix M(C_2^3) with d=1 is not considered a PPFND, then in this class of clutters we have d>1 and F7 is the only PPFND for d=2. Furthermore, since M(F7) is a square matrix then F7 is the core of itself, i.e., core(F7)=F7. Since F7 is mni then F7 is the core of an mni matrix (M(F7), precisely). Therefore, in the statement we only need to prove the uniqueness. In his doctoral thesis in the early 90s, Guenin showed that F7 is the only PPFND mni.

Keywords: *Clutter Matriz Ideal e quase Ideal, Cobertura e emparelhamento num clutter o poliedro cobertura Q(A), Propriedades de um Clutter: de encaixe encaixante MFMC (Fluxo Máximo-Corte Mínimo) Ideal, Clutter quase encaixado (mnp) quase MFMC quase ideal (mni) resp, "Eliminação Contração e Menor", core de um ponto extremo fracionário do poliedro cobertura Q(A) com A mni.*

Acknowledgements. I want to thank with great emphasis and vivacity to my 2 advisors (advisor + co-advisor): Dr.ª Tatiana Tchemisova from DMAT and Dr. João Soares from DMUC... for everything, because all work would not be possible without them; It's not the 1st time I've said that I feel very comfortable (for lack of better words) in this orientation they assure me; Even the fact that they want to excite me for this presentation have also something to do with the fact that they want to see some reflection of their work, which is very natural and understandable. I also thank the organizing committee and those who are more directly linked with responsibility to the MAP-PDMA doctoral program...because they are the cause of this prestigious event to take place and succeed. Yours sincerely. Paulo Tomás da Silva Tavares

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Building a tutor for the web application for autonomous learning SIACUA

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Abstract. Building a tutor for the web application for autonomous learning SIACUAThere is a Web application, named SIACUA, being used by hundreds of calculus students in recent years for helping autonomous learning. It is an interactive open system, with all materials available, and a Bayesian user model to provide feedback. From several surveys, it is known that many students consider the application useful; however, it does not have a tutor module capable of providing useful suggestions for guiding students. We are improving this Web application by designing and implementing a tutor module, that we expect to be available in the next academic year. For that, we are improving the concept maps, including pre-requisite relations, and developing algorithms for providing meaningful suggestions for study guidance, like appropriate concepts to study, considering students answers to questions.
The tutor is being programmed in C#, SQL and JavaScript, taking into account several examples of existing tutoring systems, making use of the beliefs about students' knowledge computed by the Bayesian networks and using the concept maps being build.
We are planning to use the tutor in the next academic year and collect feedback from calculus students through surveys to assess the results of using the Web application with the new tutor module.

Keywords: *Bayesian networks, tutor, autonomous learning, Mathematics.*

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On the selection of supports for generalized maximum entropy estimation

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Abstract. The most common estimation approach in linear regression is the ordinary least squares (OLS). Although unbiased, in the presence of multicollinearity, the OLS estimator exhibits large variance and lack of stability. This can be improved by ridge regression (Hoerl ; Kennard, 1970) and generalized maximum entropy (GME) (Golan et al., 1996). Aside from the data structure problems, the presence of outliers can also affect the estimation of parameters, although this can be handled by M estimation (Huber, 1964).
The implementation of the GME starts by choosing the sets of discrete points (support spaces) based on prior information about the values of the parameters to be estimated. The choice of priors remains a central question. Usually the sign and magnitude of the parameters is unknown, and the support spaces are defined uniformly around zero (Golan, 2017).
We propose a user-independent approach for choosing the magnitude of the support spaces based on a first GME estimation of the coefficients on standardized data. This estimation will define the minimum (or maximum) of a zero centred symmetric support with equally spaced points for each parameter. We then re-estimate the parameters repeatedly for support spaces with decreasing ranges and determine the 5-fold cross-validation root mean square error (CV-RMSE) keeping the support spaces that produce the lowest CV-RMSE. We test our approach against those previously stated in a simulation study. We also implement the algorithm in R and provide a Shiny web-application to be used by non-R users.
Our simulation will consider 100 replications and 100 observations. A specific vector of parameters, different number of independent variables drawn from a standard normal distribution and random correlation matrices will be used to generate data. Three of these continuous variables will generate the dependent variable then added by an error that follows normal distributions with zero-mean and different standard deviations. The supports for the parameters of the GME estimator are defined with 3, 5 and 7 points. The supports for the error component are defined symmetrically and centred on zero with three points, using the three-sigma rule with the empirical standard deviation of the noisy observations.
The GME estimator with our proposal for the selection of the supports generally returned the lowest median 5-fold CV-RMSE. We note that the differences in performance when different number of support points is used is not relevant, yet the time of computation increases significantly with the increase of the number of points.

Keywords: *Ordinary least squares, Ridge, M estimation, Simulation study, Generalized maximum entropy, Support space*

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Multiple orthogonality and Markov chains

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Abstract. In this project we will search for generalized orthogonal polynomials describing Markov chains beyond birth and death chains, i.e. allowing for jumps not only among nearest neighbors. We were successfully in doing so for the case of multiple orthogonality, of both types I and II, and now we intend to go deeper in this analise, to the case of mixed type multiple orthogonality.

Keywords: *Multiple orthogonality, Markov chains*

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Modeling COVID-19 with graph theory and cellular automata as an alternative to overcome the limitations of the SIR model.

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Abstract. The mathematical modeling of COVID-19 was essential to predict the spread of the SARS-CoV-2 virus as well as to understand the transmission and the impact of the subsequential interventions taken to prevent its spread. Models for this task often rely on systems of differential equations, that although have good results regarding temporal evolution, generally lack consistency when it comes to other aspects like properties of space and heterogeneous populations. The aim of this research is to adopt a new approach to the modeling of COVID-19 in order to overcome the limitations of the classical models, such as the SIR model. By adopting an approach considering graph theory and cellular automata, it is expected that some of these limitations, like lack of spatial properties and the assumption of homogeneous populations will be mitigated. Some results have already been acquired, with focus on the creation and analysis of the contact network, which is the fundamental cornerstone to establish the creation of the transmission graphs.

Keywords: *Modelling, Graph Theory, Cellular Automata, Covid19, SIR.*

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Simulating COVID-19 with Cellular Automata - Max Brenner - https://towardsdatascience.com/simulating-covid-19-with-cellular-automata-aeb820910a9

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Spatio-temporal models for time series of counts and their application to health outcomes

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Abstract. The analysis of time series of counts is a requirement in several different scientific fields, such as epidemiology, ecology, finance, and many others. Because of this need, several statistical models have been developed to account for the integer nature as well as the temporal dependence of the data. One popular approach is based on the so-called INteger AutoRegressive and Moving Average (INARMA) process, which constitutes the discrete counterpart of the well-known ARMA process popularized by Box and Jenkins in the 1970s. The INARMA models preserve the integerness of the data by replacing the multiplication for the random binomial thinning operator (Steutel ; Van Harn, 1979; Franke ; Subba Rao, 1993) and by replacing the Gaussian distributed innovation process by a discrete valued one.This research topic has gained visibility more recently, and its multivariate extensions are still underdeveloped. As such, this work aims at introducing a new class of statistical models to analyse multivariate time series of counts also exhibiting spatial dependency. The novel process is addressed as Space-Time INARMA (STINARMA) and are, on the one hand, a space-time extension of the INARMA process and, on the other hand, an integer counterpart of the continuous STARMA (Pfeifer ; Deutsch, 1980) process, by borrowing some ideas of the STARMA class of models to introduce the spatial dependency in the STINARMA process. This work deals with the STINARMA class and its subclasses, namely the purely autoregressive (STINAR) models and the purely moving average (STINMA) models. Theoretical results on first- and second-order moments are provided, as well as the space-time (partial) autocorrelation function which play an important role in model identification. Further developments include the proposal of methods to fit a model of the STINARMA class to a space-time series of counts. The estimation of the STINARMA parameters can be performed from moment-based, conditional least squares or conditional maximum likelihood with their performance being evaluated via simulation. Lastly, the use of STINARMA models are illustrated by analysing space-time count data consisting of the daily number of hospital admissions over time, in different Portuguese locations.Overall, this work contributes to the knowledge improvement of count time series by proposing a framework for modeling space-time data. Additionally, the methods for the analysis and estimation of STINARMA are being developed in R, such that these can be built into a package in view to promote and disseminate the broad use of these models.

Keywords: *Space-time series of counts, STINARMA models, Autoregressive models, Moving average models, Binomial thinning operator.*

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Artistic Creation

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Da interpretação à performance: uma experiência de criação coletiva

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Abstract. É notório o declínio na afluência a performances musicais no âmbito da música erudita de tradição europeia, verificado por vários autores que encontram algumas razões para que isto aconteça suspeitando que existe como que uma "barreira" entre performers e publico que restringe a comunicacao, (J. Sloboda ; Ford, 2013); ou uma preferencia de alguns ouvintes em reproduzirem gravacoes de obras primas no conforto das suas casas em detrimento de performances ao vivo (Haan, 1998). Destas duas ordens de razoes, a que mais me intriga, e aquela que eu estou a tentar reverter e a que se refere a uma "barreira" entre performers e publico que possa existir no ritual de concerto. Uma causa apontada por varios investigadores para a formacao desta barreira e o facto que muitos e muitas interpretes colocam o foco mais numa "execucao competente" das partituras, ou seja, a reproducao estrita no instrumento, sem erros, do texto que esta na partitura do que em "criar, materializar e partilhar a narrativa que extrapola a obra musical" (Dalagna et al., 2021).
Tendo em conta que "art is not in objects or performances but in the way in which they are perceived" (Correia ; Dalagna, 2020: 13), a minha investigação e um projeto de ressignificacao, recriando sentidos e desta forma desafiar o publico, levando-o a entrar em jogos de 'make believe' (Walton, 1990), ou seja, dar espaco ao publico para que (re)construa as suas narrativas (Correia, 2003).
Na sequência de outras obras já trabalhadas, como "Cassandra's Dream Song" de Brian Ferneyhought, "Chant de Linos" de André Jolivet e "Ego(s)" de Bruna Santander, a investigação aqui relatada tem o seu foco na construção da performance de uma ópera. "La Flute em Chantier" – Ópera para uma classe de flautas - foi composta por Claude-Henry Joubert para orquestra de flautas e 3 actores, com base numa narrativa que pretende introduzir o público mais jovem ao mundo imaginário da Flauta Mágica de W. A. Mozart.
Nas sessões de laboratorio de investigacao artistica (exploracao e criacao) com os intervenientes será explorado som, corpo e cena (com recursos multimiédia) (re-) criando simbolos a partir da narrativa inicial.
Tratando-se de um projeto de liberdade e inovação artística (o número 19 dos indicadores para a cultura da Agenda 2030), pretende-se que contribua para a inclusão de sociedades, tornando a música mais apelativa, e sobretudo significativa e relevante para a um público mais vasto.

Keywords: *Criação; Ópera; Flauta; Performance Musical*

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A century playing with Tiger Claw: Endemic piano performance in Baja California Sur from 1880 to 1980

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Abstract. Geographic and social conditions in Baja California Sur, Mexico from the end of the 19th century until the 1980's, determined a particular way of playing different piano repertories, where regional piano performances practices developed differently of the rest of Mexico, remaining till now some interpretative practices used before the 20th century, and developing techniques and aesthetic concepts that respond to an own aesthetic determined for their situation of almost insularity.The main objective of my research is to propose and create an interpretation for different piano repertoires with the socio-cultural and musical distinctive performative practices found that I define as "endemic performance"is a concept that can be used instead of the "national performance schools", that doesn't include smaller and forgotten places. In this research has been very important to define women's roles in piano performance, migration, and minority´s influences and a rescue of forbidden local and international repertoire.The creative results has been made by the hand of ethnographic study, the regional aesthetic codes, the perspective of gender and the reflexive phenomenology that have been lived and experimented in daily piano practice as a part of an autoethnographic study, where technologies has been also included as part of the artistic result where music and its repertoires have been rewritten in relation to the score, the canonical tradition, boundaries between time, genre, gender, geography and identity. For this lecture I have go deeper in this last concept, because the results of the research has shown a range of multicultural influences that coexisted in the way of making this local music, that suggest us to rewrite it.

Keywords: *endemic performance, artistic research, identity, ethnography*

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North American classical guitar homages to Jorge Peixinho (1940-1995)

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Abstract. Jorge Peixinho (1940-1995) was a major Portuguese composer of the avant-garde musical movement from the second half of the twentieth century. Jorge Peixinho's works catalogue, elaborated by Delgado, Machado, and Machado (2002), was consulted as the main source for the identification of 21 guitar works (some with several versions) composed through a period of 24 years (1971-1994).This communication focuses on two new works for classical guitar and fixed media (audio and video): "Our Great Emergency" by Spencer Arias and "Saguaros Frozen in the Canyon – Echoes of the Lyrebird" by Becky Turro. Both composers write in their own distinct musical aesthetics, while exploring different ways of paying homage to Jorge Peixinho, through diverse means which are now thoroughly analyzed. These include the resource to characteristic guitar techniques and effects; the adoption of similar notation and procedures; or the insertion of written and audio quotations from Peixinho's works and Lopes e Silva's recordings.The aim of this presentation is to raise awareness of the sheer amount of available classical guitar music written by Jorge Peixinho or inspired by him, as well as to spread these recent North American homages for guitar and fixed media, which reflect the lasting appeal of Peixinho's exquisite musical language and Lopes e Silva's unique guitar playing in today's artistic scene.

Keywords: *Classical guitar; Fixed media; Jorge Peixinho; Lopes e Silva; Spencer Arias; Becky Turro.*

References.

Arias, S. (2023). Our Great Emergency. Unpublished musical score.Turro, B. (2023). Saguaros Frozen in the Canyon - Echoes of the Lyrebird. Unpublished musical score.

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Six performative experiences: in search of a way of being with plants that can influence decisions for a more inclusive and sustainable society

Ponce de León[1], Marisa

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Abstract. One of the ways that helped me to become more aware and sensitised to the possible reasons why we face an environmental crisis today, was the way I relate to plants. There was a disconnection that had to do precisely with the relationship that I establish with myself and with living beings.
Faced with this and using my qualities as a professional flautist, I consciously reconfigured my way of being with these living beings that have existed on Planet Earth for more than three and a half billion years. Immersing myself in the world of plants inside and outside the performative context, this relationship is based on empathy, curiosity, admiration and respect for plants. Reflected in six artistic creations in the form of performative experiences, these performances were presented in five European countries during my doctorate studies (four years).
My intention with this presentation is to contribute ecologically and ethically to a more inclusive and sustainable society, as well as to open and discuss possibilities for new practices that contribute to ways of being that improve our relationships with ourselves, with our surroundings and with the environment.

Keywords: *Artistic research; plants; ecology; artistic creation; music*

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Along blurred lines: repositioning memory at the border through the sensorial

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Abstract. Thinking about the Border today, despite its increasing spread across the globe, takes on new forms and challenges, whether due to the impacts of globalization, the way we relate to spaces and places or the conceptual expansion of the act of dividing. Facing this demand, the recent praxis of Border-Studies considers the territory beyond its strict geographical frame and its stability illusion. Rather, it considers space as socially constructed and deeply rooted on the symbolic, the abstract and the intangible. Recent methodological approaches have employed temporality as a more central component in the study of borders in contrast to space-centred investigations, giving us various perspectives on how they can be understood over and through time. Thus, memory work, from a broader prism than the historiographical evolution of events, can reflect the borderscape, through the depth of the personal remembrance.

Within this space of critical imagination, artistic practices and interventions have justified the designation of border-Art by demonstrating their potential to empathetically disturb and defy established logics about the territory itself. However, the main trends have been reflecting the artists propensity for performative interventions of the territory that neglect the possibilities of exploring temporal dimensions, focusing mainly on the reconfiguration of the tangible and the immediate confrontation with the physical barrier.

This research takes a new approach at the heritage of the Portuguese border, by rescuing the aesthetic potentialities present in memory to conceive new narrative possibilities and other ways of thinking about a place today pacified and thus marked by the intangibility of the post-Schengen era. From a multidisciplinary perspective, integrating methodologies from social sciences such as anthropology and sociology, stays in different border territories help to produce audiovisual content, as well as archival research, interviews, diaries and other elements that express the contact with the territory, covering the places of memory and meaning, allowing to create a personal collection of content. To compare immersive experiences in different places, the creation of a common script of place is fundamental. The auto-ethnographic contact of the artist on site functions as a roadmap for artistic creations, reinforcing the research-practice character of the investigation, namely by using analogue technologies in the context of new media art practices to create sensory experiences. Through participation in academic and artistic contexts, the research aims to raise awareness and value the memory, identity and heritage of the border in the local and universal collective imaginary.

Keywords: *Visual Arts; Border-Art; Memory; Pratice-as-research; Archive Art*

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Biochemistry

Alginate hydrolysates as phosphates alternatives in meat products

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Abstract. Phosphates are food additives used for the retention of water in several protein-rich products, enhancing texture, tenderness, succulence, and production yield in processed meats (Tarté, 2009). However, high values of phosphate intake have been associated to cardiovascular comorbidity, and chronic kidney disease, justifying the search for clean label substitutes (Ritz et al., 2012). Alginate is an anionic polysaccharide from brown seaweed that when depolymerised into low molecular weight oligo- and polysaccharides have potential as alternatives to phosphates in meat products, by mimicking their size and charge. Therefore, in this study alginate hydrolysates were obtained partial hydrolysis assisted by microwave at 120°C (MW120) and 150°C (MW150). The MW150 hydrolysate contained a higher content of low molecular weight oligo- and polysaccharides in comparison with the MW120 hydrolysate as observed by high-performance anion exchange chromatography with pulsed amperometric detector (HPAEC-PAD). Due to its carbohydrate composition, MW150 hydrolysate was incorporated in the cooked ham formulation. For comparison purposes, hams were also prepared without the additive incorporation (negative control), with the addition of sodium tripolyphosphate (positive control), and with commercial clean label alternative additives. All hams had higher moisture than the ham without phosphate. Textural analysis showed that ham with clean label substitutes achieved less hardness than ham without phosphate. Nevertheless, moisture determination and texture profile analysis of cooked hams showed that MW150 alginate addition possessed similar moisture and hardness in comparison with the cooked hams containing the commercial additives. Colour analysis showed that in comparison with hams with phosphate (positive control) all other formulations showed perceived differences. These results show that alginate hydrolysates have potential to be a clean label substitute of synthetic phosphates additives in cooked ham formulations.

Keywords: *Alginate hydrolysates, phosphates, meat products*

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Sea Slug Mucus Production Is Supported by Photosynthesis of Stolen Chloroplasts

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Abstract. A handful of sea slugs of the order Sacoglossa are able to steal chloroplasts—kleptoplasts—from their algal food sources and maintain them functionally for periods ranging from several weeksto a few months. In this study, we investigated the role of kleptoplast photosynthesis on mucusproduction by the tropical sea slug Elysia crispata. Animals reared for 5 weeks in quasi dark (5 molphotons m2 s1) showed similar growth to those under regular light (60–90 mol photons m2 s1),showing that kleptoplast photosynthesis was not relevant for growth when sea slugs were fed adlibitum. However, when subjected to short-term desiccation stress, animals reared under regular lightproduced significantly more mucus. Furthermore, the carbohydrate content of secreted mucus wassignificantly lower in slugs limited in the photosynthetic activity of their kleptoplasts by quasi-darkconditions. This study indicates that photosynthesis supports the synthesis of protective mucus inkleptoplast-bearing sea slugs.

Keywords: *carbohydrates; Elysia crispata; kleptoplasty; Sacoglossa*

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Investigating the immunomodulatory effects of bioactive lipids on macrophages mediated immune response: A multi-omics approach

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Abstract. Exacerbated inflammation is a common cause of cellular and tissue damage, which triggers or exacerbates conditions with an inflammatory component. Monocytes and macrophages play essential roles in the activation and resolution phases of the inflammatory response (Fujiwara ; Kobayashi, 2005). Recent evidence suggests that bioactive lipids derived from omega-3 and omega-6 polyunsaturated fatty acids (PUFAs), including eicosanoids, specialized pro-resolving mediators (SPMs), lysoglycerophospholipids, and endocannabinoids act as immunomodulators of immune cells (such as macrophages) thereby modulating the immune response (Leuti et al., 2020; Maurício et al., 2022). However, the molecular mechanisms underlying the immunomodulatory effects of these bioactive lipids and the metabolic reprogramming of macrophages remain unclear. Furthermore, the specific roles of individual polar lipid species in this activity are not well characterized. Therefore, this study aims to investigate the influence of several phospholipids (PL) from different classes, such as phosphatidylcholines (PC), phosphatidylethanolamines (PE), phosphatidylinositol (PI) and phosphatidylserine (PS), esterified with omega-3 or omega-6 PUFAs, on the activation and orchestration of the immune response mediated by monocytes and macrophages using an in vitro model of inflammation induced by lipopolysaccharides (LPS). Ultimately, this study will utilize a multi-omics approach based on mass-spectrometry to analyze the lipidome, the proteome and the metabolome of these immune cells to identify the most active phospholipids. The first step of our work was to assess the viability of murine macrophages (RAW 264.7) after exposure to each pure phospholipid using the resazurin assay. The results indicated that the highest concentrations tested (200 M) of PC standards with higher unsaturation degree (PC 18:0/20:4 and PC 18:0/22:6) and lyso-PC (LPC 18:0) resulted in a decrease in cell viability. These findings suggest that each PL may induce different effects on immune cells. Subsequently, we will evaluate the anti-inflammatory activity of phospholipids using the Griess method.This investigation will enhance our comprehension of the molecular mechanisms that govern the immunomodulatory properties of bioactive lipids synthesized from PUFAs of the omega-3 and omega-6 series, in addition to elucidating the distinctive functions of particular polar lipid species in immune responses. These findings may pave the way for innovative therapeutic strategies targeting inflammatory disorders.

Keywords: *nan*

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Mineral profile as tool to identify authenticity markers of PDO pears and PGI apples cake fillings

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Abstract. The Protected Designation of Origin (PDO) or Protected Geographical Indication (PGI) label of food products is important for the food industry. While PDO "Pera Rocha do Oeste"and PGI "Maçã de Alcobaça"can be easily recognized as authentic when consumed in their natural state, it becomes challenging to identify their authenticity when processed into fruit fillings and used in pastry. To ensure the authenticity of processed products, it is important to identify unique characteristics that can serve as markers of authenticity. Fruits grown in a particular region may possess distinctive characteristics that are linked to the environment, which can be used to identify them even after being processed. With an increasing demand for certified products in the pastry industry, it is important to identify markers of authenticity to commercialize fruit fillings with PDO and PGI certification, with significant economic value. The use of multielement analysis by Inductively Coupled Plasma (ICP) combined with chemometric tools can be allow the identification of PDO pear and PGI apple markers in fruit fillings and establish their geographical origin. The objective of this study was to analyze the mineral profiles of fresh and processed PDO "Pera Rocha do Oeste"pear and PGI "Maçã de Alcobaça" apple and to identify markers of geographical origin and authenticity. According to the results, a significant difference in four elements (Mn, Ce, B, and Rb) allow discriminate PDO pear fillings to non-PDO pear fillings. For apple samples, the PGI apples (fresh fruits and fruit fillings) have lower concentrations of Cs and Rb as compared to samples from other geographical areas. These variations can be attributed to the differences in soil characteristics.The study demonstrates that the multielement analysis contribute to the identification of geographical origin authenticity markers of PDO pear and PGI apple and discriminate the fruit fillings.

Keywords: *Mineral profile; authenticity; markers; PDO pear; PGI apple*

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Galactomannan-based carriers as promising vaccine adjuvants for pulmonary delivery

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Abstract. Respiratory infections are one of the most common illnesses, affecting people of all ages and gender. Vaccination is a safe and effective way to protect both individuals and communities from infectious diseases, exposing individuals to a harmless form of the disease-causing microorganism. The immune system is trained to recognize the microorganism and respond quickly to the threat, so providing protection against future infections. Vaccine formulations include, in addition to antigens, a variety of components such as vaccine adjuvants for enhancing the generated immune response (Clem, 2011). Due to the limited number of adjuvants, especially for mucosal surfaces, new compounds are being explored such as the case of polysaccharides (Weiss et al., 2022). Galactomannans are a natural polysaccharide that can be obtained from plants such as locust bean, tara, or guar gums, presenting a main chain of -(1→4) linked D-mannose residues with singular -(1→6) D-galactose. Here I explore how this polysaccharide can be chemically modified in order to obtain a derivative that can be used to assemble microparticles and encapsulate the antigen. The resulting formulation would have vaccine adjuvant properties, and could be administrated by the pulmonary route, mimicking many airborne microorganisms path of infection and provide mucosal immunity.

The galactomannan will be subjected to partial acid hydrolysis assisted by microwave, an alternative "green" methodology that will avoid the use of aggressive reagents, allowing diminished viscosity and enhancing the polysaccharide immunostimulatory activity (Ferreira et al., 2015). Supercritical conditions will be used to assemble the galactomannans as carriers in the form of microparticles. Because these carriers are aimed as vaccine adjuvants, different model proteins will be tested, providing a better understanding of the behaviour and protection provided by the carrier. Galactomannans can provide a good target for alveolar macrophages, and for this reason, evaluation of cellular viability and proliferation of cell cultures will be carried out using in vitro conditions. Here, epithelial lung cell lines will provide insights into the carrier-lung interactions and cell internalization. The immunostimulatory mechanism will be also determined, evaluating the cytokine production and phagocytosis by macrophages, giving insights into the activated pathway.

In all, this work can provide insights into a new type of adjuvant with carrier-enhancer functions. Also, because these microparticles are prepared in dry powder form, they have the advantage of improving thermostability and removing the need for refrigeration during the transportation and storage of vaccines, possibly reducing the number of wasted doses.

Keywords: *nan*

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Active and water-resistant paper biocoatings developed from coffee and potato industry byproducts: a circular economy strategy

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Abstract. Paper-based packages are usually coated with non-biodegradable polymers to confer barrier properties, which compromises their biodegradability and recyclability. Alternatively, biobased coatings have been developed [1]. Starch recovered from slurries of potato chips industry and coffee industry byproducts have shown potential to develop antioxidant bioplastic formulations [2], but their use on paper coating remains unexplored. In this PhD, the feasibility of using bioplastics developed from recovered potato starch and extracts obtained from coffee fruit cascara (CFC) and silverskin (CS) on paper coating is being evaluated. Starch was thermomechanical mixed with CS and CFC-derived extracts, originating thermoplastics potato starch (TPS)-based biogranulates after being milled. The developed biogranulates were hot-pressed as thin films, characterized, and stamped onto the paper surface. The influence of coffee byproducts-derived extracts on the physicochemical and mechanical properties of TPS formulations was studied and the effect of stamping the bioplastics on paper sheets was assessed.CS and CFC-derived extracts conferred a brownish coloration and a faster antioxidant effect on TPS-based bioplastics. CS increased 2-fold the water contact angle of TPS-based materials, thus decreasing their water wettability, while CFC-derived extracts increased their stretchability by 21% and traction resistance by 53%, overcoming the neat TPS brittleness. When applied onto the paper surface, a TPS/coffee byproducts-based bioplastic was able to decrease ca. 20-fold the paper's water vapor transmission rate (WVTR). Therefore, bioplastics developed from potato and coffee industry byproducts can be used as active and water-resistant biobased coatings for paper, minimizing the ecological footprint of agricultural and paper sectors, and showing potential for future food packaging applications.

Keywords: *Bioplastics, Antioxidant, Potato starch, Coffee fruit cascara, Coffee silverskin, Circular economy*

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How does dilution affect the conductivity, the propensity to aggregate and the biological activity of enzymes?

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Abstract. The current theories do not provide a convincing explanation for many of the protein' manifestations in solution. Therefore, to shed some light on this critical question, the present work analyzed the effect of dilution on the ability of proteins to catalyze chemical reactions, the so-called biological activity. As models enzymes, laccase from Trametes versicolor and chicken egg white lysozyme were used.
The results show that the enzymes' specific biological activity increases on dilution. Three explanations for the intriguing observation were advanced and submitted to experimental scrutiny. Amongst the three hypotheses, only one was corroborated by experiments. According to this explanation, when dissolved in water, proteins reveal two populations: one biologically active whose relative occurrence increases on dilution and another which is not active and whose molecular proportion varies in the opposite direction.
Therefore, the reported experimental facts strongly support the chemical behaviour of the proteins in the solution. According to the herein-advocated concepts, they could undergo a dissociation process similar to that found in electrolyte chemistry.

Keywords: *Protein; Enzymatic Activity; Chemical Equilibrium*

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Metabolic barriers associated with direct reprogramming of mouse fibroblasts into induced cardiomyocytes

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Abstract. Cardiovascular diseases are among the leading causes of death worldwide. Heart injuries (eg. myocardial infarction) lead to loss of cardiomyocytes and, eventually, heart failure. The mammalian neonatal heart is capable of regenerating; this capacity, however, is lost a few days after birth, when cardiomyocytes exit the cell cycle and shift their metabolism from glycolysis to oxidative phosphorylation. Besides bioenergetics, metabolites are important regulators of histone modifications, as they act as co-factors and substrates for chromatin-modifying enzymes, thus linking metabolism and epigenetics, and contributing to the regulation of gene expression in several scenarios.

Through the overexpression of cardiogenic transcription factors Mef2c, Gata4 and Tbx5 (MGT), fibroblasts can be directly reprogrammed into induced cardiomyocytes, thus providing means for replenishing the population of cardiomyocytes. Though promising, this process is very stochastic and is hampered by several barriers, including metabolic and epigenetic.

Our results indicate that retroviral transduction of mouse embryonic fibroblasts (MEFs) and adult mouse ear fibroblasts (AEFs) with MGT activates the intrinsic cardiac program, as evidenced by increased expression of cardiac markers and decrease in fibroblast genes. AEFs, however, seem to be reprogrammed less efficiently than MEFs, emphasizing aging as an additional barrier to cell reprogramming. Immunocytochemistry analyses reveal an increase in the complexity of the mitochondrial network in MGT-transduced MEFs (associated with cells that rely on oxidative phosphorylation), whereas these alterations are not as evident in AEFs. Using an engineered reprogrammable cell line (icMEFs), metabolic modulation revealed increased reprogramming efficiency upon inhibition of glycolysis with 2-deoxy-D-glucose. Also, supplying cells with alternative fuels, either by supplementation with individual fatty acids, or through glucose/lipid deprivation, increases reprogramming efficiency.

Altogether, direct cardiac reprogramming is accompanied by remodeling of the mitochondrial network and is less efficient in adult fibroblasts. Modulation of bioenergetic pathways and mitochondrial metabolism may potentiate this process and impact cardiac regeneration.

Keywords: *nan*

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Polysaccharide-based nano-in-microparticles for plasmid DNA pulmonary delivery

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Abstract. Gene therapy has the potential to treat and cure many gene-associated diseases. However, nucleic acids, which are commonly used for gene therapy, are prone to degradation by nucleases, which can compromise their effectiveness. To avoid this, nucleic acids are often incorporated into nanoparticles [1]. To deliver these nanoparticles to the target site, the pulmonary system is often utilized, although a carrier is required. Pulmonary delivery is a non-invasive administration route that consists in the inhalation of a drug formulation with its later deposition at the alveoli. To reach the lower airways and thus be absorbed by the patient, the carrier must be in particle form and have an aerodynamic diameter between 1-5 µm. These particles may be composed of polysaccharides, thus taking advantage of the biocompatibility and biodegradability of these biopolymers [2]. It is then hypothesized that polysaccharide-based nano-in-microparticles can be used to transport plasmid DNA through the pulmonary system.

In this work, DNA-loaded chitosan nanoparticles were prepared by the coacervation method [3]. The micron-sized carrier was developed using galactomannans from Locust Bean Gum (LBG) by atomization and supercritical CO2 drying. The nanoparticles presented a hydrodynamic diameter of 233 ± 27 nm with a positive surface charge (-potential of +17.4 mV). The aerodynamic diameter of the LBG-based microparticles is expected to be between 1-5 µm and thus have the potential to reach the lower airways and avoid macrophage clearance. The combination of the developed nanoparticles and micron-sized carriers is proposed as a vehicle for plasmid DNA via the pulmonary route.

The present works will contribute to the development of sustainable, inclusive, and innovative societies as 1) the polysaccharides, specifically chitosan and galactomannans, used in this work are originated in sustainable sources, namely shrimp shells (a byproduct of the shellfish industry) and seeds of the carob tree, respectively; 2) these biopolymers are relatively cheap, making the resulting formulation more easily affordable to all people thus contributing to an inclusive society; and lastly, 3) the development of this new carrier with versatility for adaptation to several diseases by adjustment of the nucleic acid cargo will allow the development of several new formulations, thus contributing to an innovative society.

Keywords: *Nanoparticles; Carriers; Chitosan; Galactomannans; Gene therapy*

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Plasma Lipidomics Analysis Reveals Altered Triglyceride and Phosphatidylcholines profile in Children with Medium-Chain Acyl-CoA Dehydrogenase Deficiency

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Abstract. Mitochondria fatty acid -oxidation disorders (FAOD) are a group of inborn errors of metabolism. The most prevalent is the medium-chain acyl-CoA dehydrogenase deficiency (MCADD), characterised by the accumulation of medium-chain acyl-carnitines (CAR) and fatty acids (FA). The accumulation of these lipids leads to potential life-threatening manifestations such as acute hypoketotic hypoglycaemia, encephalopathy episodes and cardiac arrhythmias [1]. These toxic effects can be due to mitochondria homeostasis, causing oxidative stress, and increasing the production of reactive oxygen species (ROS), resulting in an oxidative damage of proteins and lipids and thus cell dysfunction or death [1,2]. Early diagnosis and treatment can be effective to prevent most of those complications, reducing morbidity and mortality [3]. The therapeutic approach is based on avoiding long fasting, life-long low-fat and high-carbohydrate diet.

In spite of dietary restrictions, some studies have reported specific changes in CAR and FA profile in MCADD patients' plasma, and also, oxidized PL, namely oxidized phosphatidylcholine (PC), and isoprostanes were found increased [1]. Nevertheless, the understanding of the modulation of circulating lipids at the molecular level in MCADD remains unclear.

In the present work, we sought to assess the variability of MCADD lipid profile using gas chromatography-mass spectrometry (for analysis of esterified fatty acids) and high-resolution C18-reverse phase-liquid chromatography-tandem mass spectrometry (for analysis of lipid species). Using this approach, 251 lipid species belonging to 15 different lipid classes were identified. Principal component analysis of the lipid species data set showed a distinction between MCADD and CT groups. Univariate analysis revealed that 126 lipid species were significantly different between both groups. Lipid species showing significant variation included triacylglycerols (TG) and PC, containing medium-chain saturated and monosaturated FA, which were more abundant in MCADD. The high level of medium-chain FA-containing lipid species in children with MCADD can be with the consequence of the accumulation of medium-chain FA species in MCADD. In addition, In the literature, higher level of TG and PC bearing saturated and monosaturated FA were positively associated with the risk of cardiovascular diseases [4,5].

This study was the first one comparing the plasma lipidome of MCADD and healthy children, highlighting that the lipidome of MCADD children is altered when compared with controls. Further studies with larger cohorts are needed to clarify whether these alterations are specific to MCADD patients and are related with development of possible outcomes.

Keywords: *Inborn errors of metabolism; MCADD; lipid changes; blood plasma; lipidomics; mass spectrometry.*

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Three-layered nanocellulose patches with acyclovir and hyaluronic acid for the treatment of herpes labialis

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Abstract. Herpes simplex virus-1 (HSV-1) infections affect approximately 67% of the world population and are commonly expressed in the form of sores (fluid-filled blisters) on the perioral region (also known as herpes labilalis), frequently accompanied by erythema, burning sensation, tingling, or itching (James et al., 2020). Acyclovir (ACV), a synthetic guanosine analogue, is an antiviral drug used in the first line of treatment of herpetic lesions (Mondal, 2016). ACV-based creams, like Zovirax®, are especially appealing for localized treatment of herpes simplex. However, these formulations wear off quickly while consuming food and drinks or can be removed by accidentally touching them, requiring multiple re-applications during treatment. Skin patches, such as Compeed®, are an alternative and often a more efficient option to manage this condition, as they remove excess fluid from the affected area and establish a moist environment. Notwithstanding, the patches lack pharmaceutical agents and treat the infected area solely as a wound. In this sense, this work aims to fabricate biopolymeric patches capable of shielding the blisters and simultaneously providing antiviral and wound healing active ingredients. For the biopolymeric matrix, we selected bacterial nanocellulose (BNC) membranes, produced by non-pathogenic bacteria known for their high purity, mechanical performance, porosity, high water-holding capacity, and biocompatibility. Apart from the drug (viz. ACV), we have also incorporated hyaluronic acid (HA), a polysaccharide known to promote cell proliferation and wound healing (Hussain et al., 2017), and glycerol (Gly), as a humectant and plasticizer (Cielecka et al., 2019). The patches were prepared by simple diffusion of the components into the wet BNC porous network and assembled in three layers with different compositions. The layered patches were characterized in terms of their structure, morphology, thermal stability, UV-barrier properties, mechanical performance, moisture- and water-uptake capacity, drug release profile, in vitro biocompatibility towards dermal fibroblasts and wound healing capacity. The patches demonstrate good mechanical performance, adequate moisture- and water-uptake capacity and UV-barrier properties. Moreover, they are non-cytotoxic toward L929 dermal fibroblasts and promote cell adhesion and proliferation, as evaluated in a simulated wound assay. Overall, the prepared multilayered patches exhibit a high potential for concurrent drug delivery and wound healing, which is advantageous for the intended application, i.e., herpes labialis treatment.

Keywords: *Herpes simplex, Acyclovir, Hyaluronic acid, Bacterial nanocellulose, Three-layered patches, Topical drug delivery*

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Innovative nanocomposite hydrogel-based bioinks for 3D bioprinting

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Abstract. The exploration of 3D printing in multiple areas has paved the way for the emergence of a biological variation of this technique, viz. 3D bioprinting, in which biomaterials loaded with living cells (known as bioinks) are deposited layer-by-layer in a computer-controlled way. This process originates complex living 3D constructs with defined shape and size where cells can proliferate [1]. The properties of bioinks, namely their rheological, mechanical, and biological features, influence the viability of the cells and the properties of the final structures, and, therefore, the success of the 3D approach [2]. Understandably, the existence of multiple types of bioinks, from diverse materials and with different characteristics, potentiates the advance of this technique, and the development of new bioinks is a requirement for 3D bioprinting to continue flourishing. Biopolymeric hydrogel-based bioinks are the most common option for 3D bioprinting applications, given their low cytotoxicity and resemblance with the native extracellular matrix [3]. However, these hydrogels frequently need to be modified to enhance their biological properties (e.g., increase cell adhesion) or even to improve their rheological and mechanical characteristics [4]. Herein, the use of nano- and microstructures as additives that modify the characteristics of the biopolymeric matrixes (e.g., viscosity, printability, or biological performance) or that provide the hydrogels with new functionalities (e.g., drug delivery ability) was explored. In this presentation, the final steps of a work focused on bioinks based on alginate hydrogels with curcumin-loaded cellulose esters-based particles will be firstly described. These bioinks were successfully used for the 3D bioprinting of HaCaT cells (1.2×106 cells mL-1), originating drug-releasing living constructs that maintained high cell viabilities for up to 7 days post-bioprinting (nearly 90%). Then, a different work concerning the development of all-cellulose bioinks based on carboxymethylcellulose combined with nanofibrillated cellulose (NFC) will also be described. The rheological evaluation of the all-cellulose formulations revealed that the addition of NFC impacted the viscosity and shear stress of the inks while preserving their recovery rate. Furthermore, the crosslinked hydrogels show a solid-like behaviour (G'>G") for all samples, and their degradation rate in different media was also assessed. Hence, both of these new types of bioinks demonstrate potential for the 3D bioprinting of living cells, constituting a new tool for the fabrication of tissue analogues that could be used for biomedical applications like tissue regeneration and drug development.

Keywords: *3D bioprinting, composite hydrogel bioinks, polysaccharides, living constructs*

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The importance of unraveling the alterations of lipidomic analysis for the identification of new markers in testicular cancer cells

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Abstract. Testis cancer is the most common solid malignant tumour in young men, but only accounts for about 1% of all cancers in men. Fortunately, it is highly curable when the diagnosis is done in an early stage. But early diagnosis is not always easy. The testicles tissues included many types of cells, including Sertoli and Leidyg cells, responsible for the production of testosterone and spermatogenesis. Each can develop pathological changes that can be associated with one or more types of cancer (Chovanec ; Cheng, 2022). Changes in the lipidome have been recognized in several types of cancer and are considered promising for the identification of biomarkers useful for early diagnosis and to access the progression and the outcome of the treatment. Lipids play many essential roles in cellular functions, such as cell survival, proliferation and death, since they are involved in chemical-energy storage, cellular signaling, cell membranes, and cell–cell interactions in tissues (Perrotti et al., 2016). These cellular processes are strongly related to carcinogenesis pathways, particularly to transformation of cells to malignant ones, progression, and metastasis of the tumor. The typical lipid profile of a tissues is altered in many neoplastic diseases, such as reported for prostate cancer, however the plasticity of the lipidome in others cancer cells has not been studied (Bian et al., 2020; Santos ; Schulze, 2012). This thesis project aims to discover potential biomarkers through liquid-chromatography high resolution mass spectrometry (LC-MS) in testicular cell culture with malignant cell and cell culture without malignant cells, and as well as in testis biopsy, and comparing with previous studies carried out in other cancers, specifically hormonal cancers (Wang, Wang, ; Han, 2015). The results gathered with this project can be explored as a promising tool for precision medicine, improving early diagnoses of the testicular cancer.

Keywords: *Testis Cancer, Lipidomics, Biomarkers, Liquid-Chromatography High Resolution Mass Spectrometry*

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From waste to valorization: the benefits of lipids derived from avocado by-products

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Abstract. Avocado is a farm-to-market foodstuff traditionally present on the daily diet of American countries and recently increasingly consumed worldwide. It has high nutritional and functional values (Ramos-Aguilar et al., 2019). Nevertheless, either its direct consumption or industrial processing produces large amounts of avocado by-products, as seeds and peels, which are erroneously neglected. Avocado seed and peel have a high content of lipids, including polyunsaturated fatty acids (PUFAs), with high value and benefits to prevent non-communicable diseases (Alkhalaf et al., 2019). These fatty acids are found mainly esterified in polar lipids, such as phospholipids (PLs) and glycolipids (GLs) (Pacetti et al., 2007), with intrinsic functional value. However, the characterization of polar lipidome and bioactive properties of these lipids of avocado by-products, remains poorly explored and warrants additional investigation. Modern mass spectrometry (MS)-based lipidomics approaches allows not only to understand the lipidome of avocado by-products, but also pinpoint the important relation between structure and bioactive in its polar lipid content.

In this sense, this work aims to look in-depth to the polar lipidome of Hass avocado peel and seed lipid extracts obtained by dichloromethane:methanol (2:1 v/v) extraction and with ultrasound probe-assisted ethanol extraction, and to screen the antioxidant activity of these lipid extracts. Polar lipid composition was performed using a reversed-phase liquid chromatography MS-based untargeted lipidomics approach. Antioxidant activity of peel and seed lipid extracts was examined by the measurement of the potential for scavenging ABTS•+ and DPPH• radicals. Peel and seed lipid extracts showed dissimilar polar lipid profiles, however both of them showed omega () 3 and 6 PUFA-rich PLs and GLs molecular species. In seed the PLs and GLs lipid species was found to be mainly esterified to linoleic acid (C18:2-6), while in peel they were mainly esterified to linolenic acid (C18:3-3). All the lipid extracts showed antioxidant potential with a concentration dependent effect. Results gathered in this work allows to pinpoint that polar lipid extracts of avocado by-products are a natural source of lipids with high nutritional value and with antioxidant potential. The characterization of lipid extracts showed that avocado seed and peel are a very interesting source of bioactive polar lipids, rich in -3 and -6 PUFAs, thus contributing to its valorization. Therefore, the exploitation of avocado wastes as more sustainable source of health-promoting lipids will support the national circular economy fostering their use as ingredients or raw material for the food, nutraceutical, cosmetic and pharmaceutical industries.

Keywords: *Avocado peel and seed, Polar lipids, Lipidomics, Mass-spectrometry, Antioxidant potential*

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Biology

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Eichhornia crassipes: from Amazon Basin to the World

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Abstract. The introduction of alien species in aquatic environments poses a threat to the balance of socio ecological systems, including human well-being, since these environments are a source of services for society. Eichhornia crassipes (Mart.) Solms. has been listed by International Union for Conservation of Nature (IUCN) and Global Invasive Species Database (GISD) since 2018 which provides information on over 850 Invasive Alien Species (IAS), specifying their impacts, routes of introduction and management measures. The native Amazonian plant has been recognized among the worst AIS in aquatic systems worldwide and is currently listed as a species of concern in Europe, so a protocol for risk analysis of pest invasion was created by the International Plant Protection Convention. Although, many studies reveal the negative impacts of the species on aquatic ecosystems, the number of studies demonstrating its beneficial application as use in the production of animals feed and specifically fish, bioremediation and bioaccumulation of pollutants and heavy metals, vermicomposting, production and biogas, in addition to medicinal use. A central issue of invasion biology is understanding how the impacts of its invading agents are regulated. This work aims to investigate the ecological functions performed by the species in the environment in which it is found, to understand which traits define its invasive behavior outside the native range. We performed a literature review on a selection of 2335 Web of Science peer-reviewed studies focusing on the ecological aspects of the species E. crassipes published in 39 different countries in 5 categories: 78 in Ecology, 51 in management, 31 in Biology, 9 in Phytoremediation in situ and 4 in Genetic. This data allowed us find 189 variables, but for two categories: Native and Exotic only 40. These variables were divided (6 Response and 34 Explanatory). We used variables with the minimal 3 observations. After this, only 16 variables were used for an area with two categories. Due to the non-normal distribution of the data, we used Kruskal Wallis nonparametric test for 3 categories, this data was confirmed by Dunn's Test to determine exactly which groups are different. We tested the correlation between the variables. For principal component analysis (PCA) was run to identify major axes of variable covariation and reduce the dataset into fewer functional dimensions.

Keywords: *Eihchornia crassipes, exotic, invasive, native*

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Using diatoms to investigate the role of protected areas in the conservation of rivers

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Abstract. The worlds' biodiversity is experiencing an unprecedented decline as the natural resources are being overexploited to keep up with increasing human demands (Díaz et al., 2019). Among Earth's ecosystems, rivers and streams are one of the most threatened, which seriously jeopardizes the vital services they provide to billions of people, besides compromising the survival of thousands of different species (Reid et al., 2019). Despite the extreme importance of these ecosystems, most of the actions developed so far in order to secure their preservation, have not been totally successful (Harrison et al., 2018). Although the establishment of protected areas has long been the cornerstone of conservation biology, its implementation to fluvial ecosystems is still globally underdeveloped in comparison to the terrestrial and marine environments (Susky ; Cooke, 2007) due to a number of constraints that will be considered and discussed. Hence, this project, developed within University of Aveiro's Doctoral Program in Biology, intends i) to investigate, through the study of benthic diatom communities, how effective are land-based protected areas in terms of safeguarding fluvial biodiversity and ecosystem functioning, and ii) to contribute to the definition of a national framework, with potential application in other countries, to enhance the protection of riverine ecosystems, through adequate governance and management actions. This will be accomplished through extensive literature review, analysis of historical biological datasets and also field experiments to refine and update the existing databases. The results obtained with this project are expected to contribute to a better understanding of the most effective mechanisms to protect fluvial biodiversity and halt their decline.

Keywords: *Biodiversity, Fluvial Protected Areas, Rivers, Diatoms*

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Current understanding on microbiome-based metagenomic and metabolomic biomarkers of colorectal cancer

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Abstract. The human gut is colonized by a vast community of microorganisms, from archaea to bacteria, viruses, and unicellular eukaryotes. The symbiotic and balanced host-microbiome relationship may be disrupted under certain conditions, leading to dysbiosis, which is harmful to the gut ecosystem, impairing local and systemic immune responses and often leading to disease. Colorectal cancer (CRC) may partly be associated with microbiome dysbiosis, being currently the second deadliest cancer worldwide. Research on CRC diagnosis has been increasingly relying on meta-omics tools to understand how host-microbiome interactions and dysbiosis influence CRC pathogenesis and, thus, identify potential biomarkers of disease.

Metagenomics has shifted the way host-gut microbiota interactions are studied nowadays, providing a broad range of microbial sequences describing the human gut. However, the occurrence of a species does not necessarily designate/clarify its function and, thus, metagenomic data on its own is often rendered insufficient. Metabolomics allows the identification and quantification of metabolites produced by the gut microbiome to further understand host-gut microbiota metabolic interactions. Hence, the combination of metagenomics and metabolomics is an extremely powerful approach towards understanding the biological mechanisms by which gut microbiota may contribute to the health of the host and how dysbiosis may lead to disease, connecting genetic variation with the phenotype.

The metabolic characterization of human feces has still been rarely carried out and hence the full characterization of sample stability during storage/handling and standard operating procedures (SOPs) for sample analysis are still lacking. An experimental design and preliminary results for SOP definition for feces metabolomics will be presented.

Major breakthroughs have been reached in the use of multi-omics tools towards the understanding of the relationship between gut microbiota dysbiosis and CRC development, however, there is still much progress to be made. This work will focus on the current knowledge surrounding meta-omics, namely metagenomics and metabolomics, applied to the identification of potential microbial biomarkers of CRC through stool and intestinal mucosa samples.

Keywords: *Gut microbiome, Dysbiosis, Colorectal cancer diagnosis, Meta-omics, Stool, Intestinal mucosa*

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Photodynamic inactivation: a new potential approach against Philasterides dicentrarchi

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Abstract. Philasterides dicentrarchi is a ciliate protozoan responsible for fatal Scuticociliatosis in marine fish (Iglesias et al., 2001). This parasitosis cause high mortality in farmed fish and, consequently, extensive economic losses in aquaculture sector. So far, there are no commercial vaccines to prevent P. dicentrarchi outbreaks and no effective chemotherapeutic agents to treat infected animals are known (Jalenques et al., 2021). More recently, microbial photodynamic inactivation (PDI) has demonstrated to be a promising approach against aquatic protozoa, suggesting its application in aquaculture (Wohllebe et al., 2012). In this study, the potential of PDI approach in the inactivation of P. dicentrarchi was evaluated. Photodynamic experiments were carried out in seawater using two photosensitizers (PS), 5,10,15,20-tetrakis(1-methylpyridinium-4-yl)porphyrin tetraiodide (Tetra-Py(+)-Me) and Methylene Blue (MB). Ciliates were exposed to several concentrations of each PS (0.1 – 20 μM) and the mortality determined along 60 min of white light irradiation (10 mW.cm-2). The effect of each PS was also evaluated in combination with potassium iodide (KI), a well-known PDI adjuvant. The results obtained indicate that PDI with Tetra-Py(+)-Me (5.0 μM) and MB (0.1 μM) were effective in killing all ciliates after 60 min of treatment. The application of KI (1.0 mM) improved the photodynamic action of Tetra-Py(+)-Me (5.0 μM), allowing to reduce the treatment time to eliminate all ciliates to half (30 min). On the other hand, the combination of MB (0.1 μM) + KI (1.0 mM) had an effect similar to that of this PS alone. The effect of PDI on the cellular morphology of ciliates was also evaluated: ciliates subjected to MB treatment mostly showed plasma membrane vacuolation, cell rounding and membrane disintegration, while extensive cell lysis was observed with Tetra-Py(+)-Me treatment. In conclusion, the results obtained in this study indicate that PDI is an effective approach against infective stages of P. dicentrarchi and suggest its promising application for the control of this parasitosis in aquaculture, particularly with MB.

Keywords: *Photodynamic inactivation (PDI), methylene blue, porphyrins, parasitosis, Philasterides dicentrarchi*

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Upconversion nanoparticles for multimodal therapy of melanoma

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Abstract. Malignant melanoma is the deadliest form of skin cancer (Menezes et al., 2016) and is increasing worldwide (Garbe et al., 2016; Siegel et al., 2016). Conventional clinical treatment involves tumour resection combined with radiation and chemotherapy. However, these approaches have several limitations leading to failure in complete tumour eradication. Therefore, new therapeutic approaches are needed (Siegel et al., 2016; Mishra et al., 2018; Tang et al., 2017). The main goal of this work is to develop multimodal nanoplatforms for melanoma skin cancer treatment. The originality is centred on the development of nanoplatforms formed by upconversion nanoparticles (UCNPs) with a mesoporous silica shell (mSiO2) to allow the loading of photosensitisers and anticancer drugs that, under NIR excitation will produce photodynamic therapy, release of anticancer drug (chemotherapy) and plasmonic hyperthermia (photothermal therapy). For the targeted drug release, mSiO2UCNPs functionalized with folic acid and mSiO2UCNPs with a retro-Diels-Alder-activated nanovalve, were developed. The systems were afterwards loaded with doxorubicin and respective loading efficiency and release were then evaluated. Regarding the photodynamic therapy, mSiO2UCNPs were functionalized with photosensitizers and conditions for singlet oxygen generation are being optimized by testing different functionalization protocols and laser irradiation conditions. The cytotoxicity of different mSiO2UCNPs systems was evaluated in different melanoma cells lines. Results are not yet optimal, but more tests will be performed to improve response.

Keywords: *melanoma, upconversion nanoparticles, photodynamic therapy, photothermal therapy, chemotherapy*

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How does arsenic pre-exposure affect Hediste diversicolor exposed to PMMA NPs?

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Abstract. Sediment contamination is a prevalent problem in coastal and estuarine ecosystems, where trace elements may be found in higher concentrations compared to the water column. Studies have previously found high concentrations of these pollutants in tissues of marine invertebrates and altered enzymatic activities. Trace elements, such as arsenic (As) have been demonstrated to impact behaviour, neurotransmission and oxidative status in polychaetes (Breton ; Prentiss, 2019; Silva et al., 2022).

Natural ecosystems have a wide variety of contaminants, including plastics, which have raised concerns in recent years. In marine ecosystems, plastic items break down into micro- and nanoplastics (NPs). However, the effects of NPs on benthic organisms are still mainly unknown. The effects of polymethyl methacrylate (PMMA) have been studied in fish species (Brandts et al., 2018), but there is a knowledge gap in terms of effects on invertebrates, such as polychaetes. Thus, the objective was to understand how historically contaminated organisms may have their response to the presence of NPs modulated by assessing behavioural and biochemical parameters in Hediste diversicolor, a key species in estuarine and coastal ecosystems (Scaps, 2002).

H. diversicolor specimens, collected in a reference site in Ria de Aveiro, were acclimated to laboratory conditions (temperature 16±1, salinity 28) (Silva et al., 2020). Then, 80 organisms were randomly distributed and exposed, for 10 days, to 0 and 0.625 mg As/kg of sediment. Afterwards, 10 organisms per experimental condition were selected for the behavioural and biochemical assays, while 30 organisms from each condition (0 and 0.625 mg/Kg) were randomly distributed per experimental condition (0, 0.5 and 5 mg PMMA/kg) and exposed for 10 days.

Behavioural data showed no alterations between conditions, regardless of pre-exposure. Nonetheless, cholinesterase (ChE) activity increased in non-pre-exposed organisms exposed to 5 mg PMMA NPs/Kg. The electron transport system (ETS) activity decreased in all exposed organisms, regardless of pre-exposure and NP concentration, which may indicate a redirection of energy towards the antioxidant defences, with the activity of superoxide dismutase (SOD) increasing at 5 mg PMMA NPs/Kg. Yet, it was not sufficient to prevent damage at the cell membrane (LPO) level in non-pre-exposed organisms.

The data obtained in this study demonstrated that As pre-exposure influenced the effects of PMMA NPs at the biochemical level. Hence, since NP concentrations in marine environments are expected to increase, it is important to understand the possible effects of the interaction between plastics and the most commonly found pollutants in natural ecosystems.

Keywords: *invertebrate; effects; plastic; nanoparticles; burrowing*

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Production of low-fat mayonnaise by substitution of additives by "clean label" ingredients from food by-products

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Abstract. Mayonnaise is a creamy and smooth sauce used as seasoning and consists in an oil-in-water (O/W) emulsion. Its recipe contains 65-80% fat that is crucial for its texture and appearance. When the fat quantity in mayonnaise is reduced, the oil droplets density decreases, affecting the viscosity of the sauce. Therefore, low-fat mayonnaise contains additives that increase the emulsion stability and improve the final texture (Mirzanajafi-Zanjani, Yousefi, ; Ehsani, 2019). The objective of the present work is to modify the recipe of a commercial light mayonnaise (25% fat) by replacing the emulsifiers (xanthan gum, modified starch, and egg yolk) with other ingredients, such as aquafaba, pine nut skin, and brewer's spent yeast (BSY). A model solution of 25% oil and 75% aqueous buffer at pH 3 was used to mimic the mayonnaise and to test the effects of each of the three ingredients separately at different concentrations. Emulsion formation, stability over time and separation of phases were used as criteria to evaluate each candidate. Pine nut skin and BSY alone failed in the emulsion formation. Aquafaba (60 mg/mL) alone promoted the emulsification, but it was not able to emulsify the whole volume of the sample. When increasing aquafaba concentration to 120 mg/mL, the whole model solution was emulsified successfully. Moreover, different combinations of the three ingredients were tested and the combination of aquafaba, pine nut skin and yeast all together gave the best result. Likely, proteins and polysaccharides contained in aquafaba are crucial for the formation of O/W emulsions (Sharif et al., 2018), while the surfactants contained in the pine nut skin can be used as stabilizing agents and BSY as Pickering agents. This set of ingredients (aquafaba 120 mg/mL, pine nut peel 1.0 mg/mL and yeast 2.5 mg/mL) was then substituted in the original 25% fat mayonnaise recipe. They promoted the formation of emulsion in the whole volume, but after 48h phases started to separate and after 7 days 18% of the emulsification was lost. These results showed that the combination of aquafaba, pine nut peel and BSY constitutes a promising alternative to industrial emulsifiers.

Keywords: *Aquafaba, Pine nut, Yeast, Polysaccharides, Oligosaccharides, Emulsion*

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An Integrative Approach against Shoot Blight Disease on Stone pine

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Abstract. Stone pine (Pinus pinea) is considered a robust species affected by few pathogens, but recently shoot blight has been frequently reported in Portugal, causing serious concerns for producers and pine nut industry. By hindering the development of cones, this problem affects the production of pine nuts, the main resource exploited by the industry. Lately, fungi belonging to different genera have been identified in association with shoot blight of stone pine (Silva et al. 2020a; Silva et al. 2020b). Some of these fungi are emergent pathogens (Pestalotiopsis spp.) and the biotic relationships between them and the abiotic factors affecting it are still unknown. Hence, this project aims to contribute for understanding the expression of shoot blight disease on stone pine, namely to identify biotic and abiotic factors affecting it. Moreover, it aims to develop fast ways for pathogen detection and biological control, towards an integrated approach against SBD on stone pine.

Keywords: *Biological control; Diplodia sapinea; Pathogenicity; PCR; Pestalotiopsis pini; Sydowia polyspora*

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Charcoal combustion in barbecue grills: Potential cytotoxic and genotoxic effects

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Abstract. A significant source of air pollution can result from the use of charcoal for heating and cooking. Due to the distinctive flavor and texture of the food it creates, charcoal is still a preferred cooking fuel in the developed world (Alves et al., 2022; Kabir et al., 2010; Vicente et al., 2018). In reality, restaurants and homes both frequently employ charcoal grilling which promote the exposure to air pollutants from a short distance, leading to possible side effects on health (Bonjour et al., 2013; Wu et al., 2015). The aim of this work was to evaluate the cytotoxic, genotoxic and mutagenicity potential effects of particulate matter below 10 µm (PM10) and PM10-bound polycyclic aromatic hydrocarbons (PAHs) obtained in the emissions of charcoal combustion in barbecue grills.

Field measurements were conducted to collect PM10 samples released from starting a charcoal fire, cooking meat (pork and beef) and fish (salmon and sardine). The background sample was collected before starting the tests, at the same location. The cytotoxic effects of PM10 were evaluated using the human alveolar adenocarcinoma cell line (A549). Interference in cell cycle dynamics and reactive oxygen species (ROS) production was analysed by flow cytometry while the mutagenic potential of the PAHs was studied through the Ames test, using S. typhimurium TA98 and TA100 strains with and without metabolic activation. The results showed a dose-dependent significant reduction of the metabolic activity of A549 cells, with more expressive responses for higher PM10 concentrations, even though, no differences in the LDH release were observed, which may suggest that the PM10 samples reduce lung cell viability without affecting cell membrane integrity. Regarding ROS results, only cells treated with PM10 from starting a charcoal fire and from boneless thin pork chops and pork belly showed a significant increase in ROS levels, which suggest that the increase in ROS levels could potentiate the decline in cell viability. On the other hand, preliminary results showed no changes in cell cycle dynamics. No mutagenic effects were observed for all tested PM10-bound PAH extracts. However, the generalisation of conclusions must be made with caution since the small amounts of available sample restricted the number of concentrations tested in the Ames assay.

In conclusion, using barbecue grills in homes and restaurants is a common practice that exposes people to high levels of pollutants. Thus, more research is needed to understand the biologic effects of these pollutants to reduce health outcomes.

Keywords: *Particulate matter, A549 cell line, cytotoxicity, genotoxicity, mutagenicity, barbecue grills*

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Phage treatment for Salmonella Typhimurium and Salmonella Enteritidis inactivation in egg products

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Abstract. Bacterial foodborne pathogens are a huge health threat as they are responsible for foodborne diseases in the consumers. Food contamination by these bacteria can occur at any stage of the food production, transport and consumption chain (Sillankorva et al., 2012). Salmonella enterica has become a foodborne pathogen of serious concern to the food industry (Balasubramanian et al., 2019). Outbreaks of salmonellosis have been reported in different food matrices with eggs as the most implicated foods in human salmonellosis (Jackson et al., 2013). The most prevalent serovar isolated from egg contents is Salmonella enterica serovar Enteritidis, followed by Salmonella enterica serovar Typhimurium (Whiley and Ross, 2015). Despite the egg decontamination methods currently available (Keerthirathne et al., 2017), bacterial contamination of egg products with Salmonella continues to occur. Therefore, the improvement of available procedures or the development of new strategies to overcome this problem are needed. Bacteriophages (or simply phages) have proved to be an effective approach to inactivate foodborne bacteria. Phages are viruses that only infect bacteria and they exhibit important features that make them promising antibacterial candidates, such as: (i) ubiquitousness, (ii) high specificity against a target host, (iii) self-replication capacity while their hosts are present, (iv) low inherent toxicity, (v) easy and economical isolation and production, and (vi) a long shelf life (Lorraine and Aidan, 2020). Therefore, the main goal of this study was to inactivate two important foodborne pathogens, S. Enteritidis and S. Typhimurium in egg products by using, respectively, phages phSE-P1 and phSE-5. In liquid whole egg, a maximum bacterial reduction of around 2 log colony-forming units (CFU)/mL for S. Typhimurium (after 12 h) and 6 log CFU/mL for S. Enteritidis (after 12 h) was observed with phages phSE-5 and phSE-P1, respectively, for the multiplicity of infection (MOI) of 1000. After 24 h, phage phSE-P1 was able to maintain a S. Enteritidis reduction of around 5 log in liquid whole egg. Additionally, the efficacy of phage phSE-5 against S. Typhimurium was also tested on eggshell showing around 1.5 log CFU/mL reduction (after 8 h) for the MOI of 1000. Overall, the use of phages as an eco-friendly procedure for foodborne pathogens inactivation seems to be a promising approach for food decontamination in order to improve food safety.

Keywords: *Salmonella Enteritidis; Salmonella Typhimurium; Food safety; Bacteriophage; Liquid whole egg; Eggshell.*

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Biology and Ecology of Global Changes

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Ecotoxicological impacts induced by emerging pollutants in marine species exposed to different climate change scenarios

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Abstract. Since the beginning of industrialization, human activity has been the main cause of environmental contamination and climate change (Ghazali and Ali, 2019; IPCC, 2021). The emission of carbon dioxide (CO2) is believed to be the primary source of global warming (Soytas et al. 2007), while global rainfall and evaporation cycles (Durack, 2015) induced salinity shifts. Both events have been increasing and the adverse effects on several aquatic organisms were already showed (e.g., Almeida et al., 2022; Leite et al., 2023). In order to reduce the emissions of CO2, the so-called "renewable energy technologies" such as solar and wind power as well as hybrid and electric vehicles have become popular alternatives. Some of the main raw materials used in these technologies are rare earth elements (REEs) (Groves et al., 2023). Aside from their use in renewable energy technologies, REEs are also utilized in electronics, medicine and manufacturing due to their unique magnetic, catalytic and phosphorescent properties (Balaram, 2019). However, the increasing use of REEs over the past few decades contributed to the enrichment of anthropogenic REEs in aquatic systems (Merschel and Bau, 2015), leading to potential effects to aquatic organisms. In addition, climate changes related factors may change the effects of REEs on organisms. Therefore, the aim of this work is to evaluate the toxic effects of several stressors such as the REEs (neodymium (Nd), dysprosium (Dy), praseodymium (Pr) and europium (Eu)) and climate change related factors like warming and salinity changes. The stressors were tested acting alone and in combination on Mytilus galloprovincialis, in order to identify early warning signals of environmental change caused by these stressors. For this, histopathological and biochemical alterations were evaluated in adult mussels, as well as biochemical and physiological alterations in mussels' sperm. Overall, the results obtained until now showed that REEs cause negative effects on both adult organisms and their sperm, with the combination of REEs and warming leading to higher impacts. With regard to salinity shifts, salinity 40 appeared to aggravate the effects of REE in adult mussels, while in sperm is the salinity 20 that worsened the impacts of REEs. These findings will generate essential knowledge for developing regulatory guidelines and practices to ensure the protection of coastal systems, the maintenance of goods and services.

Keywords: *Rare earth elements, Climate change, Mussels, Ecotoxicity*

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Emerging pollutants in a changing environment: impacts to estuarine bivalves

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Abstract. With the technological advance and economic development, the multiplicity and wide variety of applications of electrical and electronic equipment have increased, as well as the amount of end-of-life products (waste of electrical and electronic equipment, e-waste) (Zhang et al. 2017; Ibanescu et al. 2018). Nevertheless, most of the treatment of e-waste is not accomplished properly and the lack of recycling or its bad management can release many chemical elements and compounds in the environment, including the rare-earth elements (REEs) such as lanthanum (La), gadolinium (Gd), yttrium (Y) and terbium (Tb) (US EPA, 2012). Nevertheless, the environmental risks resulting from REEs presence are almost unknown, especially considering marine systems, which may be even further challenged by foreseen climate changes as increasing temperature and waters' salinity shifts (IPCC, 2022). Preliminary research on the differences between intertidal and subtidal mussel populations from the Ria de Aveiro to both tidal exposure and submergence was first accomplished. Comparing both populations, tidal exposure showed to be more challenging to subtidal mussels while intertidal mussels were not impacted during the submersion period. Both populations presented different life-history traits influencing energy reserves and acclimation periods, but both were adapted to the oxidative stress, making them suitable for ecotoxicological studies. Exposure to 5, 10, 20 and 40 g/L of Y and Tb was performed considering the lack of literature for these elements. Tb was found to cause biochemical alterations in mussels regardless of the concentration tested, which was also verified for La and Gd by other authors (Henriques et al., 2017; Pinto et al., 2017), while Y only caused minor effects, with most alterations occurring at the lowest concentration. Based on the results obtained, low and environmentally relevant concentrations of the four REEs were selected, and mussels were exposed to a combination of each, with either increasing temperature or salinity shifts, to evaluate if these climate change factors altered the toxicity of REEs and its correspondent species sensitivity. The findings revealed that overall, the decrease of salinity led to higher oxidative stress while the increase of temperature led to metabolic depression in the mussels, increasing the susceptibility of the organisms to the toxic effects of the REEs. The understanding of contamination and the physiological responses through detailed analysis and data collection may contribute to the development of effective e-waste management and recycling strategies and can serve as a basis for normative guidelines.

Keywords: *Rare-earth elements, Climate change, Ecotoxicology, Mussels, Oxidative stress*

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Hermetia illucens entomofertilizer- The soil safety perspective of a bio-conversion from olive pomace

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Abstract. The larvae of Hermetia illucens, the black soldier fly (BSF), has a short life cycle and high food conversion rate, representing an added value to entomoculture. From entomoculture, various insect benefits, from biofuel and chitin production to livestock feed and biomedical products, are becoming well-known recently (Purkayastha ; Sarkar, 2021). BSF larvae can also be reared in different types of organic substances, providing a good solution for difficult dwelling residues. Olive pomace is a problematic by-product of the olive oil industry, with high content of phenolic compounds and low pH. It must not be directly landfilled to the environment without pretreatment. BSF larvae can be reared in olive pomace, producing insect and metabolized food known as frass (a mixture of faeces and exuviae). The produced frass contains nutritional value and can be potentially used as an entomofertilizer (Menino et al., 2021). Before being established in the market, this entomofertilizer must be evaluated regarding safety application based on soil quality indicators. Hence, reproduction tests with the soil invertebrates Folsomia candida and Enchytraeus crypticus, and phytotoxicity bioassays with soil and aqueous extract of incubated soil using Lolium perenne and Brassica oleracea seeds were performed as safety indicators. Additionally, soil enzymatic activities (urease, -glucosidase, aryl sulfatase, dehydrogenase, phosphatases -acidic and alkaline¬) were measured. Different concentrations of the entomofertilizer (0(ct), 0.3, 0.6, 1.2, 2.4, 4.8, 9.6 %w/w) in Lufa 2.2 standard soil were applied. As an immature organic compound, frass may have late bioavailability after application. Thus, three sampling times (2, 32, 64 days) of incubated soil were considered. Collected data from soil invertebrate bioassays showed no adverse effect on adults' survival and juvenile reproduction in both sampling times. Both phytotoxicity assays in both methodologies and sampling times had no considerable negative impacts on seed germination and root elongation. Collected results of soil enzymatic activities indicated stimulation in enzyme activity with the increase in entomofertilizer concentration, and a significant increase in the enzyme activities was observed at lower concentrations of frass in later sampling times. However, aside from the promising results obtained via this study, there is still a need to consider more advanced and complex environmental scenarios and perform more in-depth evaluations on soil safety and plant fertility based on the nutritional context of the frass for agricultural purposes.

Keywords: *Hermetia illucens, Olive pomace, Bio-conversion, Entomofertilizer*

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Behavioural changes to understand Lumbriculus variegatus responses to short and long-term exposures to chemicals.

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Abstract. Sediments play an important role in the environmental partitioning of chemicals in aquatic ecosystems as they can act as a sink for lipophilic and persistent chemicals. This can lead to the exposure and bioaccumulation of substances in sediment organisms, key in aquatic trophic chains. However, studies on sediment hazard assessment are still scarce, which may result in an underestimation of the overall chemical threat to the environment.
Hazard assessment is mainly based on short-term acute exposures using lethal endpoints as observed effects. However, more sensitive endpoints are required to enhance our understanding of the effects of chemicals on ecosystems. Behavioural assays provide a faster and typically more sensitive response to chemical exposure than conventional sublethal endpoints such as reproduction and growth. But, studies for behavioural assessment, especially for sediment-dwelling species like the oligochaete Lumbriculus variegatus, are still scarce.
Avoidance behaviour tests are useful behavioural tools to assess soil contamination, linking individuals to the habitat function of soils (Loureiro et al., 2008; ISO, 2008). They represent rapid and cheap experiments to evaluate whether organisms perceive the presence of chemicals and escape to non-contaminated soils as a response. Part of this PhD project was the adjustment of the soil avoidance test design for the aquatic sediment compartment and testing it with L. variegatus. Short-term tests with three chemicals, a pharmaceutical, a pesticide and a metal, known to be persistent in the sediment, were conducted. Test boxes were divided into two compartments, with contaminated and uncontaminated sediments on each side. Ten L. variegatus were added where this division took place to give them an equal chance of choice. Data were used to calculate the avoidance percentage and the sediments' capability to keep their habitat functioning. The results show that these assays can be used to get a fast, accurate and easy-to-evaluate response to chemical stress using the sediment-dwelling species L. variegatus.
Additionally, the design of the avoidance test was modified for use in chronic experiments. For this purpose, avoidance/preference tests were conducted based on the mode of action of the selected chemical, fluoxetine, which is known to influence the neuronal pathways of organisms leading to altered foraging behaviour and light perception (Kennedy ; Connaughton, 2021; Mennigen et al., 2010). Based on this information, it was determined whether organisms could still detect the presence of light and food after long-term exposure to fluoxetine and change their behaviour accordingly to that.

Keywords: *Behavioural tests, Avoidance, Chemical hazard assessment, Lumbriculus variegatus, Chronic*

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Diversity and ecology of deep-sea Zoantharia in the North Atlantic: preliminary results

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Abstract. The deep sea, once considered untouchably remote, is changing with our shifting climate and growing human use of ocean resources. Emerging evidence shows that these changes will unequivocally impact productivity, biodiversity, and distribution of deep-sea fauna, of which we still have limited knowledge and it is now a matter of urgency to improve our understanding of deep-sea biodiversity. Zoantharians (Cnidaria, Anthozoa, Hexacorallia, Zoantharia) are an order of benthic cnidarians that are found in most marine environments, from shallow tropical coral reefs to deep-sea ecosystems including seamounts, coral gardens, cold seeps, and hydrothermal vents. Nonetheless, the diversity and ecological role of deep-sea zoantharians remain largely unknown. The main objective of this project is to increase our understanding of deep-sea zoantharians, a group that may have important roles in shaping deep-sea communities. Baseline data are also required for species distribution and habitat suitability models that map where species, habitats, and vulnerable marine ecosystems may occur, enabling the identification of biodiversity hotspots and the use of area-based management tools. To achieve this, it is required to use an innovative integrative taxonomy approach, including genetic, morphological and ecological datasets to describe the diversity and phylogeny of deep-sea zoantharians in the Atlantic Ocean. We examined specimens previously collected, as well as from recent cruises, in order to ensure representation from different deep-sea ecosystems. Morphological character and cnidome data of the specimens were obtained. In addition, a map was created with up-to-date information about the current state of knowledge of the diversity and distribution of these organisms to understand evolutionary and ecological connections. The final results of this project will contribute to developing efficient management strategies concerning anthropogenic impacts in the deep ocean, including climate change and resource exploitation.

Keywords: *Cnidaria, Zoanthid, Taxonomy, Anthozoa*

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Persistent organic pollutants in harbour porpoises (Phocoena phocoena) stranded in the Portuguese coast

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Abstract. Persistent Organic Pollutants (POPs), such as Polychlorinated biphenyls (PCBs) and Organochlorine pesticides (OCPs) are lipophilic compounds that can bioaccumulate on long-lived top predators, such as marine mammals (Jepson et al., 2016). At elevated concentration levels, these traditional contaminants lead to several negative health effects in marine mammals (Galligan et al., 2019; Williams et al., 2020). The harbour porpoise (Phocoena phocoena) population in the Iberian Peninsula is small, genetically isolated and is under several anthropogenic pressures, such as fisheries and pollutants. This preliminary study aimed at evaluating a suit of contaminants in harbour porpoises stranded along the Portuguese coast. Blubber samples of 42 porpoises (23 males and 19 females) were collected by the stranding network team between 2005 and 2013, and later stored at the Marine Animal Tissue Bank (Ecomare). Samples were analysed by GC- ECD and GC–MS and 21 compounds were target (PCBs and OCPs). Overall, the mean POP concentration levels were ranked as follows: PCBs > DDTs > drines > HCH. The most concerning concentrations were detected for PCBs (ICES 7) in mature males (9.64 ± 3.05 g/g, lipid weight) and 4,4 - DDE (2.58 ± 0.60 g/g, lw) also in mature males. Considering the whole sample, three porpoises (7%) exceeded the PCB toxic threshold defined for health and reproductive effects on marine mammals. PCB 138, PCB 153 and PCB 180 were the predominant PCB congeners (representing 91,4% of the detected PCB), which is in accordance with recent studies of persistent organic pollutants in cetaceans. In general, we found p,p'-DDE/DDT > 0,6 indicating an earlier (not recent) higher environmental DDT availability. This preliminary evaluation corroborates that traditional POP concentrations remain high in small cetaceans, despite the legally enforced bans over the years and supports the need for a conservation strategy for this species.

Keywords: *Persistent organic pollution, Bioaccumulation, Cetaceans, North Atlantic*

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In the face of global warming: Composition and variability of the Decapod larvae communities in a south Iberian estuary

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Abstract. Climate changes pose a severe threat to planktonic populations, with added risk for meroplanktonic assemblages, which may compromise recruitment success into adult life stages, mostly used as food resources (Simith et al., 2014; Souza et al., 2022). The present study aims to investigate the influence of the current and predicted environmental scenarios (RCP 2.6 and RCP 8.5) on the interannual abundance of decapod larvae assemblages in the Guadiana estuary (Portugal). A zooplanktonic sampling program was conducted on a single station at the estuary entrance, from 2014 – 2022. The decapod larvae assemblages are dominated by Upogebia spp., followed by Diogenes pugilator, Panopeus africanus, Afropinnotheres monodi, and Polybius henslowii species. Structural equation modeling results reveal that the whole community was strongly influenced by varying water temperatures and salinity, while chlorophyll-a concentrations, river runoff and the influence of the large-scale climatic mode North Atlantic Oscillation (NAO) revealed no influence on these assemblages' abundances. Overall, the whole community and the main species revealed a positive linear trend with increased salinity. While increasing temperatures revealed different effects according to species. Under the current climatic scenario, water temperature seems to be more important in predicting seasonal variation of the assemblages' abundances, with marked seasonality during Spring and Summer. On an interannual basis, no significant difference was observed in abundance nor in species composition found between warm and cold years for the current period. However, predictive models used to investigate future scenarios, RCP 2.6, and RCP 8.5, where the temperature is expected to rise 2 °C and 4.3 °C by 2100, suggest an alteration in assemblages' composition, where the abundances of D. pugilator, the second most abundant species, tend to decrease abruptly. Reported evidence along with the high connectivity of the study site with the Mediterranean Sea, where extreme climatic events, like marine heatwaves, and invasion by alien species, is increasingly more frequent, also connected with changes in freshwater discharges changes, will likely trigger significant alterations in species dominance and abundance, with clear ecological and socio-economic implications.

Keywords: *Climate change, Meroplankton, Extreme climatic events, Guadiana estuary, Crustaceans*

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Engineering Immune Cell-based Living Materials for Pancreatic Cancer Immunotherapies

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Abstract. Pancreatic cancer is a severe form of cancer that requires the development of more effective therapeutic strategies urgently. Although cell-based cancer immunotherapies have demonstrated potential in treating liquid cancers, their effectiveness is limited in solid tumors due to low tumor penetration and a lack of targeting specificity. To overcome such hindrances, this proposal aims to bioengineer a living material, herein known as immunoid, which consists of a high-density immune cell aggregate. The rationale behind the creation of this living material settles upon metabolic glycoengineering, which will be employed to modify the surface of immune cells with bioorthogonal click chemistry moieties that can enable transient cell aggregation. This interconnecting technology will enable long-term residence and biologically controlled release of anti-tumoral immune cells directly into the tumor microenvironment upon injection, thereby surpassing the limitations of intravenous administration strategies. The most significant advantage of this approach relies on its ability to specifically target the tumor site, resulting in higher efficacy in the treatment of solid tumors. Moreover, immunoids, which leverage universal cell-surface bioengineering toolboxes, have the potential to be used in treating a variety of solid tumors, making them broadly applicable and impactful in the immuno-oncology field. Therefore, if successful, this bioengineering approach can provide a novel and effective therapeutic avenue for treating highly fatal malignancies like pancreatic cancer.

Keywords: *Pancreatic cancer; Immunotherapy; Metabolic glycoengineering; Bioorthogonal click-chemistry; Living materials*

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Targeting pulmonary artery endothelial cells dysfunction in pulmonary arterial hypertension

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Abstract. Introduction: There are several types of pulmonary hypertension (PH), but current diagnostic and classification criteria are primarily based on clinical features, which may not fully capture the heterogeneity of the disease.[1] Accurate characterization of PH is essential for a timely diagnosis and better disease management.[1] Analyzing the molecular profile of plasma samples collected at the beginning and end of the pulmonary circulation will allow the discovery of new mechanisms associated with PH and uncover changes that occur as blood flows through the pulmonary vasculature without the interference of peripheral tissues. This might yield a more granular and specific pathophysiological insight regarding pulmonary circulation biology on different types of PH.Aims: To compare the metabolome and proteome of transpulmonary gradient of blood plasma of different phenotypes of pulmonary hypertension (iPAH, ScPAH, CTEPH), and understand how endothelial cell function is altered between groups.Methods: PH patients were recruited at a reference center of PH and underwent a clinically indicated right heart catheterization (RHC). During this procedure, blood was drawn from pulmonary artery and pulmonary capillaries to evaluate transpulmonary gradient. Plasma was processed and frozen at -80C until further use. In addition, pulmonary artery endothelial cells (PAECs) were collected directly from the balloon of the catheter used in RHC and characterized by flow cytometry. Human PAECs were also purchased and incubated with patients' plasma to determine the viability, proliferation, and apoptosis of endothelial cells with different phenotypes. Transpulmonary gradient of the plasma metabolome of different PH phenotypes will be evaluated using 1-NMR spectroscopy. The proteome will be characterized in the cargo of extracellular vesicles isolated from plasma and cell culture media using liquid LC-MS/MS analysis. Results: Blood from 210 patients with suspected PH was collected from the pulmonary artery and pulmonary capillaries during a RHC. Clinical history and RHC data were processed and patients were divided according to their PH classification: 24 patients with idiopathic pulmonary arterial hypertension (iPAH), 30 with PH associated with systemic sclerosis (scPAH), 45 with chronic thrombo-embolic PH (CTEPH), and 45 had no signs of PH (controls). The remaining patients have other PH classifications and/or were excluded due to other diagnosis. A preliminary study assessing the proteome of EVs of iPAH and controls was performed, in which three proteins were in significantly lower amounts in iPAH-related EVs compared with controls (adiponectin, haptoglobin, and fibulin-1). Those proteins are associated with endothelial dysfunction, inflammation, endothelial cell migration, and pulmonary vascular remodeling.

Keywords: *Pulmonary hypertension, endothelial dysfunction, transpulmonary gradient*

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Identification of a potential prognostic panel of biomarkers for stratification of head and neck squamous cell carcinoma based on HPV status and TP53 mutational status

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Abstract. Head and Neck Squamous Cell Carcinoma (HNSCC) is a malignant cancer with poor prognosis. Currently, the prognosis of HNSCC is determined by clinical and histopathological criteria. This work focused on identifying a panel of genes that have the potential to be used for prognosis of HNSCC and to improve patient stratification for treatment. To this end, a bibliometric analysis (VosViewer) was applied to identify candidate genes that were further characterized by applying several bioinformatics tools (UALCAN, ToPP). The prognostic potential of the genes of interest was evaluated using the univariate and the multivariate Cox proportional regression models and the transcriptional expression analysis among HNSCC and normal tissues. In HNSCC, the transcriptional levels of candidate genes, were analyzed in HPV-driven HNSCC, HPV-non-driven HNSCC, TP53-mutant HNSCC and TP53-nonmutant HNSCC for selecting the best set of genes for discrimination of HNSCC based on both HPV status and TP53 mutational status. These analyses revealed a signature based on four genes with greater HNSCC prognostic potential: CDKN2A, TGFB1, CD44 and MMP9, being p16 the sole biomarker currently tested. In the future, a molecular signature could facilitate the stratification of patients into high- and low-risk groups as well the wiser adjustment of therapies to each individual response allowing a personalized treatment.

Keywords: *Head and neck squamous cell carcinoma; Prognosis; Biomarkers; Precision medicine*

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Decoding the genetic architecture of reduced functional status in COPD: Insights from cluster analysis and genome-wide association study

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Abstract. Chronic obstructive pulmonary disease (COPD) is a progressive respiratory disease characterised by persistent airflow limitation, dyspnoea, and cough. There is limited evidence on how genetics might influence meaningful health-domain outcomes, such as reduced functional capacity and peripheral muscle strength. To address this gap, we sought to identify genetic variants associated with poor functional status in patients with COPD.

This study was conducted in 208 patients with COPD, a subset of whom had genotyping data available. The six-minute walk test (6MWT) and the one-minute sit-to-stand test (1-minute STS) were used to evaluate functional capacity, while quadriceps maximum voluntary contraction (QMS) and handgrip strength (handgrip) were used to evaluate peripheral muscle strength. Hierarchical cluster analysis (Ward's method) was performed to classify the patients, based on the data of the four variables transformed by principal component analysis. A multivariate logistic regression-based genome-wide association study (GWAS) was performed (adjusted for age, sex, body mass index, smoking status and forced expiratory volume in 1 second (FEV1) % predicted). FUMAGWAS was used for functional annotation of the results.

This study included 208 COPD patients (67.8 ± 7.9 years old; 21.2% female; FEV1 53.0 [40.0, 67.0] % predicted). The study identified three groups of patients with different characteristics. Cluster 1 comprised younger, mostly male patients with preserved muscle strength and functional capacity. Cluster 2 comprised patients with mild-to-moderate symptoms, reduced muscle strength, but preserved functional capacity. Cluster 3 comprised older, highly symptomatic patients with peripheral muscle weakness and impaired functional capacity. GWAS identified six suggestive loci associated with cluster 3. They were mapped to GPC1, IQSEC1, PHACTR2, FAM177A1 and ANKRD11 genes, which have been linked to disorders associated with muscle weakness, muscle fatigue, and inflammatory response.

These findings shed light on the genetic factors that contribute to reduced functional status in patients with COPD, providing potential for tailored therapeutic approaches. Further research is needed to validate the findings in independent cohorts and to unravel the relationship between these genetic variants and reduced functional status.

Keywords: *COPD, clusters, GWAS, Functional status*

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Coronary Artery Disease and Aortic Valve Stenosis: A Urine Proteomics Study

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Abstract. Coronary artery disease (CAD) and the frequently coexisting aortic valve stenosis (AVS) are heart diseases accounting for most cardiac surgeries (Ambrose ; Singh, 2015; Dweck et al., 2012). These share many risk factors, such as age, diabetes, hypertension, or obesity, and similar pathogenesis, including endothelial disruption, lipid and immune cell infiltration, inflammation, fibrosis, and calcification (Mendis et al., 2011; Sabbagh ; Nishimura, 2017). Unsuspected CAD and AVS are sometimes detected opportunistically, such as through echocardiography, coronary angiography, and magnetic resonance. Routine biomarkers for early detection of either of these atherosclerotic-rooted conditions would be important to anticipate the diagnosis. With a noninvasive collection, urine is appealing for biomarker assessment (Shah et al., 2010). We conducted a shotgun proteomics exploratory analysis of urine from 12 CAD and/or AVS patients and 11 controls to identify putative candidates to differentiate these diseases from healthy subjects. Among the top 20 most dysregulated proteins, TIMP1, MMP2 and vWF stood out, being at least 2.5x increased in patients with CAD/AVS and holding a central position in a network of protein-protein interactions. Moreover, their assessment in an independent cohort (19 CAD/AVS and 10 controls) evidenced strong correlations between urinary TIMP1 and vWF levels and a common cardiovascular risk factor - HDL (r = 0.59, p < 0.05, and r = 0.64, p < 0.01, respectively).

Keywords: *coronary artery disease, aortic valve stenosis, biomarkers, urine, proteomics*

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Identifying Cancer-Associated Genes in Myotonic Dystrophy Type 1 Patients

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Abstract. Myotonic dystrophy type 1 (DM1) is a complex multi-system disorder caused by a trinucleotide expansion of unstable repetitions of CTG in the 3' untranslated region of the DMPK gene and is characterized by progressive muscle weakness and atrophy (1). Studies have shown patients with DM1 are at a high risk of developing certain types of cancers (2-3). Hence, it is crucial to elucidate the reason for the higher cancer risk in patients with DM1. Recently, we explored the novel metabolism-related targets for DM1 and identified 71 candidate genes using automatic text-mining analysis (4). Furthermore, our data also lead to a direction indicating many of these putative genes could be cancer-associated genes. We aim to investigate the relationship between DM1 and various types of cancer by performing survival analysis using Kaplan-Meier (KM) plots with the identified 71 genes to investigate the relevant cancer-associated genes. Exploration of data is still ongoing to investigate the signaling pathways also involved with the help of various bioinformatic tools i.e., Driver DB.
These approaches may allow the recognition of potential DM1-associated cancer genes. We strongly believe that some of these targets could be validated into patients with DM1. In conclusion, this study will advance new insights into the relationship between DM1 and cancer.

Keywords: *Myotonic dystrophy type 1, Cancer, Signaling pathways, Survival analysis*

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ECG based quantification and modeling of physiological reactions to emotional stimuli

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Abstract. Emotion recognition systems are designed to help in the identification of human emotions, being associated with learning and decision-making on daily tasks as well as treatment and diagnosis in mental health contexts[Meiselman, 2021]. The research in this area explores different aspects ranging from the information conveyed in different physiological signals to different methods aiming feature selection and emotion classification[Bulagang et al., 2020]. This work enrolled 56 subjects in an experimental protocol at University of Aveiro [Henriques, 2022], to visualize videos with different emotional content (Fear, Happy and Neutral) while monitoring physiological signals, such as the electrocardiogram (ECG). Additionally, several questionnaires were answered in order to assess the traits of anxiety, the alexithymia construct, and the emotional state of the participants. This study aimed to extract and study the most relevant features in emotion characterization from the acquired physiological signals and incorporate them into an algorithm capable of correctly labeling the samples with the maximized performance. Data analysis was focused on the instantaneous heart rate, and it was used to identify time instants with a significant physiological response based on a two-step procedure. The first step aimed to identify the time instants of the protocol with a significant average group response. The second step further inspected if the individual response, at the identified time instants, is significant with respect to the pairwise variations of the baseline. The individual response to the stimulus was then evaluated for each significant group event. The intensity of the response was quantified from the individual signals used to compute the group average, considering the area under the absolute curve normalized by the duration of the event. This study considered the evaluation of the optimal number of clusters via hierarchical clustering (dendrogram) with an evaluation with the Elbow method. The optimal number of clusters was then considered in the K-means clusteringalgorithm to produce distinct non-overlapping clusters. The clusters were then ordered by increasing intensity and evaluated by performance metrics, where it was demonstrated a clear distinguishment of reactions by a clustering procedure. A machine learning model developed based on Support Vector Machineachieved a balanced accuracy above 87.01% (training) and 38.40% (test). The emotion state identification was performed over the goals of this study, indicating the potential ability of electrophysiological signal processing for automatic emotion stratification, after emotional video stimulation.

Keywords: *Emotion classification, Electrocardiogram, Cluster analysis, Support Vector Machine, Affective computing*

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Exploring the putative interaction between SARS-CoV-2 nucleoprotein and Protein Phosphatase 1: an in silico approach

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Abstract. In the last decades, various studies have explored the importance of Protein Phosphatase 1 (PP1) in the context of viral infections, demonstrating that several viruses encode regulatory interactors of PP1 (RIPPOs), whereas others encode proteins that recruit host RIPPOs. In both scenarios, the PP1 activity is modulated to favor the viral life-cycle and to evade the host immune response. Most RIPPOs have intrinsically disordered short linear motifs (SLiMs), such as the RVxF- and SILK-motifs, that mediate binding to PP1. In this study, we aimed to explore whether specific proteins from the -coronavirus severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) may act as viral RIPPOs or interfere with host-RIPPOs. A search was conducted to identify PP1-binding SLiM consensus sequences in SARS-CoV-2 proteins. The protein regions containing such SLiMs were evaluated to predict their disorder propensity and structural conformation. A cross-comparison between human RIPPOs and SARS-CoV-2 nucleoprotein interactors was performed. To gain molecular insight, the biological function(s) of the common interactors was searched. Finally, the nucleoprotein PP1-binding SLiM conservation was studied across the -coronaviruses nucleoproteins. Our results showed that fifteen SARS-CoV-2 proteins possess consensus PP1-binding SLiMs, but only nucleoprotein and nsp3 have such a motif in an intrinsically disordered surface region. Cross-comparison between SARS-CoV-2 nucleoprotein interactors and human RIPPOs revealed 8 common proteins, of which 3 are associated with viral infection and immune response. Although not conserved, -coronaviruses nucleoproteins present RVxF or SILK motifs placed in the same region, suggesting that during evolution PP1-binding SliMs have been maintained. The in-silico analysis revealed that SARS-CoV-2 nucleoprotein possesses a RVxF motif that meets the requirements for PP1 docking, suggesting a potential interaction with PP1. On the other hand, nucleoprotein interacts with RIPPOs which may also allow an indirect interaction with PP1. The conservation of a PP1-binding SliM suggests that PP1 recruitment is required for proper -coronaviruses particle formation and propagation. Further experimental research is required to validate the PP1: SARS-CoV-2 interaction.

Keywords: *SARS-CoV-2; Protein Phosphatase 1 (PP1); Regulatory interactor of PP1 (RIPPO)*

References.
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Characterization of protein aggregation profiles across the mammalian lifespan identifies age-related shifts in protein abundance and solubility of proteostasis network components in the mouse liver and cortex.

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Abstract. The formation of insoluble protein aggregates during aging has been established as a biological hallmark of several age-related diseases such as Alzheimer´s Disease and Type II Diabetes1. As cells age, their ability to maintain protein homeostasis (proteostasis) progressively declines, leading to the widespread aggregation of misfolded insoluble proteins1. It has been reported that proteins also aggregate during healthy tissue aging yet, it is unknown whether protein aggregation arises as a consequence of alterations in protein synthesis and degradation pathways during aging2,3. We hypothesize that alterations in protein insolubility occur during natural tissue aging due to an age-associated decline of proteostasis responses responsible for misfolded protein degradation. In this study, we performed SWATH mass spectrometry analysis to detect age-related shifts in protein abundance that occur in young, middle-aged, and old aged C57BL/6 mice. Detergent-soluble and insoluble proteins were isolated from total protein extracts of liver and cortex in order to allow for the identification of aggregation-prone proteins and their respective biological processes. Our results reveal that differentially abundant proteins in the total protein extract and detergent-insoluble fractions of middle- and old aged mouse groups are largely involved in translational processes while detergent-soluble proteins are involved in proteostasis-related degradation processes in both the liver and cortex. We also show for the first time that detergent-insoluble proteins containing proteostasis-related components accumulate at different timepoints of natural aging in the mouse liver and cortex. In addition, the codon usage bias of these proteins was evaluated as a measure of translation efficiency and accuracy among protein fraction types and tissue profiles. Future studies will examine the eligibility of these proteins as targets for anti-aging therapeutic strategies.

Keywords: *Healthy aging, age-related protein aggregation, proteostasis decline, protein synthesis, protein folding*

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Optineurin as a potential target to understand neuronal development and neurodegenerative diseases

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Abstract. Amyotrophic Lateral Sclerosis (ALS) is a rare, and fatal neurodegenerative disease(Zhao et al., 2020). One of the hallmarks of ALS is the formation of protein aggregates inside motor neurons. One protein that has been found in these protein aggregates is Optineurin (OPTN)(Hardiman et al., 2017). OPTN is a ubiquitous protein, present in several tissues and organs such as the Kidney, placenta, and eye although is mainly expressed in the nervous system, especially in the brain in cortical and hippocampal cells. It is a ubiquitin-binding protein that has been associated with cellular processes such as autophagy, vesicular trafficking, maintenance of Golgi organization and activation of the NF-kB factor(Ying ; Yue, 2012). OPTN-positive aggregates have been associated with several neurodegenerative diseases, and some mutations of this protein are associated with the pathophysiology of ALS(Qiu et al., 2022). Several isoforms of OPTN have been described in humans and rats. To study neuronal development, two approaches can be used namely neuronal differentiation using rat primary neuronal cultures and the differentiation of neuron-like SH-SY5Y cells. We propose that OPTN could have an important role in neuronal development and neurogenesis.

To study the differentiation process, we cultured primary cortical neurons of rat embryos (Rattus Norvegicus) for 14 days and collected cell lysates every two days, from day 0 to day 14. We also cultured and differentiated SH-SY5Y cells adding retinoic acid (until day 5) and brain-derived neurotrophic factor (from day 6 to day 8) to the culture medium. We collected cell lysates every two days. The samples from both cells were analysed by SDS-PAGE and Immunoblotting. Specific antibodies for OPTN and neuronal differentiation markers (B-III-tubulin and synaptophysin) were also used.

Two distinct bands corresponding to OPTN were identified in the analysis of the cortical neurons. The intensity of these bands increased in a linear manner throughout the 14 days of neuronal differentiation. -III-tubulin and synaptophysin also increased throughout neuronal differentiation. The differentiated SH-SY5Y cells showed that OPTN increases from day 0 to day 8 of the differentiation process.

We can infer that OPTN could have a role in neuronal development by influencing neuronal maturation and differentiation. These findings are important because, to understand pathological states, we first need improve our understanding the role of OPTN in physiological processes. This information could help to discover the role of OPTN in neurodegenerative diseases such as ALS.

Keywords: *Optineurin, Neuronal Development, SH-SY5Y, Cortical Neurons*

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The metabolic profile of plasmacytoid dendritic cells on systemic sclerosis

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Abstract. Plasmacytoid dendritic cells (pDC) are innate immune cells specialized in the production of large amounts of type I interferon (IFN). Besides particularly relevant for antiviral immunity, pDC have also been associated with autoimmunity. Systemic sclerosis (SSc) is a rare autoimmune disease characterized by immune dysregulation, vasculopathy, and fibrosis. Typically, it affects the skin, but may also involve other organs, as the heart, the gastrointestinal tract, and the lungs. Interstitial lung disease (ILD) is a frequent complication and is the leading cause of death among SSc patients. Recent studies have described pDC as essential for fibrosis development, and that depletion of pDC improves skin and lung fibrosis. Our preliminary data also suggests that pDC activate fibroblasts under stress conditions. Since the metabolic profile of immune cells, including pDC, affects cellular differentiation and activation, we are currently testing whether pDC metabolism correlates with SSc clinical outcome. More specifically, we are studying the metabolic profile of pDC from SSc patients and healthy individuals blood using SCENITH, a method suitable for rare cell populations analysis using flow cytometry. With this work we expect to identify possible targets for the treatment of SSc, that may also be relevant for other autoimmune diseases.

Keywords: *Plasmacytoid dendritic cells, Systemic sclerosis, Autoimmunity, Metabolism*

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Unravelling the role of tRNA modifications during Influenza A virus infection

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Abstract. Influenza A viruses (IAV) exploit host cell translation machinery components, including host transfer RNAs (tRNAs), to decode the viral genome at high rates. The cellular levels of tRNAs usually reflect the mRNA codon demand. However, the IAV genome is highly skewed towards adenosine (A)-/uridine(U)-ending codons, for which cognate host tRNAs are underrepresented in the cell. Despite this disadvantage, IAV still efficiently hijacks the host translation machinery and selects specific host tRNAs to meet its own mRNA codon needs. However, the exact mechanisms behind this selection are still poorly understood. As tRNAs undergo massive modification by tRNA modifying enzymes, and these are critical for translation efficiency and fidelity, particularly at wobble uridines, we believe that viruses can reprogram tRNA modifications to facilitate translation of their codon-biased viral transcripts. In fact, tRNA modifications are dynamic across cells and tissues and can change rapidly in response to external stimuli, to optimize translation under cellular stress conditions. Recently, Chikungunya virus (CHIKV) was shown to induce a codon-specific reprogramming of translation through the tRNA epitranscriptome. However, the complete picture of the tRNA epitranscriptome dynamics and the underlying molecular events during viral infections, as well as its significance for viral spread and host antiviral responses, is yet to be unravelled.We found that the tRNA modification mcm5U34 is decreased upon IAV infection. To comprehend the role of this modification during IAV infection, we silenced ELP3 – one of the enzymes responsible for installing this modification at wobble uridines. ELP3 silencing induced mcm5U34 tRNA hypomodification and impaired translation of IAV proteins. Moreover, absence of ELP3 disrupted the unfolded protein response (UPR)-related mechanisms pivotal for IAV propagation and enhanced the host cell response to IAV infection. Collectively, our findings suggest that viruses may promote alterations in the tRNA modification status to reprogram codon optimality, paving the way for the discovery of novel broad-spectrum antiviral therapies targeting tRNA modifications.

Keywords: *nan*

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Modulation of peroxisome morphology induces changes on the MAVS-dependent antiviral signaling

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Abstract. Upon viral infections, host cell organelles are explored by the virus and the cellular immune system. In recent years, peroxisomes have emerged as important antiviral and pro-viral platforms during viral infections. Different viruses have been shown to modulate peroxisome dynamics to evade the cellular antiviral response and/or promote their propagation. Nevertheless, research in this field is still incomplete and mechanistic details are scarce. Viruses likely interact differently with peroxisomes at distinct stages in their infection cycle resulting in, e.g., the reduction of peroxisome biogenesis early in infection to inhibit antiviral signaling, and the stimulation of peroxisome metabolism and biogenesis in a later phase to increase lipid metabolism and support virus particle formation.

Peroxisomes play an important role in the establishment of the cellular antiviral immune response due to the presence of the mitochondrial antiviral signaling adaptor protein (MAVS) at the organelle's membrane. During infection, cytosolic viral RNA is detected by the retinoic inducible gene-I (RIG-I)-like receptors (RLR), which interact with MAVS at peroxisomes and mitochondria, inducing its oligomerization and prompting a signaling cascade that culminates with the production of antiviral effectors such as interferons (IFN) and IFN-stimulated genes (ISGs). It has been shown that RLR activation promotes elongation of the mitochondrial network and that enforced elongation enhances downstream MAVS-dependent antiviral signaling by mitochondria. In order to unravel the importance of the peroxisomal biogenesis machinery for the antiviral defense, we have manipulated the elongation and fission of peroxisomes, through the modulation of the expression of proteins involved in both processes by RNAi and overexpression. The effect on the peroxisome-dependent antiviral response was analyzed upon stimulation with an RNA molecule that mimics viral RNA. Our results indicate that stimulation of the peroxisomal elongation and fission induces an increase in the antiviral immune response, suggesting that peroxisome proliferation plays an important role in antiviral signaling. Our team has recently discovered that the interaction between the peroxisomes and the endoplasmic reticulum (ER), mediated by the acyl-CoA binding domain-containing protein 5 (ACBD5), is required for the establishment of a robust antiviral response. In order to investigate a possible interconnection between the modulation of the antiviral response exerted by the peroxisome- ER association and by peroxisomal proliferation processes, we have analyzed the peroxisomal-dependent antiviral response upon stimulation of the peroxisomal fission machinery in ACBD5-silenced cells. Our results strongly pinpoint an important role for the peroxisome-ER interaction in the antiviral defense induced by peroxisomal proliferation.

Keywords: *Antiviral response, Peroxisomal dynamics, Peroxisome elongation, Peroxisome fission, MAVS-dependent antiviral signaling*

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CAVPENET-induced modulation of phosphatases activity reduces prostate cancer cells viability in 2D and 3D culture models

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Abstract. Prostate cancer (PCa) is a significant challenge facing the scientific community, as effective therapeutic approaches have yet to be developed. Recent studies have identified protein phosphatase 1 (PP1) as a promising target for cancer treatment, including PCa. In this context, the main goal of this work is to develop peptides to disrupt key PP1 complexes associated to PCa development. For this, a protein mimetic peptide designed to interrupt the interaction between PP1 and caveolin-1 (CAV1), coupled to penetratin to allow efficient cell delivery, was synthesized using microwave-assisted solid phase synthesis. The efficacy of this sychnologic bioportide CAVPENET, and a scrambled homologue, was evaluated in vitro using PCa 2D monolayer models. After 48h incubation, CAVPENET significantly decreased the viability and migration of PCa cells. A significant decrease in the phosphorylation of AKT at Ser473 was also observed. Moreover, simultaneous incubation of CAVPENET (10 M) with tautomycin (10nM), a highly specific PP1 inhibitor, or with cantharidin (500nM), a potent and selective PP2A inhibitor, recovered the phosphorylation levels of AKT. Such findings suggest a role for these phosphatases in the CAVPENET-induced AKT dephosphorylation mechanism. CAVPENET performance was further evaluated in 3D co-cultured tumor spheroids of LnCaP/cancer-associated fibroblasts (CAFs), an in vitro model that better mimics the cellular elements of PCa in vivo microenvironment. Overall, 20M of CAVPENET inhibited the growth of LnCaP/CAF spheroids, reinforcing its promising anticancer activity. The findings of this study underscore the potential of the CAVPENET peptide to inhibit the growth of PCa cells by targeting PP1/CAV1 complex and inhibiting phosphatases activity. Further analyses are needed to confirm the disruption of these interactions and shed light on the mechanisms of cells death.

Keywords: *prostate cancer, PP1, CAV1, peptide*

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Trithorax Group proteins are required for oocyte determination

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Abstract. We and others have shown that epigenetic regulation of gene expression is crucial for female gametogenesis. Histone demethylase Kdm5 is required for successful meiosis and oocyte reactivation (Navarro-Costa et al., 2016). Likewise, Polycomb group (PcG) proteins have been described as rate-limiting for differentiation of the supporting nurse-cells and for oocyte fate maintenance (Deluca et al., 2020; Iovino et al., 2013). Furthermore, SETDB1 (Eggless) histone methyltransferase is required for germline stem cell maintenance and for oocyte determination, the latter by promoting heterochromatin formation and repressing transcriptional activity (Sarkar et al., 2021). Recently, we showed that Sfmbt, a higly conserved PcG protein, is required for the negative regulation of Synaptonemal complex (SC) gene transcription. After female germline depletion of Sfmbt, SC gene expression is abnormally highly during mid/late prophase I, impairing the normal SC disassembly and facilitating the formation of repetitive and abnormal SC structures not associated with meiotic chromatin (Feijão et al., 2022).
Gene expression is tightly regulated by the antagonistic activities of PcG and Trithorax Group (TrxG) proteins (Schuettengruber et al., 2007). We HYPOTHESIZE that TrxG proteins have important roles in female gametogenesis, particularly in oocyte determination and in the regulation of SC assembly during prophase I. In order to test this hypothesis, we used Gal4/UAS system to specifically deplete distinct TrxG proteins in the female germline and investigated if this depletion impaired oocyte determination and SC assembly.
We observed that the depletion of several TrxG proteins significantly impaired oocyte determination and maintenance of the SC in the meiotic chromatin. These results indicate that TrxG proteins, similarly to PcG, are important for female gametogenesis, playing an important role for oocyte determination and maturation.

Keywords: *Synaptonemal complex, Oogenesis, Trithorax Group Proteins, Oocyte determination, Female germline*

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Extracellular vesicles biogenesis and secretion in response to Abeta

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Abstract. Alzheimer's disease (AD) is the leading cause of dementia, affecting approximately 38,5 million people worldwide. A main hallmark of AD is the presence of senile plaques, mainly composed of Abeta peptide aggregates. The latter peptide, which tends to deposit and aggregate into oligomers, fibrils and finally into senile plaques, is extremely toxic, triggering several pathological events, that ultimately lead to neuronal death.Extracellular vesicles (EVs) are nanovesicles secreted by all cell types and recognized as important mediators in cell-to-cell communication. In AD, it has been reported that these EVs can carry Abeta, among other proteins important in disease pathogenesis as Tau, supporting the involvement of EVs in disease pathogenesis. However, Abeta effects in EVs biogenesis and secretion are not completely understood. Therefore, this work aimed to evaluate the effect of Abeta in EVs biogenesis and secretion.N2a neuroblastoma cells were treated with Abeta peptide for 48 h, after which EVs were isolated from cells conditioned medium by ultracentrifugation. EVs were characterized by TEM and WB analysis was employed to evaluate the levels of proteins involved in EVs biogenesis and secretion. In addition, the EVs proteomic content was also evaluated.The results revealed significant differences in the levels of Flotilin, a protein involved in EVs biogenesis and in two Rab proteins implicated in nanovesicles release. Further differences also arise in the Abeta-induced EVs proteome.These results support that Abeta peptide can alter EVs biogenesis and secretion, via the ESCRT independent pathway. As EVs can be involved in cell communication, data suggest that Abeta may have an impact at this level, potentially contributing to abnormal signaling events underlying AD pathogenesis.

Keywords: *Extracellular Vesicles, Abeta, Fourier Transform Infrared, Alzheimer's disease*

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Biopolymeric nanomachines for cancer theranostics

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Abstract. Conventional therapeutic approaches against cancer, such as chemotherapy, are still haunted by their lack of specificity, often injuring also healthy tissues. Additionally, imaging modalities that allow an early detection of tumors are scarce. Nanotechnology enables the creation of nanoparticles with distinguished features from bulk materials, allowing a more effective cell targeting.1 With proper functionalizations, these nanomaterials can be tailored for tackling several aspects of both therapy and diagnosis of cancer, in a field known as theranostics – able to simultaneously detect and deliver therapeutic agents to tumors. However, there are still great challenges to overcome, for instance, most nanoparticles struggle to counter blood flow when inserted into the blood stream, survive the attack from the protein corona, and achieve deep tumor tissue penetration for efficient drug delivery.2 To counter this, added self-propulsion mechanisms can provide an additional driving force and controlled motion to these nanoparticles, rendering them nanomachines. Herein, this work aims to assemble, characterize, and evaluate the performance of multifunctional biopolymer-based nanomachines for cancer theranostics. Cellulose, being the most abundant biopolymer, biocompatible and an easily functionalized biomaterial was selected for this study. Using a derivative of cellulose, nanoparticles were produced by nanoprecipitation and functionalized with curcumin (as a model therapeutic drug) against cancer cells. Further functionalizations with both gold and magnetic iron oxide nanoparticles were performed through an in situ synthesis in the presence of the nanoparticles, to add imaging and magnetic guidance capabilities, respectively. In addition, to achieve better selectivity for cancer cell targeting, functionalization with folic acid could be considered. This biopolymer-based system was characterized with different techniques, such as scanning electron microscopy (SEM), Fourier-transform infrared spectroscopy (FTIR), Ultraviolet-visible spectroscopy (Uv-vis), dynamic light scattering (DLS), among others, and in the future, motility assays and biological tests will be conducted to evaluate propulsion and therapeutic and imaging potential against cancer cells.

Keywords: *Theranostics, cellulose nanoparticles, nanomachines, gold nanoparticles, magnetic nanoparticles*

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Extracellular vesicles phosphoproteome uncovers new biomarker candidates for Alzheimer's disease

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Abstract. Introduction: Alzheimer's disease (AD) is the most prevalent neurodegenerative disease worldwide. AD pathophysiological mechanisms are not fully understood, but protein phosphorylation is recognized as a fundamental mechanism involved in disease pathogenesis. Extracellular vesicles (EVs) are secreted by almost every cell and its role in cellular communication has gaining evidence in the last years. A peptide and Tau, the two core proteins of AD histopathological hallmarks, can be carried by EVs. Further, altered levels of these and other AD-related proteins, miRNAs and metabolic profiles were reported in AD. As EVs cross blood-brain barrier and can be easily isolated from biofluids, these represent a non-invasive tool to study AD and assess putative biomarker candidates.
Problem addressed: It is still unclear if plasma-derived EVs (pdEVs) are viable sources of AD-related phosphospecific candidates.
Suggested solution for the problem/Objectives: Hence, the main goal of this work was to characterize the phosphoproteome of pdEVs and plasma supernatant EVs free (plasma-depleted EVs), to potential unravel new biomarker candidates for AD.
Methods: Blood-derived EVs were isolated from a pool of human plasma, using a precipitation-based methodology. The pdEVs and plasma-depleted EVs were then analyzed using an antibody-based phosphospecific microarray. Gene Ontology enrichment and Reactome pathways analysis were carried out to characterize the phosphoproteomes. In addition, protein-protein interaction networks were retrieved from STRING and analyzed using Cytoscape "Network Analyzer", employing the betweenness centrality option to highlight central nodes. Further, gene names of phosphotargets, enriched in pdEVs in comparison to plasma-depleted EVs, were overlapped with a list of gene associated to AD, collated from DisGenet database.
Results: Phosphoproteome analysis resulted in the identification of more than 70 proteins enriched in pdEVs when compared to plasma-depleted EVs. GO analysis of these targets showed that the top biological processes were related to cell proliferation/division, apoptosis and phosphorylation while Reactome pathways revealed terms as toll like receptor cascade and MAPK signalling, associated with neuroinflammation or tau phosphorylation and amyloid-beta deposition, respectively. PTEN arise as a central node in the protein-protein network constructed, and 60% of pdEVs enriched phosphoproteins overlapped with DisGenet database gene list. Among those were several kinases, including CAMK2A, PKM, MAP2K1 or PTEN.
Conclusion: In sum, pdEVs phosphoproteome is enriched in phosphotargets relevant in AD context, holding value as peripheral biomarker candidates for disease diagnosis.

Keywords: *Alzheimer's disease; biomarker; Phosphorylation*

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Stem Cells as Groundbreaking Reservoirs of Antigens for the Development of Cancer Vaccines

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Abstract. Despite improvements in cancer therapy, metastatic solid tumors remain largely incurable. The development of novel cancer therapies that address unmet medical needs is warranted. Immunotherapy has emerged as a pioneering and promising approach for cancer therapy and management, and in particular intended for advanced tumors unresponsive to current therapeutics. A growing body of interest in the impact of cancer immunotherapy is emerging and it may be considered the future of personalized medicine. Still, the correct antigen loading, and tumor targeting is limiting the widespread application and efficacy of current immunotherapeutic strategies.

Patient-derived induced pluripotent stem cells (iPSCs) have been shown to share several characteristics with cancer (stem) cells (CSCs), eliciting a specific anti-tumoral response when injected in rodent cancer models. Indeed, artificial cellular reprogramming has been widely compared to the biogenesis of CSCs. iPSCs and embryonic stem cells (ESCs) share known and unknown tumor-associated antigens and tumor-specific antigens (TAAs/TSAs) and, therefore can potentially prime the immune system against cancer, bypassing the need of tumor collection. We are in the first steps of ESC-based cancer therapeutic strategies, still it will be interesting to unveil whether ESC are bona-fide carriers of TAAs/TSAs and the potential use of ESC-based cancer vaccines in a prophylactic setting before the appearance of oncogenic transformation.

We demonstrated that TNG-A (cell line derived from mouse embryonic stem cells) may be harnessed to elicit anti-tumor immunologic responses against breast cancer in a breast cancer mouse model. TNG-A were cultured in different media conditions, using Lif and 2i (CHIR99021 and PD03259010) and/or genetically manipulated, with the purpose to disturb cell pluripotency. Our preliminary data shown that immunization with TNG-A, in different pluripotency states, primed the immune system to recognize and attack tumor growth in specific conditions, in an orthotopic breast cancer mouse model.

Keywords: Immunotherapy, Cancer Models, ESCs/iPSCs, Pluripotency, Cancer Vaccines

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Keywords: *Immunotherapy, Cancer Models, ESCs/iPSCs, Pluripotency, Cancer Vaccines*

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Activation of the MAVS-dependent antiviral signaling at peroxisomes induces a complete and rapid IFN response

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Abstract. Peroxisomes are membrane-bound organelles with high plasticity that fulfill important cellular metabolic functions. These organelles are essential for lipid metabolism and a balanced redox species milieu. Peroxisomes are also recognized as important platforms for antiviral signal transduction when cells face an RNA virus challenge. Recognition of cytosolic viral RNA by the members of the RIG-I-like receptor (RLR) family, induces the activation of the mitochondrial antiviral signaling adaptor (MAVS) at peroxisomes, mitochondria, and mitochondria-associated membranes. This activation initiates a signaling cascade that culminates with the production of interferons (IFNs) and IFN-stimulated genes (ISGs), which directly or indirectly affect the viral infection.It was initially suggested that the activation of the peroxisomal MAVS induced a rapid but transient type I IFN-independent (and type III IFN-dependent, in certain cell types) production of ISGs, whereas activation of the mitochondrial MAVS resulted in a delayed but stable type I IFN-mediated response. However, a later study claimed that both peroxisomes and mitochondria had an equal ability to induce type I or III IFN, as well as no major disparities in their response kinetics. Both studies were carried out in different stable cell lines expressing MAVS transgenes that were localized to each of the organelles, having the limitation of intrinsically leading to an uninterrupted minimal activation of the signaling cascade. In order to unravel the actual specific differences between the antiviral signaling pathways originating at both organelles, which may lead to different activation kinetics and/or end products, we developed a doxycycline-inducible genetic system for MAVS activation at both organelles, and are now able to demonstrate that the peroxisomal MAVS is able to strongly induce an early type I and III IFN-dependent response, in contrast to a later, also type I and III IFN-dependent, mitochondrial response. We can further observe that peroxisomal MAVS generates a transcriptional antiviral response of similar magnitude when compared to the mitochondrial counterpart, despite a much lower MAVS expression at peroxisomes.These data emphasize the versatility of the peroxisome-dependent antiviral response, in terms of IFN signaling, and reaffirm the distinctiveness of peroxisomes in generating a prompt strong cellular defense state against viral infections.

Keywords: *MAVS, Peroxisomes, Antiviral signaling, Innate immune response*

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Non-standard translation accelerates the evolution of azole resistance and induces major genomic alterations in Candida albicans

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Abstract. Candida albicans is the leading cause of life-threatening invasive infections with mortality rates approaching 40%, despite treatment. Resistance to the commonly used azoles is increasing and alternative antifungals, such as amphotericin B or echinocandins, increase the cost of antifungal therapy. Despite the economic and clinical relevance of antifungal drug resistance, this subject remains poorly studied in comparison with the similar issue of antibiotic resistance in bacterial pathogens. Amongst the interesting features of C. albicans is its ability to ambiguously translate the universal leucine CUG codon as serine (97%) and leucine (3%). Such non-standard translation produces a flexible proteome that generates phenotypic and genomic diversity (Bezerra et al. 2013). Here, we hypothesize that CUG codon ambiguity has an important role in the evolution of resistance to clinical antifungals. Using strains with variable CUG-Leu misincorporation rates, we combined experimental evolution and whole-genome sequencing to elucidate evolutionary paths leading to the emergence of resistance to two major classes of antifungals (polyenes, azoles). Results showed that high levels of mistranslation accelerate the acquisition of azole resistance, but not polyene resistance. Hypermistranslation caused more rapid and frequent evolution of fluconazole resistance mediated through CNVs affecting the classical drug efflux and ergosterol biosynthesis pathways, while itraconazole resistant isolates showed LOH affecting transport. In the evolution with the polyene Amphotericin B, hypermistranslation had little impact in the frequency of resistance acquisition and most of the genome changes detected were SNPs and INDELs in filamentation genes.

Keywords: *Candida albicans, Fungal infections, Mistranslation, Antifungal resistance*

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Experimental evolution of tRNA-modifying enzyme knockout yeast strains induces higher levels of protein aggregation

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Abstract. tRNAs are the most modified of the RNA molecules. These modifications ensure tRNA stability, translational efficiency and fidelity, and are catalysed by different classes of tRNA-modifying-enzymes. Recent evidence linked aberrant levels of tRNA-modifications and mutations in tRNA-modifying enzymes to protein synthesis errors, protein aggregation and protein expression reprograming, and have been found associated with several human diseases. However, we do not yet understand the mechanisms by which tRNA-modifying-enzymes and tRNA-hypomodification may lead to disease onset/progression. Here, we use in vitro experimental evolution of yeast to study the impact of tRNA hypomodification in cell fitness and protein aggregation and how cells adapt to those changes. To do so, tRNA-modifying-enzyme gene-knockout strains were experimentally evolved to 500 generations and the HSP104-GFP reporter system was used to assess protein aggregation. At the beginning of evolution, knockout strains Elp1, Elp3, Trm4, Trm9 and Slm3 presented reduced fitness and increased protein aggregation. After 500 generations, cells were able to recover their fitness, but protein aggregation was increased when compared to the generation 0, indicating that cells were able to adapt to hypomodification of the wobble position in tRNAs. Preliminary results from whole-genome next-generation sequencing (NGS) showed that knockout strains acquired CNVs affecting functional categories such as tRNA and mRNA processing, ribosomal biogenesis and assembly, translation initiation, and protein folding. Along with the genomic analysis, proteomics of total and insoluble protein is being done to better understand what kind of proteins are aggregating, why are they aggregating and the mechanisms behind it.

Keywords: *tRNA; yeast; protein aggregation; Epitranscriptome; tRNA modifications*

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Optimized automated analysis characterizes alterations to mitochondrial dynamics in retinoid modulation and oxidative stress

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Abstract. Neurodegenerative diseases are linked to several cellular alterations, including at the mitochondrial level [1, 2]. These anomalies can contribute to disease progression but may also trigger cellular rescue mechanisms [2, 3]. Characterization of mitochondrial dynamics in neurodegenerative diseases is, thus, of paramount importance [4]; however, monitoring anomalies at the sub-cellular level still presents a laborious challenge.
A recently created MATLAB program, Mitometer, automatically analyzes mitochondria in timelapse frames, in both 2- and 3-dimensions [5]. However, this analysis produces a large volume of outputs, that require manual and individual handling, with the total number of files assessed quickly escalating, and managing the outputs for all parameters (up to 13), per analyzed image can be laborious and extremely time-consuming. As such, this work aims to develop an optimized strategy for an already available automated method to precisely monitor changes at the mitochondrial level and apply it to a disease model.
The developed methodology allowed for a rapid and validated characterization of individual whole-neuron mitochondria network, in addition to differentiating between axon and cell body mitochondria, essential for neuroscience applications. With a processing speed of 100 files per minute, 30 total 15-frame live 8 z-stack images can be fully analyzed in under 4 hours.
Oxidative stress was chosen as a model system, as alterations in mitochondrial activity are linked to several neurodegenerative conditions, including Alzheimer's and Parkinson's Disease. Differentiated SH-SY5Y cells were treated with paraquat to induce oxidative stress. The influence of Retinoic Acid Receptor modulation was also explored, as a potential rescuer from oxidative stress and mitochondrial damage. Other neuronal-relevant models will also be discussed.
Results show significant alterations in several mitochondrial parameters in response to paraquat and retinoid treatment, differentiating between cell body and neurite mitochondria. Taken together, the results support the use of MATLAB and Mitometer as important tools for monitoring mitochondrial dynamics and highlight the importance of optimization, diminishing the volume of manual input.

Keywords: *Mitochondria; Image processing; Software optimization; Oxidative stress; Neurodegeneration*

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Peroxisome dynamics modulate the host cell antiviral response

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Abstract. During viral infections, host cell organelles are explored by both the virus and the cellular immune system. Peroxisomes, subcellular organelles that fulfil an essential role in multiple metabolic pathways, have emerged as important antiviral and pro-viral platforms in the context of viral infections (A. R. Ferreira et al., 2022). Several viruses have been shown to modulate peroxisome dynamics and/or metabolism to either evade the cellular antiviral response or promote virus particle formation and propagation. Nevertheless, research in this field is still incomplete, as mechanistical details are scarce and, for most viruses, only specific infection stages have been analyzed (V. Ferreira et al., 2023). Peroxisomes harbor the mitochondrial antiviral signaling adaptor protein (MAVS) at their membrane, and thus are important platforms for the cellular antiviral response (Dixit et al., 2010). During infection, cytosolic viral RNA is detected by the retinoic inducible gene-I-like receptors (RLR), which interact with MAVS, inducing its oligomerization and prompting a signaling cascade that culminates with the production of interferons and interferon-stimulated genes (ISGs), inhibiting important steps of viral propagation (A. R. Ferreira et al., 2019). It has been shown that RLR activation induces the elongation of the mitochondrial network, and that enforced elongation enhances downstream antiviral signaling (Castanier et al., 2010). In this study we aim to unravel whether and how RLR activation modulates peroxisome dynamics, and its relevance in the context of the antiviral response. To that end, we have analyzed peroxisome morphology and number in human cells, by confocal microscopy, upon stimulation of the peroxisome-dependent antiviral signaling with an RNA molecule that mimics viral RNA. We have furthermore interfered with the peroxisomal fission machinery and evaluated its importance for the antiviral signaling by analyzing interferon and ISGs production. Our results demonstrate that stimulation of the peroxisomal MAVS induces a certain level of peroxisome elongation and that peroxisome proliferation may play an important role in antiviral signaling.

Keywords: *MAVS signaling, Peroxisome number, Peroxisome elongation, Antiviral response, Peroxisome fission*

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Unfolding the interplay between viruses and cellular proteostasis

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Abstract.
Respiratory viruses are a major cause of human illnesses, and a deeper understanding of the virus-host interplay mechanisms is crucial for the development of effective prevention and treatment strategies. Viruses extensively manipulate the host cell, including its protein synthesis and processing machinery, for their own benefit. Our research focuses on how respiratory RNA viruses alter the host cell transfer RNA (tRNA) pool and associated components during infection. tRNAs are essential for protein synthesis, and changes in their abundance can significantly impact cellular physiology. tRNAs are also heavily modified by tRNA-modifying enzymes (TMEs) to ensure efficient translation. Most of these modifications occur at the wobble position, located at the anticodon loop, although they may also occur in other areas of the tRNA structure. Through the study of the interplay between viruses, tRNAs and their associated components, we aim to uncover the mechanisms by which respiratory viruses manipulate the host cell to their advantage.We have recently observed that influenza A virus (IAV) specifically targets the host-cell tRNA modification enzyme population to facilitate efficient viral protein translation. Our findings suggest that tRNA-modifying enzymes, including elongator acetyltransferase complex subunit 3 (ELP3), play a crucial role in the IAV life cycle. To expand our understanding of this process, we are currently investigating whether other respiratory viruses, such as the human coronavirus 229E (hCoV-229E) and respiratory syncytial virus (RSV), also target tRNA-modifying enzymes for their own benefit, or if this is a unique feature of IAV. By studying the interaction between these viruses and tRNA-modifying enzymes, we hope to uncover new insights into the molecular mechanisms underlying viral replication and identify potential therapeutic targets for viral infections.

Keywords: *Viruses, Proteostasis, Host-virus interplay, Protein synthesis, Translation*

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The impact of immunomodulation on host response and microbiota evolution

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Abstract. The interplay between gut microbiota and the host is important for immunity development, colonization resistance and host metabolism. Antibiotic use disrupts host-microbiota interactions, potentially decreasing the colonization resistance conferred by the gut microbiota.
Lipopolysaccharide (LPS), an endotoxin present in Gram-negative bacteria, induces potent acute systemic inflammation. Nevertheless, it has also been suggested that treatment with low-dose LPS in a continuous manner, can act as an immunomodulator, conferring protective effects against infection.
Additionally, the production of antimicrobial peptides (AMPs) impaired by the antibiotic treatment was previously observed to be restored upon LPS administration and therefore thought to be implicated in LPS protective effect. However, little is known about how immunomodulation (with low-dose LPS) impacts colonization resistance to non-pathogenic bacteria or how commensal microbiota evolve in an environment where the innate immune response is strengthened.
To answer these questions, mice were treated with streptomycin, previously reported to induce gut inflammation, and then colonized with a commensal strain of Escherichia coli by oral gavage. To test the impact of immunomodulation, LPS was administered to half of the animals prior to antibiotic treatment and gut colonization.
Immunomodulation by LPS led to a decreased production of TNF- and IFN- when comparing with antibiotic treatment alone. Furthermore, LPS animals showed reduced gut damage as observed in the histopathological analysis and permeability assays. Additionally, LPS treatment delayed the colonization by E. coli in the gut as shown by the decreased count of CFUs.
Our on-going project will evaluate how LPS treatment affects AMP expression and microbiota evolution. We expect to uncover distinctive adaptive signatures between LPS-treated and control mice, thus enhancing our understanding of the role of LPS in shaping microbiota and immunity.

Keywords: *Microbiota evolution, Innate immune response, Immunomodulation*

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Exploring the potential of protein-based microunits for in vitro simulation of bone tissue regeneration

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Abstract. Bone organoid-like structures are being explored as a promising alternative to study bone tissue and related diseases by physically and biochemically simulating bone activity in vitro. However, recapitulating the complexity of bone tissue is still a challenge. Recently, we designed bone bioengineered organoids in liquefied gelatine-based microcapsules (mCAPs) containing catechol analogues as a possible autonomous and multifunctional alternative to animal models. The ability of these bone bioengineered microstructures to stimulate the osteogenesis of stromal cells and osteoclastogenesis of indirectly co-cultured monocytes in basal medium leads us to hypothesize if it would be possible to simulate bone regeneration using the mCAPs as receptacles. Human bone marrow mesenchymal stem cells (BM-hMSCs) and human monocyte THP-1 cell line (osteoclast precursor cells) were co-encapsulated at different ratios within the mCAPs and cultured for several weeks.
We have assessed the differentiation of these cells, the cellular crosstalk (RANK-L:OPG) and the mineralization/reabsorption of the extracellular matrix. As the co-culture progresses, it was observed an autonomous differentiation into osteoblasts and osteoclasts. It was also possible to access different release levels of reabsorption-inducing factors (RANK-L) or inhibitors (OPG) important for the control of osteoclast/osteoblast activity, respectively. By the end, we verified that depending on the BM-hMSCs: THP-1 ratio, we can reach cellular homeostasis (balance between matrix production and reabsorption) in earlier or later stages of the co-culture. By manipulating the cell ratio, we can synchronously control extracellular matrix production and resorption, allowing us to mimic a variety of bone defects in vitro. We believe that this new platform can provide valuable information about the mechanisms underlying the regeneration and development of bone tissue which could be used as a valid alternative for in vivo assays.

Keywords: *Liquified-microcapsules, Catechol analogs, Homeostasis, Bone Mineralization, Bone reabsorption*

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A Natural-derived Polysaccharide-based Supramolecular Adhesive with Cytocompatibility and Concomitant Antibacterial Activity

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Abstract. Tissue adhesives have been used as an alternative to sutures and staples for medical applications, serving as surgical sealants, hemostatic agents, as adjuvants in the first stage of wound healing, or for device attachment applications[1]. They offer ease of operation, and reduced surgery times and, their soft and hydrated character often match tissue properties and mechanical requirements[2]. Commercially available fibrin sealants have been used since 1940 in several surgical procedures, due to their intrinsic biocompatibility and biodegradability. However, these are prone to rupture and debonding. Cyanoacrylates-based adhesives, in opposition, enable strong tissue adhesion. However, their cytotoxicity and poor elasticity affect their application[3]. The mussel's adhesion mechanism based on the amino acid L-DOPA, has been an inspiration for the development of a broad range of adhesive biomaterials[4]. Nonetheless, strategies based on the polymeric chains functionalization with catechol or analogous groups are often expensive and laborious, and their use poses concerns regarding its possible neurological effects[5]. In addition, the integration of catechol groups culminates in their autooxidation in physiological pH conditions, with the subsequent production of reactive oxygen species (ROS), thought to induce cytotoxicity[6]. Strategies to counter the cytotoxic effect of catechol-modified materials have comprised either metal ion coordination, or the addition of exogenous molecules or materials to limit the action of ROS[5]. Although some of these strategies effectively improved cytocompatibility, the maintenance of adhesion potential and antimicrobial effect of these catechol-based adhesives, after such treatments, has not been fully explored.

Here, the exploration of a natural adhesive prepared from off-the-shelf materials is addressed, concerning the processing requirements needed for the achievement of i) concomitant adequate tissue adhesion, ii) cytocompatibility, iii) maintenance of antimicrobial and, iv) hemostatic behaviour. For that, the spontaneous coacervation of a naturally occurring and food-grade polyphenol – tannic acid (TA) – with a modified high molecular weight natural polymer – pullulan (PUL) – was promoted. Additionally, the use of modified PUL containing methacrylate groups was also tested. The mixing of a ROS-degrading enzyme – catalase – into the system was explored, imparting the system with medium-term cytocompatibility. Moreover, the proposed adhesive showed adhesion strength 3-fold higher than conventional fibrin sealants in ex vivo tests (30.8±5.6 kPa, 41.7±21.2 Jm-2), and unchanged antimicrobial effect against strains of S. aureus and E. coli. Also, the adhesive showed advantageous haemostatic ability with the shortest clotting time, and a correspondent safe hemolysis percentage ratio (>5%), when compared to the catalase-free counterpart.

Keywords: *Bioadhesive, tannic acid, supramolecular, cytocompatible, antibacterial*

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Heart-on-a-chip: a fully-human 3D printed device for disease modelling and drug screening

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Abstract. According to the World Health Organization, 17.9 million people die every year from cardiovascular diseases, accounting for about 31% of all deaths worldwide.(1) Simultaneously, a large number of drugs are withdrawal from the market due to cardiac side effects that are not detected in early stages.(2) Together, these two factors make heart one of the major targets for the pharmaceutical industry in current times. However, predictive models that recapitulate the human heart physiology in the laboratory are still lacking. Recent advances in 3D cell culture and microfluidic organ-on-chip technologies have demonstrated potential to mimic human tissues in vitro with higher accuracy thus enabling a more reliable assessment of the efficacy and safety of new drugs and therapies. In this regard, natural biomaterials, such as Matrigel, collagen and fibrin, have been largely investigated due to their similarity to the cardiac extracellular matrix(ECM). Also, natural-based bioinks, like GelMA, have been shown promising to produce complex cardiomimetic constructs. Yet, in both cases the use of animal-derived biomaterials remains problematic due of interspecies variabilities.
One possible solution, that has been deeply explored by our group, relates to the use of platelet lysates and perinatal tissues as a source of human proteins to produce photopolymerizable matrices.(3-5) Using this technique we were already able to create 3D cell culture platforms and disease models that are not associated with ethical issues, while being cost-effective and readily-available. During my PhD, I want to further explore the potential of these human-based materials, especially of the amniotic membrane(AM), as a heart-on-a-chip with health and fibrotic features for drug screening applications.

Keywords: *Amniotic membrane; Hydrogel; Heart-on-a-chip; Fibrosis*

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Magnetically powered enzyme-living hydrogel for creating 3D perfusable channels in a tissue mimetic hydrogels

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Abstract. A long-sought goal in Tissue Engineering is to create tridimensional tissues that closely replicate the complex architecture of native tissues. However, such complex mission is hampered through the difficulty in creating a functional vasculature within the construct that can continuously nourish cells with oxygen and nutrients.[1] Recent progress along this line has resulted in a number of strategies to create 3D perfusable channel networks that mimic the vascularization of natural tissues. Some of these strategies involve using cell-adhesive peptides, growth factors, sacrificial molds, varying crosslinking densities of materials or printing techniques.[1][2] Although the motivation of all of these approaches is to mimic the architecture of the native tissue by directing cell organization (using or not a supportive structure, such as channels, to guide the cellular self-assembly), the reproduction of vascular structures can be laborious and costly.[1][3] In an attempt to develop a more minimalist strategy, it is herein proposed a novel strategy to produce a custom-sculptured pattern in a methacrylated gelatin (GelMA) hydrogel using one single enzyme-living microgel. Collagenase, an enzyme that degrades GelMA, was crosslinked with varying amounts of magnetic nanoparticles labelled with Rhodamine B into spherical enzymatic microgels. Then, one single microgel was encapsulated on one side of the GelMA hydrogel before its crosslinking. A magnetic field was subsequently applied on the opposite side of the hydrogel, forcing the enzymatic microgel to engrave GelMA. Results showed that, in a single step, we were able to produce different living microgels with high shape- and size- fidelity without compromising the secondary structure of the enzyme. By adjusting the magnetic field intensity or the concentration of MNPs-RhodB within the microgels, the velocity of the sculpturing process was modelled. Additionally, by changing the magnetic field position or the size of the microgel, different topographies and sculptured patterns with various widths were created. Finally, we perfused the created open channels and analyzed their stability during the sculptured process. Altogether, these findings represent a significant step towards living microprobes capable of sculpturing the local environment of protein-enzyme pairings in a magnetic controlled system, overcoming the diffusion issues of conventional 3D constructs. With this capability, we can potentially hypothesize using this approach in theragnostic applications to efficiently deliver cells, drugs or imaging agents in easy or hard-to reach sites in the human body in a minimally invasive operation.

Keywords: *custom sculpture, enzyme-living microgel, magnetic force*

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Pinus pinea pine nut shells as eco-friendly solutions for soilless cultures

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Abstract. Despite playing a crucial role in improving the quality and yield of agricultural products and managing infectious diseases in crops, the extensive use of conventional agrochemicals is widely recognized to have detrimental effects on both the environment and human health. Some examples are contamination of soil and water, loss of biodiversity, increase in pest resistance and the toxicological consequences on human health. As a result, there is a growing interest towards finding plant-derived bioactive compounds that can substitute conventional pesticides, once their toxicity to non-target organisms is typically reduced and the risk of developing resistance is decreased [1, 2] and/or promote plant growth. Pinus pinea L. is a coniferous tree native from the Mediterranean basin mostly valued for its seeds, ie pine nuts, a product with high market value. Nonetheless, this crop generates secondary products - needles, bark, cones, nut shells and resin that are essentially used to produce energy. These agroforestry by-products are rich in compounds of interest, namely phenolic compounds, terpenes, and sterols that possess bioactive properties with possible applications in plant disease management.This work intends to explore the potential of P. pinea nut shell extracts to be used in agriculture as an alternative to synthetic agrochemicals, particularly as antimicrobial agents against phytopathogenic bacteria and as promoters of plant growth.To obtain isolated fractions rich in metabolites of interest, the pine nut shells were submitted to sequential extractions. First, terpenes and sterols were isolated and the resulting residue was re-extracted to obtain an extract rich in phytohormones and phenolic compounds The previous extracts will be screened for the antimicrobial potential in vitro and in vivo against bacterial pathogens with scientific and economic relevance, namely different patovars of the gram-negative bacteria Pseudomonas syringae and the fire blight causal agent, Erwinia amylovora. Also, the extract(s) with compounds known to act plant growth will be tested on tomato plants. Apart from that, aiming an integrated valorization of the pine nut shell, the residue from the extractions will be studied as a potential substitute to conventional growing medias used in soilless cultures.

Keywords: *pine nut shell, by-product valorisation, bioactive properties, phytopathogenic bacteria, plant disease management*

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Supramolecular biomaterials encompassing peptide amphiphiles, biopolymers and graphene oxide for tissue engineering

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Abstract. Bioengineering soft, hydrophilic, dynamic and conductive extracellular matrix (ECM)-mimetic constructs able to capture the multitude of signals of native neuronal environment is a major goal of neuronal tissue engineering aiming to rebuilt from complex lesion environments, such as spinal cord injury (SCI)(1,2). The use of mesenchymal stem cells (MSCs) therapy in SCI clinical trials has proved to decrease the inflammation and limit the associated secondary injury events that deteriorate the lesion area; however, they still fail to obtain consistent motor recovery of neural circuits (3). Combinatory strategies involving stem cells and advanced biomaterials are key to effectively modify cellular environment and stimulate tissue regeneration at the lesion site (4). Recently, the emerging field of supramolecular chemistry together with advances in tissue engineering and regenerative medicine have opened new avenues by enabling innovative ECM-mimetic supramolecular biomaterials, enlisted with biochemical and structural features, to modulate cell behavior and grow of biofunctional neural tissues (5). Peptide amphiphiles (PA) are very appealing building blocks for designing ECM-mimetic structures due to their key enabling features, such as fibrillar topography and high-density of bioactive epitopes. However, the mechanical properties of PA-based biomaterials are intrinsically weak.

Herein, a supramolecular multicomponent biomaterial encompassing the biocompatible polymers poly-L-lysine and hyaluronic acid, PA and graphene oxide (GO) has been developed by combining molecular self-assembly with the Layer-by-Layer assembly technology aiming to increase the mechanical properties of PA-based biomaterials while favoring the establishment of a conductive environment to instruct MSC's behavior. The secondary structure and morphology of the co-assembled system were studied by circular dichroism, attenuated total reflectance-Fourier transform infrared spectroscopy, and scanning electron microscopy. The successful fabrication of supramolecular multilayered thin films was monitored in situ by quartz crystal microbalance with dissipation monitoring. The preliminary in vitro biological performance of the as-developed supramolecular multicomponent matrices, exhibiting distinct mechanical and topographical cues, was assessed using MSCs with the thin films imparted with the synergistic effect of GO and PA revealing enhanced cell viability and anisotropy when compared to the control substrates. These results suggest the potential use of such hybrid biopolymer/peptide/GO supramolecular multicomponent biomaterials in neural tissue engineering.

Keywords: *self-assembled peptides; graphene-oxide; natural polymers; layer-by-layer assembly; thin films, mesenchymal stem cells.*

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Extraction of bioactive compounds from macroalgae using alternative greener extraction methodologies

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Abstract. Macroalgae have been used for centuries mainly as a food source and in the hydrocolloids industry, however, their potential as a source of valuable bioactive compounds remains largely underexploited. Macroalgae are rich in a diverse range of bioactive compounds such as lipophilic and phenolic compounds, pigments, fibers, vitamins and carbohydrates which are recognized by their interesting biological activities, including anti-inflammatory, antibacterial and antiproliferative properties making them very promising for high value applications, such as nutraceuticals, cosmetics or pharmaceuticals (Kadam et al., 2013). Nevertheless, the lack of efficient and sustainable extraction methodologies that can replace the current conventional ones (which mainly uses organic, often toxic, solvents) is still hindering the use of macroalgae in these fields.

This study focuses on two families of bioactive compounds, linear diterpenes (LD) and fatty acids (FA). LD are quite exclusive terpenoids found in a few brown macroalgae families, for instance Sargassaceae, and most notably in Bifurcaria bifurcata (Pais et al., 2019), and FA, including polyunsaturated fatty acids (PUFAs), is abundant in some macroalgae, such as in the green macroalga Codium tomentosum (Santos et al., 2015). This work proposes sustainable and environmentally friendly extraction methodologies that can overcome the challenges of conventional extractions (Kadam et al., 2013).

In this vein, three alternative extraction methodologies were used in this study: LD were extracted from B. bifurcata using microwave-assisted extraction (MAE) and switchable-hydrophilicity solvents (SHS), while FA were extracted from C. tomentosum using eutectic solvents. The extracts were evaluated regarding their total extraction yield and the content of LD for B. bifurcata and FA for C. tomentosum, analysed by gas chromatography-mass spectrometry (GC-MS) and compared with extracts obtained using conventional solvents.

LD and FA enriched extracts were successfully obtained using these greener and more sustainable methodologies, paving the way for their potential use in high-value industries.

Keywords: *Bifurcaria bifurcata, Codium tomentosum, Linear diterpenes, Fatty acids, Alternative extraction methodologies*

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Immunosensory integrated system for a fast and efficient detection of the coronavirus SARS-CoV-2 – the SENSECOR project

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Abstract. The COVID-19 pandemic severe impact in society, encouraged the development of alternative tools capable of providing an accurate, fast, and cost-effective diagnosis of SARS-CoV-2 infection, that can be easily acquired and used by ordinary citizens. In this sense, the SENSECOR goal was the proof-of-concept of an innovative and unprecedented system that integrates several units: (i) immunosensory elements, (ii) immunoassay, (iii) signal conditioning module, (iv) mobile application for smartphone, (v) data treatment and communication module. This system facilitates the decentralization of SARS-CoV-2 screening in symptomatic patients, as well as the subsequent centralization of COVID-19 epidemiological monitoring data in competent and authorized health facilities. In this way, the integrated system SENSECOR supports the rapid clinical decision-making, minimizing the use of expensive molecular diagnostic tests. Also, it reduces the overload of specialized human resources and health professionals, which altogether may contribute to contain the resurging of potential future uncontrollable pandemic events. Overall, this work aims to present an overview of the project and major impacts. The SENSECOR project, which was funded by FEDER under the programme COMPETE2020, was developed by a multidisciplinary partnership established between Academia, Research Units, Enterprise and a Hospital, gathering experts in multidisciplinary areas of biotechnology, machine learning, photonics, health and wireless communications.

Keywords: *Biosensor; photonics platform; machine learning; data communication*

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Integrated preservation-purification platform for RNA based on biocompatible amino-acid-based ionic liquids

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Abstract. The emergence of RNA as a promising biopharmaceutical has paving the way for the development of innovative medicines with broad therapeutic and prophylactic efficiencies in infectious diseases and cancer. However, the therapeutic efficiency of RNA strongly depends on its integrity, purity and biological activity, which is not easily achievable due to the highly labile nature and intrinsic low stability of RNA. Moreover, current methods for RNA extraction and purification remain laborious and costly, still constituting a challenge toward its widespread application (Pedro et al., 2018).

To surpass the described drawbacks, more competitive, effective and sustainable strategies for purifying RNA are of paramount relevance. To this end and by virtue of the high affinity between amino-acids and RNA, as well as the favourable nucleic acids-stabilization properties exhibited by amino-acid-based ILs (AA-ILs), AA-ILs may play a prominent role on this field (Quental et al., 2019). From the exposed, several AA-ILs are being investigated as constituents of aqueous biphasic systems (ABS). ABS are aimed to be used as alternative cost-effective and sustainable purification-stabilization platforms for RNA, taking advantage of the tuneability and designer solvent character of ILs, with the ultimate goal of purifying RNA from a complex recombinant lysate.

AA-ILs comprising L-arginine, L-lysine and L-histidine as cations combined with chloride or DL-aspartate, were synthesized and characterized. Their ability to form ABS with distinct salts and polymers was then investigated. All AA-ILs in study formed ABS with polypropylene glycol with a molecular weight of 400 g.mol-1 (PPG 400), allowing their use in the purification and preservation of RNA. RNA is majorly extracted with high yield either to the IL-rich phase or can be recovered as a precipitate (in the ABS composed of the dicationic AA-ILs), thus confirming the versatility and improved selectivity of these systems. The structural integrity of RNA was generally maintained during the extraction process. Ongoing work is focusing on the application of the most promising IL-based ABS for the separation of RNA from complex recombinant lysates.

Overall, the approach herein developed represents a promising strategy to surpass the critical demand of RNA with high integrity, purity, and biological activity, envisaging its potential use as biotherapeutics.

Keywords: *Biopharmaceuticals, Aqueous biphasic systems, Amino acid ionic liquid, Purification, Stability*

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Xeno-free cardiac tissue repair enabled by human protein-based microparticles as cell carriers

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Abstract. Human platelet lysates (PL) have been explored for multiple applications as a source of growth factors and bioactive proteins involved in cell function [1,2]. Methacryloyl platelet lysates (PLMA, Metatissue®) have been recently reported as a precursor to produce matrices for cell culture. PLMA can be cured upon light exposure to form hydrogels with tuneable mechanical properties and increased stability in vitro [2]. The synthesized hydrogels have proven to support growth, sprouting and migration of human-derived cells. Moreover, it was reported the production of PLMA-based porous scaffolds capable of supporting cell maintenance and function in the absence of animal-derived serum supplements [3].
Microcarriers have emerged as potential delivery platforms for cell-based tissue engineering strategies as they offer the possibility of large-scale cell culture, often required for cell-based therapies. As such, herein we propose the use of PLMA-based microparticles as platforms for cell culture and cardiac tissue engineering.
PLMA microparticles were produced by microfluidics. Water-in-oil microdroplets were formed by using PLMA solution with a photoinitiator as a continuous phase and mineral oil as dispersed phase. Afterwards, microdroplets were crosslinked using light to produce PLMA microparticles. Structural properties of PLMA microparticles were assessed. PLMA microparticles were afterwards evaluated as microcarriers to culture cardiomyocytes and endothelial cells.
Monodispersed PLMA microparticles with diameters around 360µm were produced by flow-focusing microfluidics. H9C2 cell line was used to evaluate the ability of such microparticles to serve as anchor for cardiomyocyte attachment and proliferation. PLMA microparticles were seeded with H9C2 cells or H9C2 co-cultured with endothelial cells. Our results show that PLMA microparticles can support cell adhesion and promote the formation of cell and microparticles aggregates in xeno-free conditions.PLMA-based scaffolds were already described as platforms that support cell culture even in the absence of animal-derived serum supplements. Herein, we describe the use of the same precursor material to produce microparticles to be used as microcarriers for cell proliferation and cardiac tissue engineering. Our results show great potential of such microparticles to serve not only as platforms for cell proliferation but also as potential microcarriers for cardiac tissue engineering. Such microparticles can have an autologous origin, being adequate to be used as injectable systems with no risk of cross-reactivity, immune reaction or disease transmission.

Keywords: *Platelet lysates; Microcarriers; Cardiac Regeneration*

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Boron-doped diamond as a platform for biosensing the enzymatic reaction of laccase: Potential applications in phenolic compound detection

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Abstract. Laccase, a copper-containing oxidase enzyme, is known for its versatility in catalyzing the oxidation of a wide range of substrates with high efficiency. It has found applications in various industries such as textiles, paper, food, bioremediation, cosmetics, and pharmaceuticals, due to its ability to oxidize phenolic and non-phenolic compounds (recurring to a mediator). In recent years, there has been growing interest in using laccase in biosensing applications for the real-time determination of phenolic compounds, which can have implications in biotechnology and medicine.The development of a diamond-based biosensor for laccase has potential applications in various fields. For instance, it could be used for the real-time determination of phenolic compounds in environmental monitoring, food safety, and biomedical diagnostics. Phenolic compounds are important biomarkers for various diseases, including neurological disorders and tumors, and accurate and sensitive detection of these compounds can provide valuable information for diagnosis and treatment. The use of boron-doped diamond (BDD) as a platform for biosensing offers several advantages, including its excellent electrochemical properties, high stability, and biocompatibility, making it a promising material for enzymatic biosensing applications.

In this study, we investigated the use of BDD as a platform for biosensing the enzymatic reaction of laccase with ABTS. BDD is an electrochemically sensitive material that can be synthetized using the hot filament chemical vapor deposition technique on monocrystalline silicon. The BDD surface was functionalized with NH3 plasma to enhance enzyme-transducer interactions and provide a suitable environment for the laccase reaction.

Microcrystalline diamond films were deposited on high-resistivity silicon substrates, and the laccase reaction was allowed to take place. The diamond surface was characterized using various techniques, including ATR-FTIR, SEM, Raman spectroscopy, and optical contact angle measurements, to understand the interaction between the enzyme and the biosensor.

Results demonstrated the feasibility of using BDD as a platform for biosensing the enzymatic reaction of laccase. The functionalized diamond surface provided a favorable environment for the laccase reaction, and the characterization techniques confirmed the successful deposition of diamond films and the interaction between the enzyme and the biosensor. The electrochemical signal obtained translates the occurrence of redox reactions with a consequent decrease of the material resistance throughout the reaction time.

In conclusion, the study demonstrates the potential of using BDD as a platform for biosensing the enzymatic reaction of laccase. The results encourage further research and development of diamond-based biosensors for the real-time determination of phenolic compounds and other enzymatic reactions.

Keywords: *Laccase, Boron-doped diamond, Biosensor, Electrochemical, HFCVD*

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Exploring Living Materials for Tackling Human Diseases

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Abstract. Living materials represent a new generation of human-engineered biotherapeutics that are highly attractive for a myriad of medical applications. Such innovative technologies provide multi-adaptable cell-rich platforms, with encodable and controllable bioactivity, that is unattainable with current and conventional biomaterial approaches. Owing to their living characteristics, the cellular units within these materials can also be rendered with additional therapeutically-relevant biofunctionalities. On this focus, this project aims to develop hydrogels with tissue-like density for biomedical applications, through the glycoengineering of multipotent stem cells, followed by their bottom-up processing through additive manufacture and volumetric 3D bioprinting technologies. By applying technologies such as metabolic glycoengineering to stem cells and developing hydrogels through copper-free click chemistry reactions, one will be able to create platforms exhibiting tissue-like programmability and functionality, with relevant cell densities (up to 10ˆ8 cells/cm3) and responsiveness. Such disruptive approach will leverage the development of multi-cellular tissue-like platforms, applicable to a wide range of tissues and biomedical applications, by exploiting the differentiation potential of such cells.

Keywords: *Living Materials, Stem Cells, Metabolic Glycoengineering, Tissue Engineering, Disease Modeling*

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Advanced electromechanical devices for use in bone tissue engineering

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Abstract. With the increase in the prevalence of bone disease and lesions, there is the need for advanced bone implants utilizing biocompatible materials that improve the healing process [1]. Current metallic implants have good mechanical properties but lack biocompatibility. This can be overcome by modifying the surface of the metallic implant materials, for example by coating them with polymers such as Poly (L-lactic acid) (PLLA) [2]. PLLA is known as a material for bone implants due to its biocompatibility, biodegradability, and piezoelectric properties that have been shown to improve bone regeneration [3]. Piezoelectric properties originated from the crystalline zones of PLLA. This causes a significant impact of the degree of crystallinity, crystallites orientation, and crystal morphology on the piezoelectric properties [3]. By analyzing the effects of variables such as the treatment of the stainless-steel surface and the temperature, concentration of the PLLA solution, and the cooling and heating rates used during the crystallization, it is possible to better understand and adapt the crystallization behavior of the PLLA coating. This knowledge could then be used to tune the properties of the implant devices for bone tissue engineering. In our work, the stainless steel was submitted to either thermal treatment or UV irradiation followed by the silanization process to improve the adhesion between the PLLA and stainless steel. A thin film of PLLA was deposited on top of the stainless-steel substrate via spin coating with PLLA solution concentrations of 2.5 wt.% or 5.0 wt.%. The effect of the different pre-treatment on the efficiency of the adhesion is discussed along with the impact on the morphology of the crystalline PLLA. After deposition, the film was crystallized using different temperatures, cooling, and heating rates. XRD, FTIR, Raman, AFM, and PFM results showed that the morphology of the crystalline PLLA films as well as the crystallinity degree were highly affected by the different variables used. Samples with a higher degree of crystallinity were obtained on UV-treated stainless steel, lower cooling rates, and higher PLLA solution concentration.

Keywords: *stainless steel 316L; Poly (L-lactic acid); piezoelectrics; bone implants.*

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Natural phenolic compounds – gut microbiota dynamics: A reciprocal modulation approach for personalized nutrition

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Abstract. Currently, the concept "let food be the medicine", often ascribed to Hippocrates(400 BC) has attracted increased attention due to the focus that the scientific community has given to the relationships that exists between the gut microbiota(GM) and dietary components (Zmora et al., 2019). Human GM consists of a complex microbial community colonizing the human intestinal tract, with about 1014 bacterial cells, have a significant impact on human health. Their composition is highly influenced by diverse internal and external factors, being dietary components one of the most prominent (Duda-Chodak et al., 2015; Espín et al., 2017). For example, the well-known dietary phenolic compounds(PC) could modulate GM composition, with potential health benefits (Hervert-Hernández ; Goñi, 2011). Thus, while GM metabolizes dietary PC, these compounds/metabolites modulate GM composition as prebiotics or antimicrobial agents (Ozdal et al., 2016). Moreover, PC bioavailability has a crucial role in their human health beneficial effects and in this two-way relationship (D'Archivio et al., 2010). Notwithstanding, most of the literature studies have evaluated both bioavailability and this bidirectional relationship through complex food matrices, hindering the detailed knowledge of the individual dietary PC bioavailability as well as to understand their metabolism by GM and their role as modulators.

In this vein, the bioavailability of ten individual PC representative of the major classes was evaluated in an in vitro simulated gastrointestinal digestion(INFOGEST) and further analyzed and quantified through ultra-high performance liquid chromatography with diode-array detection and coupled to electrospray ionization tandem mass spectrometry(UHPLC-DAD-MSn). Then, an in vitro fecal fermentation was performed. A pool of fresh feces from five healthy human donors was incubated in anaerobic conditions, at 37ºC, for 48h, using standard PC representative of three major families – naringenin, ellagic acid, and phloroglucinol. Then, the PC and resultant metabolites were identified and quantified by UHPLC-DAD-MSn and short-chain fatty acids(SCFAs) production was analyzed by gas-chromatography coupled to a flame ionization detector(GC-FID).

Most of PC showed a bioavailability >50% in intestinal digestion phase, as observed e.g. for phloretin. However, PC solubility variation along the gastrointestinal tract has a substantial impact on quercetin, EGCG and ellagic acid bioaccessiblity variation among the digestion phases. Regarding intestinal absorption, all compounds seemed to be highly absorbed, with the lowest percentage (~82%) observed for phloretin. Thus, these results are a relevant contribution to understand bioavailability among different PC classes. Moreover, the work on the identification and quantification of the resultant metabolites from fecal fermentation is still in progress.

Keywords: *Human gut microbiota, Phenolic compounds, Bioavailability, INFOGEST, in vitro Fermentation, Metabolites*

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Bone tissue regeneration through sound and magnetism – the use of acoustic and magnetic stimuli to organize cells and create microtissues

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Abstract. Bone tissue engineering has emerged as a promising field for the development of functional tissues and organs to tackle the daily challenges of the clinical orthopedic needs. Despite the great achievements in this field, controlling stem cell multipontency and engineering bone in vivo it often leads to heterotypic and inferior osseous tissues. Moreover, a plethora of cellular external factors is still poorly explored. In fact, cells are highly sensitive to external signals and different stimuli can be used to modulate cell organization and differentiation. We are particularly interested in exploring the acoustic and magnetic fields to guide stem cell differentiation and microtissue formation. For that, self-regulated liquid capsules, loaded with mesenchymal stem cells (MSCs) and magnetic-responsive microparticles were envisioned to recreate the dynamic environment of bone tissue. The liquid capsules comprise (i) a membrane that ensures permeability to essential molecules for cell survival; (ii) surface functionalized magnetic-responsive poly(-caprolactone) microparticles loaded into the liquid core acting as cell adhesion sites; and (iii) MSCs. Within this unique liquid environment, cells can move freely and construct their own 3D system by recruiting surface functionalized microparticles according to their needs. Moreover, taking advantage of the liquid core microenvironment, it is possible to increase fluid flow simply by moving an external magnet. The hydrodynamic shear provided by the external magnet is expected to maximize the interactions between cells and microparticles while improving mass transfer inside the compartmentalized capsules. Additionally, we can recreate the magnetic methodology after implantation. Acoustic patterning is a promising technique that allows precise spatial arrangements of structures using sound waves. The acoustic stimulation will be applied to scale-up the liquid capsules into 3D structures with specific geometries. Our hypothesis is that by enhancing the hydrodynamic shear inside of the compartmentalized capsules using magnetic stimulation and assemble them into specific geometries applying acoustic fields, new microtissues with superior quality and without requiring any osteogenic medium supplementation could be engineered.

Keywords: *Tissue engineering, Bone regeneration, Acoustic patterning, Magnetic field, Liquified-microcapsules, 3D system*

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Towards the application of Avian Immunoglobulin Y (IgY) antibodies in both treatment and prophylaxis of infectious diseases caused by MRSA

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Abstract. Due to the inadequate use of antibiotics, bacteria experience unremitting mutations, becoming resistant to these pharmaceuticals, while turning microbial infections difficult to treat [1, 2]. This worrisome scenario is well known as Antimicrobial Resistance (AMR) and it is one of the most serious public health threats worldwide, being Methicillin-resistant Staphylococcus aureus (MRSA) one of the most problematic multiressistant bacteria [3-5]. Thus, its prevention and control are deemed public health priorities in the European Union [4]. Despite being important for the treatment of infections, antibiotics are gradually losing their efficient [6]. Therefore, it is important to develop effective alternative therapeutics to tackle this scenario, such as biopharmaceuticals.

Avian immunoglobulin Y (IgY) is a promising antibody to be employed as biopharmaceutical, being obtained by non-invasive techniques and at high yields from hen's egg yolk [7,8]. By being a polyclonal antibody, it recognizes various epitopes on an antigen, which is useful for the treatment of several infectious diseases, including the ones triggered by MRSA [7,8]. Notwithstanding, its widespread application as biopharmaceutical is limited by the complexity of egg yolk that affects its recovery at high purity and yields, and by their preservation. To surpass this limitation, a low-cost purification technology established on liquid-liquid extraction processes with Aqueous Biphasic Systems (ABS) was already exploited, granting high purity (>98%) IgY at high yields. Hence, this works aims to assess the potential of IgY antibodies as biopharmaceutical against infectious diseases caused by MRSA, by evaluating their stability and activity towards this bacteria. To this end, IgY was recovered from the egg yolk of hens immunized with the recombinant Penicillin-binding protein 2a (PBP2a) of MRSA and purified by the previous purification platform. The stability of IgY formulated with sugars, polyols and amino acids was assessed by Circular Dichroism (CD) Spectroscopy under different conditions. The percentage of aggregates formed during storage was evaluated by Size Exclusion-High Performance Liquid Chromatography (SEC-HPLC) and the ability of IgY to maintain the PBP2a recognition was evaluated through Dot-Blot. Promising stabilizers for IgY were found, envisioning their use as excipients in future IgY therapeutic formulations for MRSA infectious diseases, while helping to decrease economic, societal, and health burdens.

Keywords: *Methicillin-Resistant Staphylococcus aureus; Multiressistant bacteria; Avian Immunoglobulin Y; Biopharmaceutical*

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Decellularized in vitro-assembled mini-tissues for regenerative medicine

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Abstract. Tissue regeneration is an intricate physiological process that relies on the provision of biochemical and mechanical cues to promote the recruitment of cells and the deposition of new and healthy pro-regenerative extracellular matrix (ECM). Biomaterials can be designed to stimulate tissue-specific ECM deposition and tissue formation and ideally can be integrated in a defect to drive regeneration on site. Some current commercial alternatives are based on animal or human cell-derived or decellularized-based materials to obtain cell-laden or dECM hydrogels however these approaches have not yet successfully recapitulated entirely a functional in situ tissue-specific and pro-regenerative microenvironment on the injury site. This project comprises the design of an in vitro manufactured platform for tissue regeneration composed only by cell deposited ECM, being cell and material-free as a final implantable form with the versatility to be donor and tissue tailored in terms of composition and macroarchitecture. In the first step, cell-only fibers composed of highly enriched tissue-specific ECM will be generated by two approaches: using pre-differentiated cells to assemble the fibers or starting from pre-assembled fibers composed of undifferentiated cells and matured afterwards with organotypic cell culture media. A decellularization-based strategy is here used to minimize a possible cytotoxic host response towards the bioprinted material upon implantation with a specific goal of maintaining the ECM/microenvironment of the in vitro-assembled construct. Preliminary results indicate that a successful approach for the decellularization of the ECM networks was obtained. A proof-of-concept for osteogenic differentiation suggests that the decellularized osteodifferentiated constructs could be providing cues to promote the differentiation of surrounding cells in vitro. The final product is envisioned to be an off-the-shelf device with tailored composition and shape control to enhance in situ host cell recruitment and induce healthy regenerative tissue-specific ECM deposition in a target defected tissue.

Keywords: *Cell fibers; decellularized ECM; bioprinting; regenerative medicine*

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Separation of colorants/proteins from Gracilaria gracilis using silica-based materials functionalized with ionic liquids

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Abstract. The interest in microalgae, macroalgae and cyanobacteria has been growing in academia and industry due to their composition. As part as the most interesting compounds from the point of view of commercialization are the pigments, namely chlorophylls, carotenoids and phycobiliproteins (Mittal et al., 2017). Phycobiliproteins are photosynthetic light-harvesting and water-soluble proteins, which enclose phycoerythrin (PE), phycocyanin, phycoerythrocyanin, and allophycocyanin. These proteins are applied in several areas, such as food, nutraceutical, pharmaceutical and energy. The most common extractions of these proteins are maceration, freeze-thaw and ultrasounds. Normally these techniques are used in combination with solid-liquid extraction, which can use water or other solvents (Kovaleski et al. 2022) and be then conjugated with chromatography, ultrafiltration, and aqueous biphasic systems regarding purification. In this work, silica-based materials functionalized with ionic liquids (alternative solvents with interesting properties for the development of more sustainable processes) were studied as adsorbent materials for the separation of pigments from the seaweed Gracilaria gracilis. Five silica-based materials functionalized with different ILs were tested in batch and the optimized conditions applied on continuous mode. The main results obtained show the separation of PE from other components present in the pigments' extract, such as phycocyanin and chlorophylls. Also, it was proved in this work that the silica-IL-based material can be used at least 5 times without losing efficiency between cycles.

Keywords: *Phycobiliproteins, Extraction, ionic liquids, silica-based material, solid-phase extraction*

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Exploring the synergistic effects of topographical and biochemical modification of microparticles as injectable platforms for bone tissue engineering

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Abstract. Bone tissue engineering has primarily aimed to recreate the bone microenvironment by using scaffolds for the delivery of key biomolecules and physical signals, to guide cell fate towards bone repair. To this end, microparticles have been extensively explored, namely as drug delivery systems, cell expansion carriers, and building blocks (Neto et al., 2019). Although traditionally used in their spherical shape, the standard concept of microparticles has increasingly been challenged by the modification of their features, such as surface chemistry, geometry, topography, or porosity, in order to meet several needs for different tissue engineering applications (Neto et al., 2019). However, as in most tissue engineering approaches, research is generally still limited to the simulation of individual aspects of the bone extracellular matrix (Jesus et al., 2022). The targeting of more than one feature through the combination of different cues would most likely enhance biomimicry of the native tissue, creating a better osteoinductive microenvironment (Jesus et al., 2022; Mertgen et al., 2020).

In that regard, we propose a novel system composed of geometrically modified microparticles that combine mechanical cues with polymer and protein coatings for the efficient delivery of growth factors (GF). The new microparticles should present curved patterns on their surfaces to modulate cell behaviour and phenotype, and an enhanced surface area to volume ratio due to their disc-shaped format, providing more adhesion sites while also allowing simultaneous dorsal and ventral topographical stimulation of cells (Bjørge et al., 2019). Additionally, we will take advantage of poly(ethyl acrylate) (PEA) biological activity by nanocoating this polymer on the surface of the microparticles. PEA has been reported to trigger the biomimetic assembly of fibronectin (FN) in fibrillar networks, mediating FN adsorption in a conformation that favours the simultaneous availability of integrin-binding regions and GF-binding domains, allowing us to use ultra-low doses of the latest (Llopis-Hernández et al., 2016; Salmerón-Sánchez et al., 2011).

So far, we were able to create moulds with the desired curved patterns at the appropriate scale and use them in soft-lithography techniques to achieve the patterned microparticles. We have observed the transfer of these patterns to the polymeric microparticles although still dealing with some optimization steps.

We hypothesise that this new class of microparticles can be used as an injectable fit-to-defect system, capable of supporting cell-mediated bottom-up assembly of robust 3D constructs while providing cells with an osteoconductive and osteoinductive environment that promotes new bone formation and osteointegration.

Keywords: *Bone tissue engineering, Bottom-up, Microparticles, Mechanobiology, Curvature, Growth Factors*

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Hyperbaric storage as a blood preservation methodology

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Abstract. In some low/middle-income countries, blood preservation for transfusion remains a challenge, because, due to lack of conditions to maintain the refrigeration chain necessary for blood preservation [1]. Therefore, it is essential to develop new techniques that can improve blood preservation or storage in these more difficult circumstances. Hyperbaric storage (HS) is a new preservation methodology that allows the storage of products under pressure (up to 100 MPa) for variable time periods and has been studied almost exclusively in food products [2]. When used at uncontrolled room temperature, this methodology is a quasi-energetically costless procedure since, after pressure generation, no additional energy is required to keep it along storage, allowing energetic savings [3]. So, in this work, hyperbaric storage has been studied as a potential new blood preservation methodology. Whole swine blood, with citrate-phosphate-dextrose-adenine (CPDA-1), was stored for 35 days under pressure (25 – 75 MPa) at variable uncontrolled room temperature and refrigeration temperatures and compared to a conventional whole blood preservation method (refrigeration). Quantification of hemolysis, pH, and a multivariate and metabolic composition analysis by 1H NMR spectroscopy were performed to evaluate HS feasibility for blood preservation.
The results showed that pressures above 50 MPa, regardless of temperature, promote cell lysis. However, at lower pressures (25 – 45 MPa) and variable uncontrolled room temperature, it was possible to maintain hemolysis values below 0.8 % (hemolysis limit allowed for blood transfusion) up to 12 days. At the same pressures but combined with refrigeration (5 °C) better hemolysis results were obtained with values below the limit (0.8%) during 35 days of storage. However, when compared to the conventional method (refrigeration), the values differed only by a maximum of 0.35%. The metabolic composition analysis by 1H NMR revealed a lower lactate and a higher glucose concentration in blood stored under pressure, which may indicate a decrease in red blood cell metabolic rates when pressure and refrigeration temperatures are combined. The potential decrease in red cells metabolic rate is a good indicator, since it indicates lower cellular activity, with potential to keep cells alive for longer with less added nutrients.
This study gives a global perspective on the feasibility of using hyperbaric storage as a whole blood preservation technique. To have a deeper insight, additional research and analysis are required, such as flow cytometry for microvesicles detection and microscopy for morphology characterization.

Keywords: *Blood preservation, Hyperbaric storage, Hemolysis, Metabolic profile*

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Soft free-standing multilayered membranes made of marine-origin polysaccharides for controlled drug delivery

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Abstract. The design of polymeric drug carriers that could promote the efficient encapsulation, protection, transport, and sustained release of bioactive agents has been attracting much interest in the biomedical field. Among them, nanosized polymeric micelles, polymer particles, polymersomes, or liposomes are very promising carriers owing to their high drug loading capacity. To improve site-specific controlled release of proteins/drugs/therapeutics, the functionalization of surfaces with multilayered thin films by resorting to the Layer-by-Layer (LbL) assembly technology has been widely used. This is a simple, inexpensive and highly versatile bottom-up approach to functionalize any type of surface and engineer robust architectures, with tunable properties and functions at the nanoscale, by resorting to a myriad of building blocks exhibiting complementary interactions (Borges ; Mano, 2014). Although a multitude of complementary intermolecular interactions can be employed in the growth of multilayered assemblies, the electrostatic interaction between oppositely charged polyelectrolytes has been the most explored mechanism. In particular, natural polysaccharides are attractive building blocks for the build-up of multilayered (bio)materials owing to their biocompatibility, biodegradability, non-cytotoxicity and non-immunogenic properties (Silva et al., 2016). Among them, the marine-origin polysaccharides are a sustainable renewable resource for the fabrication of nanostructured biomaterials. Chitosan (CHT) and alginate (ALG) have been commonly assembled into multilayered devices owing to their opposite charge nature (Costa et al., 2015). However, the insolubility of CHT in physiological conditions limits the range of bioapplications of CHT-based LbL structures. In this regard, the modification of CHT by quaternary amine groups has been proposed as an efficient strategy to increase its solubility in neutral pH (Andreica et al., 2020).
Herein, we propose the design of free-standing multilayered membranes encompassing water-soluble quaternized CHT (N-(2-hydroxypropyl)-3-trimethylammonium chitosan chloride (HTCC)) and ALG for the controlled release of model drug molecules. To assess the influence of the film structure in the drug release profile, two different membranes, having either the model drug fluorescein isothiocyanate-labeled bovine serum albumin (FITC-BSA) as an intrinsic building block (HTCC/ALG/HTCC/FITC-BSA)100 or added after as an outer layer into the membranes (HTCC/ALG)200/HTCC/FITC-BSA, have been produced. The thickness, morphology, in vitro cytocompatibility, and release profile was evaluated for both membranes, with the ones having FITC-BSA as an intrinsic building block of the LbL film denoting a more sustained release rate. This work holds great promise for the development of a vast array of CHT-based biomedical devices for different bioappplications, overcoming the limitations associated with the use of native CHT under physiological conditions.

Keywords: *Water soluble chitosan, Layer-by-Layer assembly, Marine-origin polysaccharides, Drug Delivery*

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Drug combination enhanced by photodynamic therapy: a targeted delivery therapeutic approach in pancreatic cancer

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Abstract. Pancreatic cancer (PC) is one of the most fatal types of cancer worldwide, presenting a 5-year overall survival of only 10%. Chemotherapy is usually applied; however, it has some limitations as 1) low response; 2) frequent collateral effects, and 3) drug resistance. Among the mechanisms associated with drug resistance, the overexpression of the P-glycoprotein (P-gp) is one of the most outstanding in PC. In the last years, it was shown that some flavonoids can function as P-gp inhibitors (Barros, 2018). Photodynamic therapy (PDT) is a relatively non-invasive therapy that leads to the direct death of malignant cells. Nevertheless, PC PDT has some weaknesses as the limited penetration depth and the hypoxia caused by the abundant and tight stroma in PC tissues (Wang et al., 2020). Therefore, there is still a need to improve PC PDT, especially by delivering the photosensitizers (PSs) in a more targeted way and combining therapies. Nanoparticles have been explored to overcome the problems of compounds delivery, allowing a more precise approach. In fact, past studies already demonstrated that using nanoparticles for combined chemotherapy and PC PDT has shown good results. However, there is a lack of studies investigating drugs combinations with PDT. In this work, we propose the combinations of low doses of different chemotherapeutic agents and flavonoids together with photodynamic therapy with different PSs, loaded into mesoporous silica nanoparticles conjugated with low-density lipoprotein (LDL). It was already demonstrated that PC cells overexpress the LDL receptor and the efficiency of LDL-conjugated nanoparticles was already evidenced in other diseases, but remain unexplored in PC treatment (Wu et al., 2020). These nanoplatforms will be tested on PC cells in 2D and in 3D co-culture systems. The effects on cell viability will be analysed by MTT assay and calcein AM/PI staining and possible synergistic effects will be evaluated. The underlying toxicity mechanisms, as effects on cell cycle, ROS production and apoptosis, will then be assessed. Gene expression will be evaluated by RT-qPCR. With this work, we will contribute to new paths in PC treatment.

Keywords: *Mesoporous silica nanoparticles, Low density lipoprotein, Chemotherapeutic agents, Flavonoids, Photodynamic therapy, 3D spheroids*

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Using thermoreversible aqueous biphasic systems and ionic liquids to improve the manufacturing of mRNA nanomedicines

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Abstract. If there is one thing the COVID-19 pandemic has taught us is the enormous potential of messenger RNA (mRNA) vaccines as an effective tool to contain infectious disease outbreaks. Over conventional vaccines, there are several advantages to mRNA vaccines, namely improved safety and efficacy, and the possibility of repeatedly administration [1]. However, mRNA nanomedicine production is still a complex and expensive process that requires improved technologies to produce more stable and widely accessible products, meeting a timely and sufficient manufacturing capacity.
Ionic liquids (ILs) are molten salts comprising organic cations, with a remarkable structural diversity and with promising applications as solvents and catalysts. If properly engineered, ILs can improve the stability of RNA [2] and contribute to the achievement of highly selective purification processes when applied as components of aqueous biphasic systems (ABS) [3]. Therefore, this work aims to integrate the production and clarification steps of mRNA nanomedicine manufacturing processes by using thermoreversible ABS comprising ILs, simplifying subsequent purification steps. Initially, the production of mRNA by in vitro transcription using a T7 polymerase-based cell free system was implemented. Several quality control methods (UV spectroscopy, electrophoresis, fluorescence-based mRNA quantification, PCR, dot-blot, circular dichroism, etc) were designed to evaluate the integrity and purity of mRNA. ABS formed by dextran from Leuconostoc spp. with an average molecular weight of 450.000-650.000 g/mol (Dex 500) and polyethylene glycol (PEG) 3350 g/mol, containing ionic liquids (ILs) as adjuvants were deeply characterized. These systems generally display an upper critical solution temperature (UCST) behavior, which renders them promising candidates for the development of the integrated process. Preliminary mRNA extraction experiments using the developed ABS indicate that the mRNA is preferentially partitioned toward the DEX-rich phase, being recovered with high yield and with high integrity. Ongoing work, having into consideration the most promising ILs able to maintain the stability and integrity of mRNA, is focused on the selection of the best integrated production-clarification platform resorting to thermoreversible IL-based ABS, to be achieved by a careful selection of the ABS components and mixture points.
In conclusion, the development of a new integrated production-clarification platform, resorting to thermoreversible ABS comprising ILs, can be used to overcome the challenges of mRNA nanomedicine production, namely by lowering costs and environmental impact of current manufacturing processes while improving mRNA stability, yield, and speed of production.

Keywords: *mRNA nanomedicines; ionic liquids; thermoreversible aqueous biphasic systems; in vitro transcription*

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Development of bioactive human-based bio-inspired scaffolds for bone tissue engineering

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Abstract.
Bone degenerative diseases and trauma injuries affect millions worldwide. Specifically to temporomandibular joint, beyond about 60–70% of the general population have signs of disorders, only about 25% of those are reporting symptoms. The deterioration of temporomandibular joint condyle bone may cause malocclusion, skeletal facial deformity and facial asymmetry, being a demand to solve this disfunction [1]. Beyond the capacity to bone regenerate itself in many situations, when the defect is caused by trauma, systemic diseases, pathological fractures (consequence of metastasis or primary malignancy), infection or a compromised blood supply, this ability to adequately self-heal can fail [2].Currently, the treatments for bone defects comprise bone transplantation (including autografts, allografts, and xenografts) and implantation of synthetic bone substitutes (metal, polymeric implants, and so on). However, these methods still have shortcomings as supply limitation, resorption of surrounding tissue, risk of donor site morbidity, infection, rejection, high rate of failure or loosening (lack of osseointegration). Moreover, when the defects are severe, the options are very limited [3]. Considering these issues, bone tissue engineering and regenerative medicine may offer added advantages in managing bone loss.
In this sense, in this project, we are developing scaffolds based on human-derived proteins from placental chorionic membrane, highly abundant of numerous extracellular matrix (ECM) proteins, as collagen and laminin as well as with important growth factors [4]. We were able to produce hydrogels with tunable mechanical properties and which allowed the encapsulation and proliferation of adipose-derived stem cells (ASCs). Moreover, the hydrogel proved to be an important platform for engineering vascularized tissues, as the case of bone, since it allowed the organization of endothelial cells in tubular structures. For the next steps, we aim to produce scaffolds that better mimic the anisotropic microstructure characteristics of the hierarchical bone tissues. For that, we will apply a strategy of unidirectional freezing of cryogels that, according to the literature, allows the production of oriented anisotropic structures [5].

Keywords: *Human proteins; Bioactive scaffolds; Bone tissue engineering.*

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Laminarin-based snack for cells

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Abstract. In recent years, nano- and micromaterials have been widely used in tissue engineering and biomedicine. Polysaccharide-based particles are promising carriers for delivering physiologically and pharmacologically active compounds to the target cells due to their versatility and tunable properties1,2. Here, we report a novel laminarin-based particles using microemulsion method and subsequent UV crosslinking. For this purpose, particles were formed based on the immiscibility between an aqueous phase of methacrylate laminarin and aqueous phase of polyethylene glycol phase and crosslinked by UV radiation. Glucoamylase enzyme was entrapped inside the particles to gradually degrade laminarin to glucose units. The efficiency of internalization and effect of glucose release of particles on cells viability was evaluated using Human Mesenchymal Stem Cells (hMSC).

Initially particles were characterized in terms of their size, morphology and surface charge. Series of particles with different sizes were produced by varying stirring rate and needle size. SEM images demonstrated that the particles were spherical with a smooth surface. Dynamic light scattering (DLS) results showed that particles were negatively charged (-10mV). The dose-dependent toxicity of the particles was studied by measuring the hMSCs metabolic activity. Only 300ug of particles caused toxicity and significant reduction in metabolic activity. The time course of particle internalization was studied from 4h to 3 days. Over 24h very few quantities of particles were internalized. After 3days, there was a considerable increase in particles uptake for all the particle concentrations. Furthermore, impact of glucose release from the internalized particles on cell's metabolic activity was assessed. Once hMSCs internalized enzyme-encapsulated particles, the culture media was switched to a glucose-free medium. As such, any difference in cell's response could then be attributed directly to the presence of glucose inside the cells. Most of cells which internalized particles without glucoamylase and cultured in glucose free medium were died and detached. In contrary, cells that internalized enzyme encapsulated particles were maintained their viability and showed elongated shape.

This is the first time that particles are reported to deliver glucose to cells through internalization. Such particles will make cells autonomous in providing their own source of energy. We believe this work will open new windows for future advancements in tissue engineering by addressing the lack of glucose diffusion in 3D-structures and spheroids/organoids culture.

Keywords: *Laminarin, enzyme, degradation, particles, internalization, glucose*

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Artificial "mini-placenta" biofactories: bioinspired human protein-derived microcapsules for modular bone tissue engineering

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Abstract. Tissue engineering seeks the development of platforms that can stimulate the healing capabilities of human tissue or even replace damaged tissue altogether. By recovering medical waste materials, it is possible to isolate proteins of human origin, which can be leveraged to produce biomaterials that better resemble the structure and function of native tissues. The amniotic membrane (hAM) is a particularly interesting source material, as it displays reduced immunogenicity, and contains growth factors that can promote tissue regeneration as well as structural proteins that can be easily functionalized to produce hydrogels with interesting mechanical properties[1,2]. The aim of this project is to develop a novel hAM-derived biomaterial that can be processed into "mini-placentas" – liquefied microcapsules encapsulating umbilical cord-derived stem cells and endothelial cells. These microcapsules will be directed toward the osteogenic differentiation of encapsulated cells, producing small pockets of bone that will be "jammed" together to produce complex bone tissues, in order to address the growing demand for bone grafts to repair damaged bone[3]. By taking advantage of host-guest interactions between proteins and a photocrosslinkable cyclodextrin[4], we propose the development of a supramolecular biomaterial – AMSupraMA – that exhibits self-healing properties, which will facilitate the assembly of the "mini-placentas" into bone tissue. The interactions between the cyclodextrin and hAM proteins have been characterized through spectroscopic analysis, and the hydrogels that result from these interactions have been confirmed to exhibit self-healing abilities and high moldability. Mechanical characterization revealed the ultra-soft nature of AMSupraMA matrices, while cell encapsulation assays have confirmed the suitability of this hydrogel to maintain cell viability and promote cell spreading behavior. Thus, AMSupraMA hydrogels constitute a promising platform for modular tissue engineering strategies.

Keywords: *Human amniotic membrane, supramolecular hydrogels, liquefied microcapsules, bone tissue engineering*

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Supported ionic liquids for L-asparaginase downstream processing

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Abstract. L-asparaginase is an enzyme applied as a biopharmaceutical, as an acrylamide reduction agent and in the development of biosensors for the detection of L-asparagine (Nunes et al., 2020). L-asparaginase is widely distributed in nature, but microorganisms are the preferential source of production since they easily grow on inexpensive substrates (Lopes et al., 2017). For all the described applications, high levels of enzyme purity are required, reinforcing the need of developing cost-effective processes for the L-asparaginase purification.
The major focus of this work is to develop an alternative and simple semi-continuous flow-through downstream process using Silica-based supported ionic liquid-like phase (SSILLP) materials for the purification of L-asparaginase. SSILLP materials comprise ionic liquids (ILs) covalently attached to silica, allowing distinct interactions to be established between the target compounds and the support.
SSILLP materials based on quaternary ammonium cations with different alkyl chain lengths and the Cl anion were synthesized and characterized by elemental analysis, point of zero charge, Attenuated total reflectance-Fourier-transform infrared spectroscopy, Brunauer-Emmett-Teller surface area analysis, Barrett-Joyner-Halenda pore analysis, and scanning electron microscopy (SEM). An initial screening was performed to select the most promising SSILLP material for L-asparaginase purification. Optimization of L-asparaginase purification conditions, namely pH and solid/liquid ratio, was then carried out by Response Surface Methodology. Semi-continuous L-asparaginase purification was finally addressed using the best identified SSILLP material under optimized conditions (pH 3 and solid/liquid ratio of 15), attaining a purification factor of 5.15. Through this method, process costs could be significantly reduced, leading to the decrease of the enzyme price and thereby enabling its widespread application.

Keywords: *L-asparaginase, Downstream processing, Supported ionic liquids.*

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Untargeted NMR exometabolomics for non-invasive osteodifferentiation monitoring

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Abstract. Due to their ability to differentiate into multiple lineages and secrete bioactive factors essential for tissue repair, mesenchymal stem cells (MSCs) have become the basis of numerous bioengineering studies [1]. Metabolomics may unveil information on MSCs' osteodifferentiation,[2,3] allowing their behavior to be potentially guided towards improved osteocommitment.[4,5] Specifically, exometabolome analysis allows for the non-invasive monitoring of differentiation, while providing knowledge on the cell interactions with their niche.[3,6] Here, untargeted nuclear-magnetic-resonance (NMR) metabolomics was applied to monitor exometabolome changes of human adipose-derived mesenchymal stem cells (hAMSCs) from different donors during 21 days of osteodifferentiation compared to proliferation. Proliferation-related metabolic adaptations revealed requirements for specific metabolites, such as glucose and glutamine for energy supply, and the secretion of most amino acids, often after day 7 of cell culture. On the other hand, osteogenesis was characterized by a less extensive amino acid secretion and a marked lactate production. Some variations were proposed as proliferation-specific (such as glucose, glutamine, citrate, threonine and 3-hydroxybutyrate) or osteogenic-specific (such as isoleucine, glutamine and lactate), independently of the nature of the donor, although confirmation of this in additional donors is required. A preliminary articulation of endo- and exometabolome results was also attempted, enabling important correlations to be established regarding energy metabolism in hAMSCs osteodifferentiation. This work paves the way to exploit metabolic markers to monitor (and potentially predict) cell proliferation and osteogenic ability for different donors.

Keywords: *mesenchymal stem cells; osteogenic differentiation; NMR spectroscopy; metabolomics; exometabolome;*

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Business and Economics

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Desajustamentos educação-trabalho na transição do Ensino Superior para o emprego em Portugal: persistência, amplificação e desigualdade dos seus efeitos

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Abstract. A literatura economica demonstra que muitos recem-diplomados enfrentam desajustamentos educacao-trabalho quando entram no mercado de trabalho (Buchel ; Mertens, 2004; Carrol ; Tani, 2013; Dolton ; Vignoles, 2000), situações estas que podem definir-se como um desencontro entre as competências adquiridas no Ensino Superior (ES) e as exigidas pelo emprego que desempenham (McGuinness et al., 2017). Estes desajustamentos tem consequencias, como penalizacoes salariais presentes e futuras (Buchel ; Mertens, 2004; Clark et al., 2017; Korpi ; Tahlin, 2009; Murillo et al., 2012), menor produtividade e satisfacao com o emprego (Allen ; van der Velden, 2001; Kamplemann et al., 2019; Mavromaras et al., 2013), para alem de dificultar a procura por empregos ajustados (McCormick, 1990). A literatura indica igualmente que estes fenómenos sejam persistentes à saída do ES, sendo que dois terços dos trabalhadores permanecem nesse estado, pelo menos, um ano após a entrada no mercado de trabalho (Clark et al., 2017) e que trabalhadores desajustados tem uma penalizacao salarial reforcada em razao do genero (Castagnetti et al., 2018), e que entrar no mercado de trabalho durante uma recessao pode aumentar a probabilidade de desajustamento (Liu et al., 2015).

Assim, utilizando dados obtidos a partir dos Quadros de Pessoal, esta investigação pretende medir a persistência dos desajustamentos educação-trabalho e dos seus efeitos à saída do ensino superior e na entrada do mercado de trabalho verificando, primeiramente, se o consenso cientifico se aplica em Portugal relativamente a persistencia dos desajustamentos, e aos seus efeitos, nos recem-diplomados. Pretende posteriormente estudar as diferenças de género que estes efeitos podem causar, observando se as penalizações são reforçadas em razão deste fator, e o impacto que ciclos económicos negativos – em particular, a anterior crise financeira – têm no reforçar da persistência desses efeitos, para o caso dos indivíduos recém-diplomados portugueses.

Keywords: *Salários, Desajustamentos Educacionais, Retornos da Educação, Transições Escola-Trabalho, Igualdade de Género, Ciclos Económicos*

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Environmental Risk, Development and Financial Development Nexus in Sub-Saharan Africa: A Driscoll-Kraay Approach

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Abstract. The need to protect the ecological stability of the planet Earth has received enormous attention among researchers, governments, and international agencies due to the incessant deterioration of the environment and its glaring consequences on humanity. This study explores the simultaneous impact of financial development (FD) and economic development (ED) on environmental risks (ER) in Sub-Saharan Africa using panel data of 42 economies for the period 1990 – 2018. The study made use of second-generation econometric methods that are resistant to cross-sectional dependence and slope heterogeneity. The slope coefficients were heterogeneous according to the Pesaran-Yamagata homogeneity test. Additionally, the cross-sectional dependence of the studied panels was confirmed by the Breusch-Pagan LM test, the Pesaran scaled LM test, the bias-corrected LM test, the Pesaran CD test, and Friedman's test. The series long-run equilibrium relationship was examined using the Driscoll-Kraay standard error regression estimator. This study found that whereas FD significantly negatively impacts greenhouse gas emissions, economic development increases environmental risks in the region. Further, FD increases the deteriorating effect of economic development on environmental stability. The causal connections amid the series were finally explored through the Dumitrescu–Hurlin panel causality test. Additional policy suggestions are discussed.

Keywords: *Environmental risk, Financial Development, Economic Development, Carbon Emissions, Sub-Saharan Africa*

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Factors influencing innovation performance in Portugal: a cross-country comparative analysis using the Global Innovation Index and the European Innovation Scoreboard

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Abstract. In recent years, the world has experienced a sequence of events with an impact on the economy. Innovation plays a key part in meeting the challenges of the future, but despite unprecedented investment in innovation, both by the public and private sectors, Portugal has been recording a negative decrease in the various indicators that assess the country's performance in this area. This study aims to answer the question about the current state of innovation in Portugal, based on relevant global and European innovation indicators from the last four years (respectively, the Global Innovation Index, which evaluates the performance of innovation ecosystems in 132 countries, and the European Innovation Scoreboard, which evaluates the innovation performance of the member states of the European Union), comparing the country's performance to that of Ireland, Belgium and the Czech Republic. The areas where the main changes have occurred are set out, highlighting the aspects in which Portugal stands out for superior or poor performance, providing a benchmark for the definition of policies to foster innovation in Portugal. Institutions, business sophistication and knowledge and technology outputs in Portugal score negatively, while creativity outputs stand out as a strength. Environmental sustainability, firms' investment in innovation and the impact of innovation on sales are aspects that Portugal needs to improve; human capital and the attractiveness of R;D systems deserve positive remarks. It is fundamental to understand where we stand, how we are preparing for the future and what we can learn from others. The study contributes with new perspectives and knowledge on the state of innovation in Portugal. Clues are provided to entrepreneurs and governments. What should be done better to contribute to the creation of a strong commitment of the scientific community and civil society, in the exercise of a responsible and active citizenship, with rights, but also with duties?

Keywords: *Innovation, Indicators of Innovation, Performance, Competitiveness, Portugal, European countries*

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Conceptualization and identification of hrm practices that lead to high performance of academicians in higher educational institutions of portugal

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Abstract. STATE OF THE ART
It is an established fact that HRM practices may improve organizational performance. But still there are no definite answers regarding which management practices enable performance improvements and whether these management practices differ according to the type of organizations. Therefore, the problem statement for this research study is to identify what are the HR practices that will enhance the performance of employees working in higher educational institutions of Portugal. The study will identify the factors, reasons, features and specific HRM practices that enhance the performance of educational institutions of Portugal.Significance of Research Study:
In this research study, the type of organization under consideration is the higher educational institutions in Portugal, a diverse but extremely important class of organizations. The parameters of high performance for educational institutions are not profit metrics, but are society oriented, more specifically to produce highly qualified graduates, who contribute positively to nation's development and in turn shape the reputation of their own institution. This study focuses on highlighting the issues and lapses in the field in identification of the HRM practices leading to high performance of educational institutions. Therefore, this study aims to analyze and explore these HRM practices from an adaptive perspective.
OBJECTIVES
• Highlighting the HRM practices labeled as high-performance oriented practices in literature.
• Identification of the HRM practices which lead to high performance of academicians serving in Portuguese educational institutions.
• To analyze the best HRM practices identified in Portuguese higher education institutions and their role towards a balanced employee-employer relationship in the context of the organization's performance evaluation.
• Identification of factors influencing the mental health of academicians regarding HRM practices.
The research objectives are designed with a primary focus to signify the importance and role of HRM practices and associated factors towards performance of academicians in Portuguese Higher Educational Institutions (PHEI). The research objectives of the study include identification of the HRM practices that are considered to generate high performance generally in organizations and specifically in PHEI. This will develop a baseline for the study to proceed further towards the relevant issues to be addressed later in the study.

Keywords: *HRM Practices, Human Resource Management (HRM), Performance management*

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Efeito Contágio nos Mercados Financeiros: análise empírica ao passado e presente, com perspetivas de futuro

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Abstract. The objective of this article is to analyze the effects of contagion on financial markets. Over the last decades the theme of financial contagion has deserved the attention of numerous authors, presenting different definitions. We will begin the study with a brief literature review, which deals with the theme of financial contagion, as well as some other related and pertinent themes and concepts for a better understanding of the theme. Subsequently, the process of collecting and processing the data necessary for the pursuit of the objectives and research questions is explained, as well as the methodology adopted. We present a complete methodological process, which includes the performance of stationarity tests, in order to verify the stationarity of the time series, as well as the presentation of traditional and more recent models for measuring contagion. In these we include the DCC-MGARCH and TVP-VAR model for the afferent of contagion effects giving special emphasis on the occurrence of the Russia-Ukraine war. One of the most commonly accepted definitions of financial contagion comes from Forbes and Rigobon (2002) who define contagion with an increase in correlations between countries, promoted by the occurrence of a crisis. Therefore, we can conclude that in the event that the results obtained consist of an increase in correlations (in the period during the war compared to the pre-war period) between the assets of the analyzed markets, then it can be concluded about the presence of the contagion effect. The results will be of particular interest to investors in the constitution of their investment portfolios and protection against risk (making it possible to cover it), as well as to public policy makers to mitigate possible effects of these contagions and avoid spread and adverse effects in the face of historical episodes of economic and financial crises.

Keywords: *Contagion; Financial Impact; Returns; Spillovers; Volatility*

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ICTs and Country Image: A case study of the Nigerian Experience

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Abstract. Purpose: This project seeks to promote digital ethics in Nigeria as desired for improving image branding. Since the advent of Information and communication technologies (ICTs) have become an integral part of modern societies, transforming the way people communicate, work, and interact with one another. ICTs have become an essential tool for promoting a country's image with innovation called security branding. Today, building a country's brand and image promotion are closely linked to the process of global digital transformation.The Nigerian scammers have become notorious for using email and social media to defraud people around the world which has resulted her negative image and tagged as a hub of cybercrime which makes it more difficult for the government to promote a positive image.Cybercrime is a threat to the national security and continuous cyberattacks ruins the international order and disrupts the normal functioning of international relations. Therefore, the present study presents the following research objectives: - To understand the role of Information and Communications Technologies (ICTs) in shaping country's image.
- To understand how ICTs impacts on Nigeria's image, including issues relating to cybersecurity.
- To develop and validate an ICT/digital technology framework for the promotion of Nigeria's country image and brand.
Design/methodology/approach:The research approach applied on this study focuses on multiple peer-reviewed journal articles, conferences papers, book chapters, social media sites. The study area is Nigeria which include Abuja and Lagos (The current and former capital city of Nigeria). This study adopts a mixed-method research methodology (qualitative and quantitative) whereby responses can be gathered through the survey strategy and semi-structured interviews with experts in the target fields.Data collected will be analysed with use of SPSS and SmartPLS.Possible Findings:The study observed the inequality in digital literacy between developed and developing countries as major reason why it difficult for developing countries in accessing ICT for innovation and infrastructure. Each country defines its own key effective tools to promote its image suitable to the realities of the region and considering global trends.Originality/value: The study aims to highlight advantage of Information and Communication Technologies (ICTs) and its relevance in shaping the global perception of countries image, especially in Africa where it is evident a lot of discrepancies on the efficient adaption of ICT to boosting country image.The study wishes to contribute to knowledge on theories and concepts relevant to the research questions.Keywords: Digital culture, Information Security, Telecommunications, Brands, Country image, Cybercrimes.

Keywords: *Digital culture, Information Security, Telecommunications, Brands, Country image, Cybercrimes.*

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The longevity of the Portuguese Tea Industry brand: a case study

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Abstract. Purpose: This PhD research project aims to understand how corporate brand contributes to place identity.
Problem Addressed: The research setting is the old Portuguese tea industry in Azores. The study attempts to understand the mechanisms through which corporate brand reputation contributes to create a strong place identity (Anholt, 2010) and how the last offers ground for new local market ventures and to reinforce the heritage and brand equity of its local brands (Burghausen, 2023). In doing so, some initial research questions come up:
Questions:
Q1: How did the tea industry brand heritage contribute to the Azores brand identity?
Q2: Why did the economic behavior of the tea industry diverge from the archipelago economic cycles?
Q3: How does the engagement of stakeholders in place identity and branding contribute to the longevity of the corporate brand heritage?
Q4: What is the role of innovation to the longevity/sustainability of corporate brand in this industry?
Methodology: Based on a case study approach, a set of studies will be subsequently developed to attend the research question. Case study represents an appropriate research strategy to investigate this problem and setting, in which there is the need to capture a contemporary phenomenon embedded in a complex context and confront actual facts, decisions, and behaviors with historical events (Yin, 2014). The first study concerns a bibliometric analysis on stakeholders' engagement on place brand and a literature review over corporate heritage brand and place. This phase will contribute with some inputs and gaps to build the framework that will guide the case study by a mix methods design. The results of this second study will hopefully allow us to conceptualize and/or create a theory.
Expected Results: The expected results are twofold theoretical and managerial. We expect to draw a book of recommendations on management strategies for family-owned businesses to strengthen their corporate brands (Aaker, 1996) and ensure its longevity/sustainability, and how the territorial branding contributes to this phenomenon (Kavaratzis, 2015). Moreover, we expect to outline the opportunities pursued by the industry that led to innovation and how the environment can represent a competitive advantage that allows the survival of the industry and the longevity of the brand.

Keywords: *Tea industry, longevity, place brand image, place identity, corporate brand; corporate heritage*

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"I Did It For The Health Of The Animals" – Measuring The Impact Of Dietary Pattern On Purchase Intention And Consumer Trust

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Abstract. Nowadays, consumers change their dietary patterns for several reasons, namely the environment, health, and animal welfare. They develop distinct identities around their food choices – dietarian identities – supported by online communities. These food-related identities impact consumers' purchase behaviour, attitudes, and self-categorization concerning food choices (Rosenfeld, 2018; Kirsten et al., 2020). Firms in different industries support consumers with distinct dietary patterns by introducing or adapting products in their offer to reflect animal welfare and environmental concerns. Nevertheless, there is a call for more research on new consumption trends and, particularly, on the specific differences between dietary patterns in their behaviour (Kirsten et al., 2020). Studies so far applied the Dietarian Identity Questionnaire (DIQ) (Rosenfeld ; Burrow, 2018) to measure individual differences at the contextual, internalized, and externalized levels of identity and to create a taxonomy of dietarian identities. Moreover, studies addressed consumers' attitudes and purchase intention (PI) toward vegetarian products. However, there is a lack of studies that connect consumers' distinct dietarian identities to their attitudes, concerns, knowledge, motivations, and actual behaviour. Our study hopes to fulfill this gap as follows. First, it identifies the distinct consumer segments and their dietarian patterns associated with vegetarian product consumption. Then, it explores how consumer's dietary pattern impacts PI and actual purchase behaviour. Moreover, it addresses consumer motivations, concerns, knowledge, and attitudes as PI antecedents. Currently, our study presents the constructs' theoretical background. Motivation refers to the factors that direct human action toward a goal (Atkinson, 1964; Solomon, 2017). The end goals of consuming vegetarian products can be to benefit oneself or society, do what is morally correct, or a combination of them (Rosenfeld ; Burrow, 2017). Moreover, attitude comprises individuals' positive and negative assessments towards behaviour performance (Ajzen, 1985). Finally, knowledge refers to the individual's insights, understandings, or thoughts. It consists of what individuals think they know – subjective knowledge –, and what they know – objective knowledge (Brucks, 1985; Manika et al., 2021). Furthermore, we intend to develop a conceptual model and measure the relationships between the proposed constructs through an online survey. This survey will be applied to consumers with distinct dietary patterns who consume vegetarian products. This in-progress study hopefully will contribute to the literature by demonstrating how consumers' distinct dietary patterns interact differently with other constructs and lead to purchase behavior. Besides, we hope to enhance the creation of more accurate and personalized marketing strategies, particularly in the food industry.

Keywords: *Social Identity Theory, Purchase Intention, Actual Behaviour, Dietarian Identity, Vegetarianism*

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Economics, happiness and climate change: can we replace GDP?

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Abstract. For many decades, Western economies have been growing: more production and more consumption have increased the income of more and more people. In the 1930s, Simon Kuznets developed a set of national income accounts, and among them, GDP became the most popular measure of well-being. Kuznets himself launched the measure saying that "the welfare of a nation can hardly be inferred from a measure of national income" (Kuznets, 1934). Despite such a warning, GDP is still used not only as the main measure of economic performance, but also interpreted as an index of economic well-being (Patrizii et al., 2017).

All this controversy has played a key role in advancing knowledge in the field of economics of happiness. Happiness is considered the ultimate goal of human life. Happiness research is relevant not only in sociology and psychology, but also in economics. It can inform economic policy decisions, highlighting the importance of institutional conditions such as the quality of governance, the size of social capital or the rule of law on subjective well-being. It can help in understanding the formation of subjective well-being, as well as people's values, behaviors and beliefs. In addition, it can help achieve regional convergence and mitigate social inequalities (Siposne Nandori, 2014).

This paper aims to contribute to the growing field of economics of happiness by studying the correlation between environmental factors linked to climate change and well-being. The main objective of this paper is to determine which progress indicators best reconcile economics, happiness, and the environment. It will conduct a comprehensive literature review to identify gaps in existing research and analyze relevant policies and frameworks related to climate change and well-being. Additionally, this research will examine indexes or indicators that have the potential to replace Gross Domestic Product (GDP) as the main economic index, and investigate reasons why they are not being widely used. Despite the efforts to find a new metric that incorporates factors beyond economic growth, making a paradigm shift is not an easy task. However, urgent measures are necessary to mitigate climate change, and it's becoming more crucial than ever to explore alternatives that enable us to pursue a more sustainable path, while also promoting greater happiness. The ultimate goal of this paper is to propose a path for a paradigm shift towards a "happy economy"where the well-being of people and the planet is at the center of policy-making decisions.

Keywords: *Economics of happiness, Climate change, Economic indicators, Social well-being*

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Evolution of Local Entrepreneurial Ecosystems in Portugal

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Abstract. The Entrepreneurial Ecosystem (EE) concept has been gaining attention as a holistic approach to studying the evolution of a local economy, being increasingly adopted by policymakers to promote entrepreneurship and innovation and foster local socio-economic development (Cho, Ryan, and Buciuni 2022). Despite the growing interest, there are still several theoretical and empirical gaps (Wurth, Stam, and Spigel 2021). For instance, most EE studies lack a 'time' dimension, with very few studies focusing on how the evolutionary processes of EEs are established and developed, which is a key dimension in building resilient and sustainable EEs (Theodoraki, Dana, and Caputo 2021).
Linking the Evolutionary Governance Theory (EGT) (van Assche et al., 2014) with the recent research on Evolutionary EEs (EEEs), this study aims to push forward the emerging debate on EEEs by depicting the evolutionary processes of local EEs. Besides, this study focuses on resource-constrained environment, many times forgotten in EE research (Roundy 2017). Evidence is taken through the collection of primary (interviews, field visits) and secondary data (reports, statistics, archival data, etc.) from three Portuguese Municipalities - Amarante, Fundão and Penela - between 2012-2022.
The study highlights the importance of having a long-term vision, a strategic plan, an entrepreneurial perspective in policy-making (with innovative policies that answer local needs and explore opportunities and future trends) are important to the birth and transition phases of the EE. Besides, having open policies and governance to involve citizens and avoid the so typical one-size-fits-all top-bottom strategies is relevant to improve local legitimacy and participation of more local actors in the EE.
The findings also highlight the strong role of local government in the creation and development of the EE, filling the existing governance and resources void in this type of environments, through the performance of several roles during the different phases of the EE evolution. This work provides important contributions to EE and local development literature, as well as implications for local policymakers that may find important guidelines to consider when starting a sustainable and resilient EE-focused strategy.

Keywords: *entrepreneurship; entrepreneurial ecosystem; local development; evolution; governance*

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Business and Innovation

Effects of retail investors' sustainability preferences on the range of eligible instruments - Evidence from mutual funds universe in Germany

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Abstract. The European Commission (EC) committed to a net-zero economy by 2050. Already by 2030, the net greenhouse gas (GHG) emissions need to be reduced by 55% based on the emissions of 1990. A sustainable finance roadmap defines the EU regulatory framework aiming to channel investments aligned with climate goals. This suite of different regulations is not limited to one area but rather affects multiple areas, such as accounting and disclosure requirements for companies, consumer protection, or financial market regulation. As of August 2022, when European Union (EU)-based investment firms provide investment advice or portfolio management, they need to educate the investor on the sustainability and adverse impacts of investments and incorporate the investor s sustainability preferences in their investment proposal. Mezzanotte (2021) concludes that incorporating sustainability preferences in the legal regime of suitability will be challenging in practice. D'Apice et al. (2021) examine if a funds management company's ESG disclosure practice leads to higher ESG intensity of its funds. They also hypothesize that in countries with mandatory ESG disclosure (like SFDR within the EU), the impact is smaller and conclude that mandatory disclosure can be even less valuable for the investor. This article aims to analyze the effect of potential sustainability preferences on the eligible investment universe, based on mutual fund data from Germany. The data was retrieved in August and November 2022 as well as in January and April 2023 to examine how the industry is adapting to the regulation. The Markets in Financial Instruments Directive (MiFID) II amendment defines financial instruments meeting sustainability preferences. The effect of sustainability preferences on the instrument universe has not been subject to research so far. Also, the quantity of fund data analyzed, and the timing of retrieval provides unique insights. We find that applying sustainability-related filters according to this instrument definition to a large universe of some 9,000 funds, is reducing the eligible instruments dramatically. One root cause of this effect is the timing of EU regulatory efforts that are not ideally orchestrated leading to inconsistent data throughout the value chain. This article will be presented in the 1st Conference on Sustainable Banking ; Finance CSBF 2023 at the University of Naples in June 2023, aiming to leverage the publication opportunities of the conference. The research is the second part of a thesis written in the Doctorate in Business Innovation Program of the University of Aveiro.

Keywords: *Sustainable Investments, MiFID II, ESG Investing, Sustainable Finance Disclosure Regulation (SFDR), Mutual Funds*

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Exploring user needs of stoma patients

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Abstract. Stoma patients, individuals who have undergone surgery to create an opening on their abdomen for the elimination of waste, often face various physical, emotional, and social challenges. Understanding their needs is crucial for developing effective and comprehensive new products. This study aims to explore the user needs of stoma patients through in-depth interviews with individuals who have undergone stoma surgery. The findings of this analysis shall be used for user-centric product development process at a later stage, resulting in a a novel stoma bag, that no longer is worn outside but inside the body. Ideally, the outcomes of this study - and ultimately the resulting product - shall address the unique needs of stoma patients and improve their quality of life.

Keywords: *stoma, bag, ostomy, medical device, innovation*

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Universities third mission for a sustainable circularity future: driving forward entrepreneurial green innovation ecosystems

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Abstract. This study aims to advance the role of universities in promoting green innovation in the context of regional development. A shift in paradigm in how universities can effectively interact with the circular economy industry is essential in the transition from a traditional linear to a circular value cycle (Aschemann-Witzel ; Stangherlin, 2021; Bimpizas-Pinis et al., 2022; Muscio ; Sisto, 2020). The research theoretically conceptualises and explores university governance frameworks, structures, policies and other institutional support mechanisms required to enable and foster universities' Third mission and Quadruple Helix entrepreneurial approach in a sustainability oriented future (Alvedalen ; Boschma, 2017; Baker ; Welter, 2020 ; Cai, 2022; Cantner et al., 2020; Hernández-Trasobares ; Murillo-Luna, 2020; Stolze ; Sailer, 2022). Furthermore, the goal is to explore the ways in which universities collaborate with and have greater involvement with industry stakeholders, government and civil society in the creation and operation of innovation ecosystems to leverage resources, expertise, knowledge transfer and access to networks, through interdisciplinary thinking and a practical approach to key issues, to accelerate the uptake of the bioeconomy sector (Audretsch ; Belitski, 2022; Hall et al., 2019a, 2019b; Jacobides et al., 2018; Némethy, 2021; Teece, 2010). Therefore, this systematic literature review (SLR) will focus on a comprehensive understanding of entrepreneurial ecosystem practices to gage the evolution of existing structures of universities, how they are equipped to scale green innovation, identify gaps and the barriers that may exist and that prevent it's structures and systems transformation to suit changing times (Baker ; Welter, 2020 ; Clarke ; Crane, 2018; Mills, 2020; Snyder, 2019). The research strategy for this study relies on a bibliometric technique and mapping analysis to find existing links (Chistov et al., 2021; Skute et al., 2019; Snyder, 2019).These findings offer universities multidimensional missions' valuable insights into governance, critical mappings of research and practice implications, as well as it outlines a roadmap through a systemic approach that highlight distinct factors in knowledge, skills, attitudes and values needed to address gaps and deficiencies in circular innovation domains.

Keywords: *advance innovation; entrepreneurial innovation ecosystem; governance mechanisms; third mission; triple helix; university transformation*

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Development of an Industry 4.0 Maturity Model for the Operational Unit in SMEs

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Abstract. The high benefit of Industry 4.0, once launched as a buzzword, makes it increasingly necessary for small and medium-sized enterprises (SMEs) to address the topic as technical developments and implementation in large companies continue to advance. While large companies can build primarily on their market power and existing resources, the entry for SMEs is associated with many hurdles such as high costs, unspecific information, overburdened employees and a lack of strategy, which not infrequently culminates in overwhelm, sometimes even resignation and capitulation, even before the project has really gained momentum nor that effective results have been achieved. However, the future is not standing still and is waiting for SMEs. This dissertation is therefore dedicated to the attempt to achieve and present insights and recommendations for the introduction of Industry 4.0 in SMEs. Through a systematic literature review (SLR), data and facts from existing Industry 4.0 maturity models will be obtained for this purpose, which will then be incorporated into a newly developed maturity model that focuses on the operating unit (production, logistics and related administrative areas) of SMEs. This maturity model will provide companies with a tool to determine their current Industry 4.0 status and then derive the steps to achieve the desired target level. It's also planned to provide practical hints, tips and advice on how to reach a higher Industry 4.0 level.

Keywords: *Industry 4.0; Maturity model; SME; Readiness model; Manufacturing; small and medium-sized enterprise*

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Business model innovation in construction technology – a review

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Abstract. Purpose: This paper has two main objectives: (1) to do the current state of research on business model innovation in construction technologies; and (2) to do the current state of research regarding to business model innovation in disruptive technologies in the construction industry.

Method: A Structured Literature Review was carried out and a total of 231 papers between 2023 – 2019 were identified during the first search process in Web of Science. During a screening process 82 papers have been excluded and the remaining 149 papers have been included for further qualitative and quantitative analysis.
Findings: Business model innovation in construction technology refers to the development of new and innovative ways of creating, delivering, and capturing value in the construction industry. This paper explores the potential benefits of business model innovation in the construction technology sector, including increased efficiency, improved sustainability, and enhanced customer satisfaction. It also discusses the challenges associated with business model innovation in the construction industry, such as the resistance to change and the need for collaboration and integration across different stakeholders.

Innovation: Interesting results were found in the structured literature review about what business models are currently being applied in different construction technology areas and the new business model innovation in disruptive technologies in the construction industry. However, more future research on specific business models to successfully implement modular construction technology in the market is needed.

Impact: Business Model Innovation can have significant impact on the construction industry, which is traditionally characterized by low profit margins, fragmented supply chains and slow adoption of new technologies. By implementing new business models that leverage pre-fabrication, automation and digital technologies, construction firms can optimize their workflows, increase productivity and reduce waste which can lead to lower building costs and faster project completion.
Keywords: Business Model Innovation, Construction Technology, Digitalization, Sustainability, Transformation, Pre-fabrication

Keywords: *nan*

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Mapping arts-based methods to stimulate creativity and innovation in tech industries

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Abstract. Over the past two decades, the role of creativity in the economy has become increasingly prominent, drawing the attention of corporate across the world (UNCTAD, 2008). Particular attention has been paid to the relationship between creativity and economy: creativity has been regarded as a key element in determining the growth and competitiveness in organization (Scott, 2014). The development of creativity is also a major challenge for companies: creativity not only affects originality and innovation but also increases the utility of products, services and ideas, thus yielding a competitive advantage in the market (Chien et al, 2020). According to Verganti (2020), at the heart of innovation process lies a fundamental practice: the way people create ideas and solve problems, in a creative way. In a similar situation, the interactions between art, creativity and technology seem to even a higher impact in tech companies. Following recent research, fostering creativity is of greater importance in explaining the link between market orientation and new product success for high-tech companies (Im et al, 2004). Within this framework, the main question of our research is to investigate the impact of arts-based methods to stimulate innovation in tech companies, with the goal of providing recommendations based on scientific research in applying art thinking to foster creativity. The initial systematic literature review showed that there is a lack of structured knowledge on the implementation of arts-based methods and stressed the interest in driving business innovation using arts methodologies. In this perspective, this doctoral research is an opportunity to further explore and systematically identify the value of arts thinking for fostering creativity in tech companies. Therefore, a design science research approach is considered as a methodological framework which combines data from systematic literature review as well as qualitative analysis of expert interviews to identify recommendations and deliver it as a resulting artefact.
The research is designed in two parts: 1) it will underpin the theoretical contribution of arts-based methods by identifying the practices that define different interpretations of the paradigm and 2) will define requirements and practical guidelines on how to apply it to the specific context of tech companies. The expected research results shall contribute to frame arts-based methods that can drive innovation and perform impact in the creative processes of tech companies.

Keywords: *Arts-based methods, Design thinking, Creativity, Innovation, Tech companies*

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Science and Technology Parks and Innovation Districts: an evolution journey

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Abstract. Innovation ecosystems have become increasingly complex and multifaceted, with a growing emphasis on collaboration, entrepreneurship, and knowledge exchange among different stakeholders, such as firms, universities, government agencies, and local communities. Innovation districts are designed to address these challenges by creating a physical space that facilitates interactions and collaborations among different actors in the innovation ecosystem, and are characterized by a mix of uses, including research and development facilities, startups, incubators, accelerators, housing, retail, and cultural amenities, creating a vibrant and inclusive environment that attracts and retains talent and fosters innovation. The evolution of science parks to innovation districts is not only a result of changes in the innovation ecosystem but also a response to broader socio-economic trends, such as the rise of the knowledge economy, urbanization, human resources retention, and the increasing importance of creativity and innovation for economic growth and competitiveness. Innovation districts have been shown to have significant advantages over traditional science parks, such as greater flexibility, adaptability, and inclusivity, which can lead to higher levels of innovation and economic performance.

The Creative Science Park Aveiro Region will be used as a case study that can offer a unique perspective on the potential evolution of science parks to innovation districts. The study will examine the factors that can drive this transformation, such as changes in the global economy and the local innovation ecosystem, as well as the challenges and opportunities that this evolution presents.

Keywords: *Innovation district, Science and Technology Park, Technology Transfer, Knowledge and Innovation Economy; Entrepreneurship*

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The Challenges of Digitalisation – the Role of Leadership, Culture and Technology Empirical Evidence

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Abstract. Digitalisation is one of the key drivers of today's business. A SLR conducted in the context of this thesis revealed that issues with business models functions and processes, are already being dealt with in multinational companies, with SMEs lagging behind. While different maturity models of overall Industry 4.0/digitalisation targets are presented in the literature, little is known about the transformation/implementation of these models, and the few studies that report on it neglect the main driver of sustainable results – the alignment of leadership, culture and the inclusion of technology. (Pech ; Vrchota, 2020)
SMEs are at a disadvantage compared with global companies in terms of know-how, experience, budget and number of staff. (Schuh et al., 2017) SMEs need a clearly described transformation/implementation roadmap for their supply chains, which will help them to compensate for the disadvantages by taking advantage of the associated increase in process efficiency, -structuring and -improved use of already existing resources. (Chonsawat ; Sopdang, 2017)
The connection between digitalisation and leadership, technology and corporate culture is not sufficiently addressed in the existing literature. Hardly any digitalisation or holistic transformation approach documented in the relevant literature deals with a coherent approach that takes the three categories and their dependencies into account. The categories as such are (partially) covered in the various approaches (Maturity Models) but not their combined application in form of a coordinated triad.The implementation of a transformation model outlined in the first paper and applied in those to follow requires identification of weaknesses, particularly in the areas of know-how and the available resources. Resources include staff, finances and strategic alliances with other SMEs. Therefore, the approach developed should be as simple and comprehensible as possible and as close as possible to the business.The next steps are to empirically fill the identified scientific gaps, that SMEs will be empowered to independently develop a strengthened digitalisation/transformation roadmap. The verification or exploration of the presumed high importance of the discussed triad will take place in the form of several scientifically conducted expert interviews.
Currently they are processed, that means that expert interviews being conducted to compare and contrast/align the identified gaps from the SLR with the expert opinions.
The ultimate contribution of the set of papers is the development of an approach to ensure a systematic process to solve the digitalisation paradigm. This should enable SMEs to independently derive a coherent digitalisation journey.

Keywords: *SMEs, Digitalisation, Transformation Roadmap, Industry 4.0.*

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Investigation of sustainable Design Thinking for SMEs

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Abstract. Small and medium-sized enterprise (SME) executives have limited information about the use of design thinking to drive business success, sustainability, and competitive advantage in the enterprise (Manzke, J., 2022).
The purpose of this qualitative case study was to describe the perspectives of design thinking experts on how small and medium-sized businesses and top management can successfully use design thinking in the enterprise as an innovation strategy to drive innovation and competitive advantage in a sustainable manner.
A multiple case study was conducted to collect data from a purposive sample of seven design thinking experts.
Guided interviews with a communication and interaction style, data from the systematic literature review contributed to the credibility of the findings through data triangulation.
Data analysis resulted in 6 coding categories with a total of 646 aggregated coding references based on the conceptual framework: (a) company mapping, (b) definitions of design thinking from an expert perspective, (c) implementation of design thinking in a cross-functional team in SMEs, (d) development of success factors with a design thinking business model for sustainability, (e) confrontation of the success factors and barriers of design thinking from the literature with a real implementable business model, and (f) embedding design thinking in an SME to promote competitive advantage.
This research requests to contribute to the academic discourse about design thinking, innovation, and sustainability by presenting a framework that SMEs can use to integrate design into their organizational culture and ultimately lead to positive change. This framework can assist SMEs in better understanding the needs of their stakeholder, identifying opportunities for improvement, and developing sustainable and innovative solutions.
Currently, integrating Design Thinking into SMEs' business practices remains a challenging task. Design thinking is gaining in popularity to solve problems, but implementing it requires a significant shift in organizational culture and mindset (Storm ; Smith, 2023). The integration of sustainability principles in SME operations has also gained attention over the past few years, due to increased stakeholder pressures and an awareness of the impact business operations have on society and the environment (Storm ; Smith, 2023). There is still a lack of practical frameworks and resources to help SMEs implement sustainable practices (Ghag, Acharya, ; Khanapuri, 2022). This research aims at filling this gap by combining design thinking with sustainability principles to promote positive changes in SMEs.

Keywords: *Design Thinking, SME, Innovation Strategy, Business Sustainability, multiple case study*

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Value chain models and circular economy: a systematic literature review

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Abstract. The transition from the dominant value chain models based on "Take, Make, Use, and Dispose"to the Circular Economy (CE) is gaining global traction as a sustainable development approach. With a growing global population surpassing 7.7 billion people, the need for sustainable practices that safeguard resources and protect vulnerable communities is becoming increasingly urgent. This article presents a systematic literature review conducted to assess to which extent researchers are addressing the adaptation of value chain models to the emerging concepts of CE, using a structured methodology that involved three stages: definition of the research focus, search for relevant literature, and reporting the results, being the goal to provide a comprehensive and unbiased analysis. Based on a final working sample of 159 articles extracted from Scopus and Web of Science Core Collection, we discover there is a higher interest from the scientific community to analyze traditional value chain models and relate them with the new concepts introduced by circular economies, revealing an active engagement of the scientific community in addressing the challenges posed by consumers and policy regulators to promote a sustainable society. Furthermore, the results suggest a rising trend of the combination of traditional value chain models with strategies and objectives of the CE practices.

Keywords: *Value Chain; Circular Economy; Sustainability; Sustainable Development*

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Future mobility challenges for established car manufactures - A model to ensure the long-term competitiveness.

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Abstract. The market for future mobility is driven by a combination of technological changes. These are connected mobility, autonomous driving, electric mobility, and shared mobility. The successful market entry of Tesla Motors has shown that seemingly insurmountable barriers can be overcome by newcommers (Stringham et al., 2015). Established car manufacturers (ECM) are facing new rivals in this dynamic market (Perkins ; Murmann, 2018). The purpose of this study is to research how established car manufacturers can stay competitive by transforming their business in this changing market. The proposed scientific methodology involves a systematic literature review on academic papers in the automotive industry in Web of science current contents. Based on 981 academic papers from 1998 to date, we perform content analysis identifying main schools of thought, focusing on the business perspective. The second step involves conducting a case study to identify existing solution approaches. Based on the findings of the literature review and case study, a model will be developed to select the appropriate approach based on specific circumstances. This model aims to provide a structured approach to decision-making for ECM. We identified the following key areas by performing the systematic literature review. Business transformation for future mobility, cooperation with suppliers and partners, optimization of manufacturing, organizational development, marketing and communication and finance. The outcomes provide advantages to both researchers and entrepreneurs/practitioners within the automotive industry.

Keywords: *Automotive companies, Car manufacturing, Future mobility, Competition, Business transformation*

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Value creation for healthcare ecosystems through artificial intelligence applied to physician-to-physician communication

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Abstract. The potential of artificial intelligence in healthcare is vast and can transform the way care is delivered. AI can speed up diagnoses, optimize treatment plans, and support personalized medicine. Additionally, AI can enhance operational efficiency and reduce errors, thus helping to lower costs. However, there are several challenges in extracting value from physician-generated real-world data (RWD) in healthcare, including data quality, lack of standards, physician adoption, and regulatory hurdles.
Professional Medical Chats (PMCs) are a source of physician generated RWD that are yet to be fully leveraged. PMCs present an opportunity to obtain real-time insights into clinical decision making that can optimize patient outcomes. However, there is a need to understand how this data can be best utilized.
A comprehensive literature review will be conducted to identify best practices for extracting value from PMCs and to evaluate the impact of AI-based insights on patient outcomes and the healthcare system. A preliminary pilot with a small test group of physicians and/or real data will help refine and validate our proposal and approach to leverage the wisdom of the professional crowd to optimize care.
The study aims to provide valuable insights for healthcare organizations, entrepreneurs, investors, and other stakeholders seeking to harness the power of RWD and AI to drive innovation and create new business opportunities.
Additionally, the study seeks to explore how to incorporate key values such as morality, ethics, and transparency as an integral part of these processes. The importance of incorporating such values in AI-based healthcare solutions begs for innovative approaches to Responsible AI development and deployment. An ethical framework and guidelines may be proposed to ensure that RWD and AI are used: a) in a responsible and ethical manner, and that patient privacy and data security are maintained; and/or b) with transparency, by making clear how it's used in patient care and decision-making processes; and/or c) by placing patient interests and welfare at the center of their decision-making processes (i.e., aimed at improving patient and healthcare outcomes).
In conclusion, the future of AI in healthcare (including Generative AI) is promising. However, there is a need for a multi-disciplinary approach to address the challenges in extracting value from physician generated RWD in healthcare. The study will contribute to the development of best practices for leveraging PMCs for real-time AI-based insights that can amplify the impact on people and economies while promoting ethical and socially responsible AI practices in healthcare.

Keywords: *Artificial intelligence, Machine learning, Physician, Consultation, Communication, Healthcare*

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Heating setpoint recommendation strategy for thermal comfort and energy consumption optimization

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Abstract. Residential Heating, Ventilation and Air Conditioning (HVAC) systems are progressing towards smarter climate control solutions, centered on the user needs and the system energetic performance. These systems aim to optimize their energy consumption without compromising the thermal comfort of the building occupants. Not only because it would reflect cost reductions for the customer (hence increasing their satisfaction), but also due to the environmental challenges that arise on a global scale. Rather than relying on a simple user-defined setpoint temperature, many times inadequate to the desired comfort level, these systems should be able to provide comfortable conditions throughout the day. This can be achieved by adjusting the setpoint to the expectable demand levels to minimize energy consumption.The use of smart connected thermostats is being widely accepted as a way to improve the sustainability of the controlled systems and the thermal decisions of its users. These devices can provide a continuous stream of information about the operation of the HVAC system to its provider as well as the homeowner. The latter will leverage this information to take more conscious decisions about their heating, cooling or ventilation profiles. Previous studies are pointing to solutions that can contribute with strategies to reduce the energy footprint of smart HVAC systems. However, many of them rely on information that it is neither easily accessible nor measurable in real application scenarios. Namely, personal factors such as body temperature, metabolic rate or thermal comfort sensation level, or building information such as its geometry, insulation and construction details. Thus, limiting the applicability of such solutions.This work intends to study a strategy to assist the households select more energy-conscious HVAC setpoints without compromising their comfort level. To do so, it explores the adaptive comfort theory for homes combined with predictive indoor temperature models to define an adaptable strategy for optimized indoor temperature setpoints. The novelty of this study focuses on the generic methodology that proposes. Particularly because it does not rely on system-specific information nor on data unfeasible to measure or collect without the direct participation of its users. Additionally, the solution complexity was taken into account, looking for its application in embedded products, like smart thermostat devices, with constrained computational capabilities. This ongoing research is in the framework of the Doctoral Program in Business Innovation (DBI) of University of Aveiro and involves the Bosch Termotecnologia S.A. company.

Keywords: *Smart home, Smart thermostat, Energy savings, Indoor thermal comfort patterns, Adaptive thermal models, Data-driven, Machine learning, Predictive models.*

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Low utilization route driving patterns for transport logistic trucks: identification and optimization of vehicles utilization

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Abstract. In Europe trucks are driving approximately one billion kilometres p.a. Based on statistics between 25 – 40 % of the tours are driven with an empty cargo hold (McKinnon, 2015). Unused and not sufficiently used cargo space leads to waste of critical resources and pollution (European Commission, 2023). Systematic literature review, on scientific articles as well as commercial and industrial patents has shown some research gaps. Main gaps are: a) on usage of appropriate technology to identify empty or underutilized trucks and to b) offer mapping and routing data (based on mass data assessment) to fill up repetitive low utilization trip patterns with freight offering from freight exchanges.In order to show possible solutions to the problems described, a Prove of Concept demonstrator will be designed. The aim is to prove that low utilization trips can be reduced for the relevant application domain(s) by the usage of appropriate digitalisation technologies for existing truck fleets.
Looking at today's baseline, if a reduction of 2 – 5 % of such trips can be achieved, it would equate, only for Germany, to a reduction of 6 – 8 Mio. logistics trips with the associated CO2 emissions.
Target and focus point of this work is to outline the overall plan for the approach, to provide and discuss first insights regarding the described technology assessment and to provide and discuss first insights regarding the demonstrator output based on real data.Key Words
empty runs, driving patterns, logistics transports, telematics, industry 4.0

Keywords: *empty runs, driving patterns, logistics transports, telematics, data analytics, logistics 4.0, industry 4.0, communication technologies*

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The Experienced employee - valuable beyond retirement. A glance at the economic impact of seasoned employees on organizations, societies, and economies

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Abstract. The impact of the demographic development on European labor markets is becoming increasingly severe. Neither societies, organizations nor regulators are sufficiently prepared for a situation where an ageing population and declining birth rates lead to an insufficient number of adequately skilled and experienced staff to stay competitive. Leaving governments and the industry struggling to replace the intrinsic knowledge, expertise, and skillset that experienced employees take with them into retirement.

At the same time, retirees that have been working in challenging and stimulating environments all their adult life are discovering a need for "brain-food" beyond retirement. Words like "unretirement" and "best-agers" reflect the change in attitude, expectations, and actual practices in particular by those dependently employed.

This work is based on the premise that developing customized opportunities for experienced and seasoned employees to stay attached to their organization beyond legal retirement age will lead to positive (socio-) economic value.

Observations of the current developments in Europe's labor markets and a systematic literature review have confirmed this opportunity and reinforced the relevance for both companies and individuals in finding strategies to continue incorporating the contribution and high performance of older workers.

The relationship between age and leadership for example has been researched across industries and professions with a broad range of perspectives and interpretations. However, there is less research on the employee's perspective.

This study will focus on professionals whose academic education, continued development of their skillset and long-term work experience reflect a considerable financial investment of both employee, education system and employing organization.

Based on continually updated literature research, and a qualitative study design, a set of semi-structured interviews will be carried out focusing on employees on the verge of reaching legal retirement age, retirees, and their retirement experience as well as those responsible for HR strategies and hiring.

The research problem will be discussed considering the triangulation of two additional sources:

- A legal advocate's position on the regulatory frameworks of selected countries like Germany, France, Austria, and Switzerland whose labor law regulations have a signaling effect.
- A set of interviews with top and/or HR managers about their general attitudes and practice towards maintaining skilled older workers in their companies.

At the current stage of research, we are confident that this study will have theoretical and practical contributions and add unique perspectives to the discussion.

Keywords: *Age-diversity, Team performance, Leadership, Economic impact*

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Design framework for pharmaceutical smart factory production

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Abstract. Today's pharmaceutical production concepts are mostly designed to process one type of drug, active ingredient or dosage form at a time on one production line (Sarkis et al., 2021). New technologies offer the opportunity to overcome current obstacles towards an Industry 4.0 inspired future (Wölfle et al., 2022). Traditional approaches are being challenged, practices and business models are changing with new opportunities and ways of thinking (Arden et al., 2021; Reinhardt et al., 2020). Promising technologies are emerging to meet the expected increase in market demand for on-demand or personalised medication (Norman et al., 2017).

Innovative methods for the design of production facilities, which form the basis for the application of Industry 4.0 concepts in the pharmaceutical industry, are not yet established. Manufacturers of pharmaceutical equipment have to deal with short innovation cycles and must deliver the highest quality to meet Good Manufacturing Practice (GMP) standards. From what we read in the literature and receive as feedback from industry, there is a need for a methodological approach that supports the innovation process for such devices.

Our current research proposes an innovative information model that structures the design, development and deployment steps for the engineering and testing of new pharmaceutical devices.

The proposed model was created through an exploratory literature search that yielded 176 articles focusing on design principles for hardware and software in regulated industries. The used design framework (Axiomatic Design, Quality by Design) and methodological development (Model Based Systems Engineering) for pharmaceutical manufacturing in the context of Industry 4.0 are fundamental to this innovative approach. Within interviews, the initial model was reviewed in detail and updated according to the valuable feedback from 10 industry experts.

The novel design procedure that resulted from the research provides a solid basis for testing the proposed information structure as a method in real development projects for the pharmaceutical manufacturing industry. The model behaviour will be evaluated in the context of a case study focusing on a robotic line for small batch production concepts.

Our research contributes to fill the gap in literature that does not yet give applicable instructions to transform the needs of pharmaceutical manufacturing into a structured design process for the supplying industry.

The later implementation of the framework will lead to a software toolchain that helps to reduce time to production for new machine concepts which can support reduced time to market for pharmaceutical products.

Keywords: *Industry 4.0, Pharma 4.0, Smart Manufacturing, Pharmaceutical Production, Axiomatic Design, Model Based Systems Engineering*

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Implementation of an Innovative Co-Creation Accelerator for disruptive innovation in the food and beverage industry

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Abstract. There is a growing need for innovation to occur at a faster pace to keep up with the demands of today's rapidly evolving world. Innovative co-creation can help the food and beverage industry adapt to the impacts of climate change, changes in weather patterns and increasing water scarcity.
Third parties are known to enhance collaboration because they can promote the welfare of both parties and the joint venture. Holzmann et al. (2014) note that it is necessary for intermediaries to set up a "matching process"to foster collaboration between the two parties.
The main focus of this PhD thesis is to find out how innovation can be accelerated with the help of an intermediary and what framework conditions need to be in place. More recently, research has focused on collaboration between industry and startups. This research adds a unique perspective by focussing on the role of third-party support. The intent is to create value for the industry companies as well as startups by encouraging disruptive innovation and new business models, and thus increase the public awareness of the importance of innovation in the food and beverage industry to shape a better future. This leads to the research question: What does a third party need to do to support collaboration between established companies and startups, to help accelerate disruptive innovation and new business models in the food and beverage industry?
A Paper Thesis will be elaborated in three papers. First, a Systematic Literature Review on the topic will help to define the state of the art analysis of existing programs and the stakeholders, which are involved in co-creation processes (Xiao ; Watson, 2019). The second part of the research will be carried out as semi-structured interviews (Saunders et.al., 2016) of relevant stakeholders from the food and beverage industry as well as food and beverage startups. This provides information on the current status and the question, what are the challenges and needs for change. This part will be carried out in a case study strategy. (Saunders et.al., 2016) As a third part of the Doctoral Thesis a prototype based on the design thinking strategy model (Plattner et.al., 2013) with inclusion of the findings of part one and two will be built up and tested in two prototype iterations in order to dynamically create a model.
By examining the specific actions to take, this research fills a gap in literature.

Keywords: *food, beverage, industry, ecosystem, start-up, collaboration, co-creation*

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Readiness for change in business contexts: a systematic literature review

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Abstract. Readiness for Change in Business Context: a Systematic Literature Review
The purpose of this paper is to provide a systematic literature review on the topic of Readiness for Change (RfC) in business contexts, a topic that is been gaining importance during the last decade. The specific objective is to collect and list all antecedents of RfC.
Data collected from the Web of Science. Systematic literature review procedures are used, starting with a search protocol and validated by two independent researchers. The final selection of 79 articles was analyzed per year, journal, author, country, area, and frequent words as well as with deep text analysis technology to identify relations between keywords. The review articles found, were exported to NVivo for full content analysis and coding.
An overview of all antecedents of RfC, as well as a structured categorization of the published reviewed papers. Knowledge transfer is recognized as one key antecedent of RfC.
This article presents empirical evidence on the state of the art in RfC including a list of antecedents of change, a topic that is receiving increasing attention from the academic community.
The research is limited to English language papers listed on the WoS with business context and should be extended to other indexed databases as well as other contexts.
This work has policy-setting implications for understanding the RfC process and its antecedents. It can also help organizations prepare, anticipate, and minimize the impact of negative organizational change.

Keywords: *Behavioral change, Business, Change Readiness, Literature Review, State-of-the-art, change, readiness, organizations, reorganization*

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The development of an information technology architecture for automated, agile and versatile companies with ecological and ethical guidelines.

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Abstract. In many companies that are currently looking for an efficient implementation of digital change, it has turned out that market developments in the course of digitization were recognized too late and that the internal structure is deficient both regarding the organization and in the "hardwired"production units. Since market developments are easy to predict in a first approximation and are mostly dictated by political currents but also by trendsetters in business (Google, Microsoft, Amazon, Tesla, ...), firms aiming for success should analyze these tendencies, convert them into the inherent system build-ing blocks and provide instructions for restructuring and adaptation [1]. Events such as the pandemic or the Ukraine war are so-called "disruptive variables"that influence the control behavior of the entire corporate organism. The significance of this research study lies in how it is possible to simulate interactions and currents in the market and, in the sense of the continuous cost-benefit ratio, the predefined, easy-to-implement measures are evaluated and quickly implemented. In a second step, this "adaptation"should be done semi-automatically. Leading research institutes, but also objective data from neutral government reports provide very good information about the current market economy situation. A continuous analysis of the funding programs and changes in the law provide a second forward-looking input. The modularized building block typology, on the other hand, represents an economy that is reflected in the actual module parameters. The agility of the basic modules in terms of their changeability is the basic requirement. Based on the algorithms of artificial intelligence, this research study develops the set of rules that is necessary to carry out a "restructuring"without having to interrupt production [2] (which should never stop). The technology required for this, including the services required to maintain functionality, is provided in ad-vance and is therefore not visible as such, but is an integral part of the concept. Self-adjustment to changing market conditions is therefore an integral part of daily production. Continuous market adjustment and a company that can be permanently fully utilized are the non-material and monetary advantages of this concept.

Keywords: *agile manufacturing, manufacturing information systems, digital transformation, modulated production processes, VOSviewer*

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Chemical Engineering

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Upgrading recovered carbon black from the pyrolysis of end-of-life tires

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Abstract. Disposal of end-of-life tires (ELT) represents an environmental and health threat, raising social and economical concerns. Technologies such as pyrolysis of rubber from ELT have been emerging as a solution for reprocessing this waste stream. Pyrolysis of ELT allows the production of three valuable products: fuel, syngas and recovered carbon black (rCB). The economic feasibility of the process highly depends on the market value of the solid fraction (Costa et al., 2022).
The heterogeneity of rCB limits its application, hence post-pyrolysis treatments have been investigated to enhance the reinforcing capacity of rCB in tire formulations. In comparison with commercial virgin carbon black (CB), rCB is composed of a mixture of all CB grades used in tires, inorganic compounds (fillers and additives added during tire formulation) and carbonaceous deposits from the secondary reactions occurring during pyrolysis (Cardona-Uribe et al., 2021). The aim of this work is to develop an innovative process to produce rCB with reinforcing properties to incorporate in new tires. The first approach comprises the activation of the material with an activating agent (steam and/or CO2) at high temperature to remove carbonaceous residues present in the rCB that block the surface area available for rCB-rubber interaction. A prototype unit was designed and constructed for conducting these studies, and the treated rCB was characterized to evaluate differences in the chemical and morphological properties.

Keywords: *activation, end-of-life tires, pyrolysis, recovered carbon black, reinforcing*

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Enhancing the Properties of Recovered Carbon Black: Demineralization Process Investigation

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Abstract. The disposal of roughly 3 billion end-of-life tires (ELT) annually poses substantial environmental and health threats (Afrin et al., 2021). Pyrolysis has emerged as a promising method for converting ELTs into valuable products such as fuel, syngas, and recovered carbon black (rCB) (Costa et al., 2022).
Substituting rCB for virgin carbon black (CB) not only aids in waste valorization but also cuts down on fossil fuel usage. However, compared to virgin CB, rCB contains a higher amount of carbonaceous residues and organic and inorganic compounds, which negatively impacts its properties (Malinova, 2022). To overcome these issues and boost the reinforcing capability of rCB when incorporated into new tires, treatments like activation, demineralization, and surface modification are necessary (Chaala et al., 1996).
The aim of this study is to enhance the properties of rCB and improve its compatibility with polymers, which in turn reinforces its performance in tire manufacturing. We conducted experimental demineralization tests using various acids and/or bases, concentrations, temperatures, and lixiviation durations to study their effects on reducing the ash content in rCB. Both the rCB and the demineralized rCB were characterized using physical and chemical techniques.
The insights gained from this research will further our understanding of the demineralization process and its potential to optimize the quality of rCB for tire production.

Keywords: *Recovered carbon black, demineralization*

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Production of adsorbent particles based on natural polymers and clays for removal of drugs present in aqueous media

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Abstract. The use of natural polymers and clays to produce adsorbent particles is an alternative to traditional adsorbents. Materials from renewable sources, agro-industrial residues and abundant clay materials (Neves et al., 2022) receive attention due to their low cost, abundance and high adsorption capacity of pollutants (Enyojo et al., 2023). The increasing environmental pollution and studies showing the toxicity of man-made chemicals present in aqueous media motivate studies that evaluate the removal of these contaminants, such as pharmaceuticals, from aquatic systems. Pharmaceutical drugs are a class of emerging pollutants and their presence in waters and effluents represents a current challenge in water quality control. The presence of these substances is a concern because they are persistent and biologically active for long periods which implies potential risks to human health and environment (Morin et al., 2022). Since many of these molecules are recalcitrant to sewage and water treatment processes, these contaminants have been detected in drinking water, surface water, and groundwater (Silva et al., 2022). This work evaluates the production of particles based on kappa-carrageenan, alginate and expanded vermiculite for adsorption of pharmaceutical contaminants present in water. Aspects related to the production process and the performance of the new material in the removal of pharmaceuticals present in aqueous media are evaluated.

Keywords: *Alginate; clays; natural polymers; adsorption; drug pharmaceuticals*

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Incorporation of aceclofenac in k-carrageenan/sericin-based multiparticulate systems

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Abstract. The development of new pharmaceutical dosage forms has been widely studied as a strategy to minimize the problems associated with conventional drugs (Abhishek et al., 2017). Some of the main side effects caused by orally administered drugs are attributed to adherence in the gastric mucosa, and peak concentrations in the bloodstream caused by the fast release of the drug (Santinon et al., 2021). Polymeric multiparticulate systems stand out as advantageous alternatives for ensuring improvements in the pharmacokinetic profile and distribution of the drug in the body (Zakowiecki et al., 2020). Biopolymers are promising materials for the development of drug-carrying matrices because they are widely available, biodegradable, and non-toxic (Vieira et al., 2023). In this context, the present study proposes the development and characterization of particles based on the polysaccharide -carrageenan and the protein sericin for the incorporation and modified release of the anti-inflammatory aceclofenac. The interactions will be also evaluated.Keywords: Aceclofenac; sericin; -carrageenan; modified release.

Keywords: *Aceclofenac; sericin; -carrageenan; modified release*

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Preparation of new polymeric membranes based on poly(4-vinylpiridinium iodide)/graphene oxide for pollutants removal from water and wastewater

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Abstract. The intensive and inadequate use of water resources culminates in the scarcity of quality water for the population and in the increasing volume and diversity of pollutants in effluents (Gogoi et al., 2018). In this context, the adaptation of advanced methodologies offers an opportunity for technological optimization applied to the treatment of contaminated water and effluents (Al-Tohamy et al., 2022; Mohd Yusoff et al., 2023). In this study, hydrolyzed polyacrylonitrile (hPAN) membranes containing poly(4-vinylpiridinium iodide) and graphene oxide (hPAN/IPVP/GO) were synthesized, characterized and applied in the removal of metallic ions in water. The deposition of IPVP/GO onto the membrane surface reduced its roughness, modified the size and shape of the sublayers macrovoids and decreased the materials hydrophilicity. The hPAN/IPVP/GO membrane showed promising results regarding the removal of distinct metallic ions, highlighting the lead, chromium and copper. More studies are being carried out to define the best removal conditions of the new membrane, as well as the possible mechanisms of adsorbent/adsorbate interactions.

Keywords: *Adsorption; Metallic ions; Graphene oxide; Polyacrylonitrile membranes; Water treatment*

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Molecular Dynamics Computation of Diffusion Coefficients of Cork-Contaminating Substances in Supercritical Carbon Dioxide

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Abstract. Cork contains natural contaminants that are severely detrimental for the organoleptic properties of beverages, mainly wine (cork taint). Typical examples are chloroanisoles, bromoanisoles, chlorophenols, alkylmethoxypyrazines, geosmine, methylisoborneol, octenol, octenone, and guaiacol, from which 2,4,6-trichloroanisole (TCA) emerges as the most relevant cork contaminant. Therefore, granulated cork is industrially treated by steam distillation, desorption (under vacuum and/or heating), and more recently supercritical fluid extraction (SFE) to reduce such contamination. The accurate design and optimisation of SFE units requires the diffusion coefficients (D12) of those substances in the cork and in the supercritical carbon dioxide (SC-CO2). In this work, the D12 of TCA in SC-CO2 was estimated by Molecular Dynamics simulations and compared with values obtained from well-known phenomenological models.The potential chosen for TCA was the All-Atom Optimised Potential for Liquid Simulations (OPLS-AA) while for CO2 it was the Elementary Physical Model (EPM2). The simulations were made in the canonical ensemble (NVT) and the D12 was determined from the calculated trajectories by Einstein's diffusion equation. The phenomenological models were the predictive Wilke–Chang expression, the predictive TLSM model and its 1-parameter TLSMd correlation.

Keywords: *nan*

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Integration of combustion and supercritical fluid units through CO2 capture and purification

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Abstract. Nowadays, sustainability has become a crucial aspect of the industry. Companies are actively seeking ways to minimize their carbon footprint and adopt circular economy practices [1 - 3]. In this context, the capture and utilization of CO2 from flue gas emissions have emerged as a compelling solution. To achieve this goal, a preliminary literature search has been conducted on the technical/economic viability of various purification methods, including absorption, adsorption, membrane separation, cryogenic distillation, and chemical loop combustion. Each method presents its own advantages and challenges [3 – 5]. Being the most promising technology, this study specifically focuses the simulation and optimization of a CO2 capture process based on the absorption using a MEA-MDEA solvent mixture [4, 5]. The simulation is conducted using Aspen Plus, employing packed columns and a rate-based method to ensure an accurate representation of the process. In addition, this study encompasses also CO2 compression, aiming to enhance the understanding of its potential as a raw material for supercritical extraction. By exploring viable solutions for CO2 capture and utilization, this work contributes to sustainable practices, aligned with the principles of the circular economy.

Keywords: *Circular Economy, CO2 Capture Methods, Absorption Process, CO2 Compression*

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Development of non-isocyanate polyurethane adhesives for cork stoppers

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Abstract. The development of non-isocyanate polyurethanes (NIPU) has been in the spotlight of research as a sustainable method to substitute the conventional production of polyurethanes. According to the literature (Gomez-Lopez et al., 2021), NIPU may be produced by reacting diamines with cyclic carbonates. The latter can be obtained upon reaction of polyols with dimethyl carbonate (DMC), preferably those with vicinal hydroxyl groups.In the scope of the project GCORK – "Desenvolvimento de rolhas de cortiça aglomerada com colas e tratamentos de superfície Bio, produzidas por processos mais verdes e sustentáveis" of CICECO – Aveiro Institute of Materials, the feasibility of using different starting materials from renewable resources, such as sucrose, soy protein, cork granules and tannins, to prepare cyclic carbonates that can react with hexamethylenediamine (HMDA) to produce adhesives has been studied. Additionally, a biobased diamine has also been tested. Until now, tannins have demonstrated high potential for the development of NIPU adhesives for cork stoppers.Keywords: NIPU, polymerization, wood agglomerates, hexamethylenediamine

Keywords: *NIPU, polymerization, wood agglomerates, hexamethylenediamine*

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Optimization of end-of-life tires pyrolysis and processes for the production of marketable recovered carbon black and fuel

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Abstract. The pyrolysis of end-of-life tires (ELT) allows the production of fuel, syngas and recovered carbon black (rCB). The latter represents a more ecofriendly alternative to virgin carbon black (CB), which is traditionally produced from fossil fuels. Hence, fossil crude oil consumption and CO2 emissions are both reduced and, at the same time, ELT residues are valorized [1]. In this sense, University of Aveiro and BB;G-AWES have been working on the development and optimization of an ELT pyrolysis process to produce both rCB and fuel with specifications that allow their application in the market within the scope of the circular economy concept. Moreover, a high-quality syngas resulting from the pyrolysis process is burned to meet the process energy requirements. The optimization of the pyrolysis conditions (temperature, residence time, feed rate, etc.) was conducted on a pilot plant unit engineered and manufactured by the company, while all three products were collected and characterized.
An extensive characterization of the rCB is fundamental in order to ensure its increased added-value and therefore its market application. The characterization techniques performed in this work included toluene discoloration assays, Thermogravimetric Analysis (TGA), ash content determination by calcination, elemental analysis CHNS, particle size distribution, Scanning Electron Microscopy-Energy Dispersive Spectroscopy (SEM-EDS), Scanning Transmission Electron Microscopy (STEM), X-ray Diffraction (XRD), helium pycnometry, nitrogen adsorption (Nitrogen Surface Area, NSA), Inductively Coupled Plasma-Mass Spectrometry (ICP-MS), solid-liquid extraction followed by Gas Chromatography coupled to Mass Spectroscopy (GC-MS) for the quantification of Polycyclic Aromatic Hydrocarbons (PAH), and evaluation of rCB performance by in-rubber tests – curing properties, static mechanical analysis, dynamic mechanical analysis and dispersion. Additionally, the design of the fuel and gas treatment lines has been also accomplished.

Keywords: *circular economy; end-of-life tires; pyrolysis; recovered carbon black*

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Analytical equations for the effectiveness factor of isothermal reversible reactions

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Abstract. The competition between chemical reaction and intraparticle diffusion in porous catalysts is typically modeled by effectiveness factors, for which there are analytical expressions for isothermal nth order irreversible reactions and 1st order reversible reactions (Froment et al., 2011). In other cases, effectiveness factors can be numerically determined, though this approach exhibits certain drawbacks, such as lengthy computational implementation and absence of guaranteed convergence towards a valid solution.

In this study, analytical user-friendly equations for the effectiveness factors of isothermal reversible reactions are developed and validated through comparison with numerical results and experimental data from two liquid phase reactions, namely, the esterification of acetic acid with ethanol (Antunes et al., 2011) and the synthesis of acetaldehyde dimethyl acetal (Gandi et al., 2005), both catalyzed with Amberlyst-15, a strongly acidic ion exchange resin. The formulated equations are expressed in terms of a generalized Thiele modulus that embodies: (i) a dimensionless quantity defined for a hypothetical nth order irreversible reaction; the ratio of effective diffusivities; the ratio of surface concentrations; and the equilibrium concentrations of all species (Rios et al., 2023).

A systematic framework is also presented to derive effectiveness factors for diverse kinetic schemes arising from the general case A+B C+D. Moreover, the impact of employing different methods of calculating multicomponent effective diffusivities on the resulting effectiveness factor is analyzed. The derived analytical equations provide a faster and efficient approach for the optimization and design of catalytic systems.

Keywords: *diffusional limitations; effective diffusivities; effectiveness factor*

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Study of furanic compounds sorption and its presence in transformers' insulating materials degradation

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Abstract. Power transformers are a crucial part of the electrical network, so that the wellness of their constituents, more specifically their insulators, need to be ensured. The study of transformers insulators (mineral oil and insulating papers) ageing in laboratory allow to obtain more information about their degradation and help on the detection of faulty in-service transformers. The degradation of cellulosic materials has been associated with the detection of furanic compounds in the oil (Cheim et al., 2011; Scheirs et al., 1998) and the reduction of the cellulose degree of polymerization (Cheim et al., 2011). In collaboration with EFACEC, and within the project NEXTRA, accelerated ageing tests were prepared with two different insulating papers (Kraft paper and thermally upgraded crepe Kraft paper, TUP) immersed in oil in closed systems, at 120 °C, with 5 to 7 weeks of duration. However the partitioning of degradation markers (e.g., furfural) between oil and paper affect significantly the analytical results of the oil (Yang et al., 2016).
Furfural (FAL) and furfuryl alcohol (FOL) were indicated as compounds of interest after accelerated ageing tests, then sorption assays of these compounds were performed in an orbital shaker at 30 °C and 100 rpm, in "oil + Kraft paper" or "oil + TUP" systems. Mixed solutions of FAL and FOL in the oil were also prepared. The oil was separated from the paper to be further analysed by high-performance liquid chromatography (HPLC) with diode-array detection (DAD). The results showed that both furanic compounds exhibit different distribution and sorption kinetics. For example, FOL presents higher affinity towards both papers than FAL. Overall, this research helps to strengthen the understanding of the formation and distribution of these chemical markers during insulation ageing process.

Keywords: *Furanic compounds ; Insulation systems ; Oil analysis ; Transformer insulators*

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From multilayer plastic waste towards valuable products

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Abstract. The large amount of plastic waste accumulated in the environment makes plastic pollution a critical environmental concern. Furthermore, multilayer plastic packaging is a particularly problematic plastic waste stream because, due to its complexity, it is not recyclable using the mechanical recycling approach available in the industry, resulting in poor-quality products (Rosen et al., 2020). Therefore, multilayer waste is the most prominent plastic waste in landfills and the environment in the form of uncollected waste (Jubinville et al., 2020). To address the recyclability of this waste stream, alternative technologies such as selective dissolution-precipitation, delamination, compatibilization, and pyrolysis are proposed in the literature (Kaiser, 2020); however, the first three were mainly applied to low contaminated post-industrial waste, leaving a large amount of post-consumer plastic packaging waste behind. Pyrolysis, though, results in the plastic's downcycling to recover fuel and energy.
In this work, we propose a framework for valorizing multilayer plastic waste, considering the treatment of a real mixed multilayer plastic waste from a plastic recycling facility to recover valuable products. For this purpose, a detailed study on the (i) characterization of the mixed multilayer waste; (ii) several valorization strategies based on dissolution-precipitation, depolymerization, and delamination technologies; and (iii) extensive chemical, thermal, and mechanical characterization of the recovered materials will be given.

Keywords: *multilayer packaging, plastic recycling, circular economy*

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Multilayer plastic waste and tomato pomace in additive manufacturing: a circular economy approach

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Abstract. Multilayer plastic residues are the most prominent plastic wastes in landfills and in the environment in the form of uncollected waste (Jubinville et al., 2020). On the other hand, tomato pomace (TP) is a by-product generated by the tomato processing industry, mainly constituted by seeds (up to 55 wt.%) and peels (up to 60 wt.%), that represents a significant environmental burden, despite potential aplication in animal feed (Casa et al., 2021). Considering a circular economy approach, new alternatives should be contemplated to reintroduce such wastes into the productive system. In turn, additive manufacturing, often known as 3D printing, provides the ability not only to minimise the consumption of raw materials, but also to reduce polymeric waste (Huang et al., 2013).The aim of this work is to develop a strategy within the concept of plastic sustainability and circular economy to valorise polyolefins recovered from multilayer plastic waste and TP residues, focused on the development of 3D printing filaments. Formulations with a polyolefin-rich fraction, recovered from multilayer plastic packaging, and different TP contents were prepared by melt-mixing and its thermal and rheological properties where evaluated. Subsequently, such formulations were tested in the process of extrusion as 3D printing filaments and the performance of these in FDM-based 3D printing was assessed.

Keywords: *multilayer plastic waste; tomato by-products; circular economy; 3D printing*

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Exploring the use of supercritical fluids in the recycling of multilayer plastic packaging

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Abstract. Multilayer plastic packaging wastes are of growing environmental concern due to the enormous amounts disposed of over the years. This is aggravated by the fact this type of plastic waste cannot be recycled using well established recycling methods. In view of this, methodologies need to be developed to recover these plastics (Aymonier ; SLOSTOWSKI, 2019; Soares et al., 2022).
Further to ongoing studies in the group based on selective dissolution-precipitation approaches, the use of supercritical carbon dioxide (SC-CO2) combined with co-solvents is being explored. After preliminary studies to select the best co-solvent, an existing high-pressure equipment was adapted to carry out the supercritical experiments. Next, in order to have a better understanding of the process, a well-defined polyethylene/poly(ethylene terephthalate) sample was submitted to several conditions of pressure, time, and ratios of sample to SC-CO2 in order to optimize the separation of these components. This study will then be the basis for the separation of multilayer plastic packaging waste.

Keywords: *multilayer plastic waste, supercritical fluids, chemical recycling*

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Adsorption of Cork Volatile Organic Compounds over Different Types of Porous Materials

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Abstract. Adsorption of cork volatile organic compounds over different types of porous materials
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Abstract
Volatile organic compounds (VOCs) are low boiling point (523 K) species resultant from a variety of natural or anthropogenic sources. These compounds may be harmful for human health due to their mutagenic, neurotoxic, and carcinogenic features, and also present repercussions for the environment, contributing for acid rain and greenhouse effect (Li, 2021). In the particular case of this work, VOCs resulting from the supercritical fluid extraction of cork are focused, as some of their natural contaminants are severely detrimental for the organoleptic properties of beverages, mainly wine (cork taint).
Adsorption appears as an interesting recovery post-processing technology owing to its cost-effectiveness, flexible operation, low energy consumption and efficient recovery. Activated carbon and zeolites are the most common materials used for adsorption of VOCs, due to their high surface area, hydrophobic properties, and high adsorption capacity (Zhu, 2020). Reusability is a critical criterion to consider when selecting an adsorbent for practical applications in order to reduce costs of raw material and secondary pollution related to adsorbent disposal. In this sense, zeolites demonstrate good thermal stability, shape selectivity and hydrothermal stability, as well as non-flammability for safe regeneration (Veerapandian, 2019).
In this work, adsorption of acetaldehyde (model VOC) was performed using different types of porous solid materials, namely activated carbon, layered double hydroxides (LDHs), clays, zeolites and zeotypes. In the particular case of zeolites the influence of Si/Al ratio and pore structure (MOR, MFI, BEA, FAU) were evaluated. The adsorption experiments were conducted continuously with on-line VOC analysis in a gas chromatograph coupled with a BID detector (GC-BID). Breakthrough curves for several adsorbents were measured and the stoichiometric and break point times were determined. Regeneration of the spent adsorbent was performed in-situ and studies were made regarding regeneration temperature and atmosphere.

Keywords: *Volatile organic compounds, Adsorption, Adsorbent, Activated carbon, Zeolites*

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Prediction of diffusion coefficients in supercritical carbon dioxide using Machine Learning models

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Abstract. Transport properties are extremely important for the design, simulation and scale-up of separations and chemical reactions. The molecular diffusion coefficient, D12, is fundamental to estimate dispersion coefficients, convective mass transfer coefficients, catalysts efficiency factors, etc. (Oliveira et al., 2011). Supercritical carbon dioxide (SC-CO2) is one of the so-called "green-solvents", which have been gaining traction in both academia and industry. However, experimental diffusivity data in SC-CO2 is still scarce in terms of solutes and operating conditions, requiring accurate models capable of providing reliable D12 estimations.Currently, the Wilke-Chang equation, is the most well-known and most used equation to calculate solute diffusivities in SC-CO2. Other models have been proposed, such as the Lai-Tan equation, a modification of the Wilke-Chang equation specifically devised for SC-CO2, and the correlation of Dymond-Hildebrand-Batschinski (DHB), which given some known data about the system allows for interpolation and extrapolation to the desired conditions. In this work, we developed predictive models to estimate diffusivities of solutes in supercritical carbon dioxide, using machine learning models. A large database of experimental data containing 21 properties for 174 solutes and 4917 data points was used in the training of the machine learning models. Four machine learning models were evaluated: a k-Nearest Neighbors model, a Decision Tree algorithm, and two Ensemble Methods (Random Forest and Gradient Boosting). The results were compared with a simple multi-linear regression and with the conventional models of Wilke-Chang, Lai-Tan, and DHB (Aniceto et al., 2021).The best results were found using the Gradient Boosting algorithm which showed an average absolute relative deviation (AARD) of 2.58 % for the 1476 points in the test set (points not used in model training). This model has six parameters: temperature, pressure, density, solute molar mass, solute critical pressure, and solute acentric factor. The k-Nearest Neighbors, Decision Tree and Random Forest models presented overall results between 4.1 % and 5.5 %. By comparison the multi-linear regression obtained an AARD of 15.86 %. The conventional models of Wilke-Chang, Lai-Tan, and DHB, showed worse performance for the same test set with deviations of 12.41 %, 26.01 % and 4.27 %, respectively (Aniceto et al., 2021). Although the DHB model shows performance similar to the machine learning models, it requires previous experimental data to fit the system parameters, which is not always possible. The model developed in this work was made available to the public via an online calculator and a command line application.

Keywords: *Diffusion coefficients, Machine Learning, Prediction, Supercritical carbon dioxide, Supercritical fluids*

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One step towards the quantification of p53-minicircle DNA

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Abstract. p53-minicircle DNA (mcDNA) is a biopharmaceutical with potential use in the genetic therapy of cancer. Despite the therapeutic relevance of DNA-based products, current clarification and purification steps are complex, resulting in high-cost biopharmaceuticals [1]. The existing strategies for mcDNA isolation are based on chromatographic techniques, such as size-exclusion, hydrophobic interaction, and affinity chromatography. Despite the selectivity achieved with the affinity strategy, it depends on the genetic manipulation of the vector to include specific sequences and/or in the use of enzymes to eliminate impurities [2,3]. Thus, up to date, one of the best strategies resorts to size exclusion chromatography, allowing the recovery of 66% of mcDNA with a purity of 98% [2].
Due to the lack of an efficient purification strategy, a quantification method for mcDNA is non-existent. Considering this, an analytical method based on ion exchange chromatography for mcDNA quantification is under development. Firstly, the p53-mcDNA is produced through the culture of transformed Escherichia coli. Then, the mcDNA is extracted with a commercial kit. The samples obtained after the extraction are applied in developing the new analytic method. Also, an extraction method using ionic liquid (IL)-based aqueous biphasic systems (ABS) is under evaluation for the replacement of the commercial kit used for the purpose. For that, the cytotoxicity of several analogues of glycine-betaine ILs is being also assessed.

Keywords: *Biopharmaceutical, Minicircle DNA, Extraction, Quantification, Ionic Liquids, Citotoxicity*

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Uncovering the scale-up drawbacks on the recovery of proteins from algae and their valorization as peptides

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Abstract. Among consumers, the demand for protein hydrolysates is increasing exponentially every year. This happens due to a growing lifestyle choice for healthy food with high nutritional value and a decrease in meat consumption, which drives the search for functionalized foods (Nasri 2017). Algal biomass arises as a sustainable protein source that can improve human health due to bioactive peptides' presence in their composition (Admassu et al. 2018). However, the scalability of the existing processes to extract and purify proteins is still a barrier that needs to be overcome to consider algae as a viable protein source (Bleakley and Hayes 2017).

In this context, the main goal of this work is to develop and scale-up the process of extraction and purification of proteins from two fresh algae, Porphyridium purpureum (microalgae) and Palmaria palmata (red macroalgae), to obtain them in the final form of peptides. A range of eutectic solvents will be evaluated considering their ability to efficiently extract proteins in a more selective way and perform hydrolysis in a single step. After selecting the solvents with the best performance and finding the optimum operational conditions, eutectic solvents-based ABS and/or solid-phase extraction techniques will be used to isolate the peptides. Then, a techno-economic assessment is going to be performed considering the efficiency and economic impacts of the best processes (for both algae). Further investigation to establish amounts of net electricity and heat demand and net consumption of basic chemicals will be conducted, and impacts of the supply paths and the consumption of primary resources discovered through process simulation (ProSimPlus), being a precise LCA created. Lastly, the most promising unit operations and suitable conditions obtained from process simulation will be implemented in the GreenCoLab infrastructure.

This project's ultimate goal is to develop a successful and sustainable process for the extraction, purification, and hydrolysis of proteins from micro and macroalgae, and their transfer from lab to pilot scale. It is expected that the development of these versatile technologies can be further applied to other marine species and biocompounds in the future, contributing to the development of a blue biorefinery and a bio-based economy.

Keywords: *Deep eutectic solvents; Peptides; Aqueous biphasic systems; Solid-phase extraction; Process simulation; Scale-up; Algae.*

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Development of 3D printing filaments using tomato byproducts

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Abstract. Tomato industry produces considerable amounts of organic residues, such as tomato pomace (i.e., skin and seeds) and mature/immature tomatoes, often discarded in landfills or partially used in animal feed, despite of having valuable biomolecules of interest for the development of new materials. On the other hand, fused deposition modeling (FDM), a 3D printing technology, allows the development of 3D structures with complex geometries through layer-by-layer deposition of thermoplastic filaments. In this PhD thesis, the use of these agri-food byproducts to develop functional and biodegradable filaments processable by FDM is explored. Until now, tomato pomace was the only tomato byproduct incorporated in polypropylene (PP)-based filaments without exhibiting a substancial thermal degradation during the composite preparation. Since thermoplastic starch (TPS) from commercial sources has been successfully applied in the preparation of 3D printed materials (Haryńska et al., 2021; Ju et al., 2022), tomato pomace and mature/immature tomatoes were used as additives to developed starch-based filaments. Following the circular economy approach, starch was recovered from potato washing slurries.
The chemical characterization of the starting materials, the preparation of composites and the filament extrusion results will be presented and discussed as well as some preliminary results considering FDM.
Future work will be related to physico-chemical and mechanical characterization of PP-based filaments and biodegradability tests will be performed to both PP- and starch-based materials.

Keywords: *Agri-food byproducts, Tomato pomace, Mature tomato, Immature tomato, Additive manufacturing, Polypropylene, Thermoplastic starch*

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Valorization of bleached kraft pulps hemicelluloses and cellulose in Biorefinery processes for sustainable applications

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Abstract. Over the past few decades, the extensive use of petroleum-based single use plastics allied with the continuous growth of the world population and the depletion of fossil resources have been leading to serious environmental problems. As a result, there is a growing need for the development and adoption of sustainable alternatives to petroleum-based materials (Fiorentino, Ripa, ; Ulgiati, 2017). Hemicelluloses, which are a large component in lignocellulosic biomass, can be used in many different applications including conversion into chemicals, and the development of sustainable material with a wide variety of applications, spanning from active packaging materials, drug delivery and biomedical applications among many others (Naidu, Hlangothi, ; John, 2018).
The main focus of this work is to develop novel biobased materials from bleached kraft pulps hemicelluloses (mainly xylans) and cellulose (nanofibrillated cellulose) that can be further used in the transition towards a more sustainable and circular economy.
So far, we have followed two distinct approaches: namely, the development of wood inspired films; and highly flexible chitosan/xylan films plasticized with deep eutectic solvents (DES). The wood inspired films were prepared by solvent casting of a mixture of the three main macromolecular components of wood, namely xylans, nanofibrillated cellulose and lignosulfonates (magnesium or sodium salts), and presented excellent optical, mechanical and thermal properties, as well as antioxidant capacity and UV protection features.
The chitosan-xylan based films were also prepared by solvent casting, and to demonstrate their potential application in the biomedical field, the optical properties, antimicrobial activity, mechanical performance, thermal stability, moisture uptake capacity and cell viability of skin cells when in contact with the prepared films were assessed.

Keywords: *Xylans, Biobased films, Biorefinery, Bioeconomy*

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Extractive fermentation for laccase production

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Abstract. Laccases (EC 1.10.3.2) are multicopper enzymes that use molecular oxygen to catalyse the oxidation of several substrates, such as phenolic compounds and aromatic amines (Jeon et al., 2012). Laccases are used in a wide range of industrial and biotechnological processes, including wastewater treatment, paper and pulp industry, and polymerisation reactions. However, enzymes' production and purification costs are high due to low productivity and the multi-step purification process (Raina et al., 2022).

Aqueous biphasic systems (ABS) are liquid-liquid extraction systems composed mainly of water, which creates a biocompatible environment ideal for applications within the biotechnology field (Magalhães et al., 2021). These advantages have led to extensive research on ABS in the downstream processing of value-added biomolecules, such as enzymes. For the purpose of creating competitive and more environmentally friendly downstream processes than those currently in use, the development of integrated bioprocesses is necessary, such as extractive fermentation (Magalhães et al., 2021). In this process, the microorganism is restrained in one of the ABS phases, while the target compound produced is partitioned to the other phase, combining the production and primary purification steps process in a single step.

This work aims to design an extractive fermentation to integrate the production and purification of laccase using a genetically modified yeast (Pichia pastoris) while creating a sustainable and low-cost process.

Genetically modified P. pastoris for the production of recombinant laccase from Trametes versicolor was cultivated in BMGY medium for 24 h, and further used to inoculate the fermentation assays. Fermentation occurred in BMMY with copper supplementation and daily methanol supplementation. To study extractive fermentation, the fermentation medium was supplemented with multiple ABS constituents (salts, polymers, and ionic liquids) with concentrations between 10-20 wt% and microbial growth was monitored by OD600 measurement.

The expression in P. pastoris was successful, and extracellular recombinant laccase was detected after six days of fermentation. Several ABS constituents were tested to evaluate microbial growth. Using 10 wt% propylene glycol with a molecular weight of 400 g mol-1 (PPG 400), cholinium chloride and ammonium sulfate inhibit yeast growth. The best growth results were achieved using 10 wt% polyethylene glycol with a molecular weight of 2000 and 8000 g mol-1 (PEG 2000 and PEG 8000) and 10 wt% phosphate buffer pH 6.

Keywords: *laccase, extractive fermentation, aqueous biphasic system*

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Extraction strategies for developing recombinant messenger RNA vaccines resorting to biobased ionic liquids

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Abstract. Messenger RNA (mRNA)-based vaccines played a key role in fighting the COVID-19 pandemic, representing nowadays a promising alternative to conventional vaccination (Ladak et al., 2022). Typically, mRNA production is achieved by in vitro transcription (IVT). However, this method is expensive and relies on a complex and limited supply chain. Consequently, the generation of mRNA by IVT at large scale and under current good manufacturing practice remains challenging (Rosa et al., 2021). For this reason, a robust and self-sufficient production for mRNA is essential to support market demands (Rosa et al., 2021). As eukaryotic organisms are generally recognized as Safe (GRAS) for humans, yeasts are promising alternatives as recombinant microfactories for mRNAs, being currently under investigation for this purpose (Yscript, 2023). However, as mRNA is produced intracellularly, it is necessary to develop an integrated extraction-purification process. Considering the tunable nature of ionic liquids (ILs) and ability to stabilize nucleic acids (Dinis et al., 2023), this work aims to investigate the use of bio-based ILs in the lysis step (Dinis et al., 2023). Firstly, ammonium-based ILs were synthesized and characterized (chemical structure by NMR spectroscopy and water content by Karl Fischer titration) and the yeast strain was cultivated according to a previously optimized protocol (Yscript, 2023). Yeast cells were recovered by centrifugation and incubated with specific concentrations of ILs, after which the released intracellular mRNA was precipitated and recovered. IL-mediated yeast lysis was optimized to increase the yields. The integrity of recovered mRNA was evaluated using agarose gel electrophoresis, the concentration using UV spectroscopy and the identity using in vitro translation. Results revealed that some ILs were able to promote cell lysis and, consequently, mRNA recovery. In addition, their effect on mRNA stability was investigated. The mRNA samples were dissolved in aqueous solutions of the different ILs. The mixtures were incubated for different periods, namely 1, 15 and 22 days at 25 ºC and at 4 ºC. After incubation, mRNA was precipitated, recovered and its integrity evaluated using agarose gel electrophoresis. All ILs revealed to be a good stabilization media of mRNA. Overall, this study highlights the potential of bio-based ILs as an effective method for lysing yeast cells and extracting mRNA; however, the process needs to be optimized to increase the yield of extracted mRNA. Then processes for the mRNA clarification will be developed.

Keywords: *mRNA vaccine, Bioprocess, Extraction, Integrated process, Ionic liquids, Stability*

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Conversion of tannery wastes by AM technologies

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Abstract. Tannery wastes, such as solid residues and wastewater, are generated during the leather production process and can have significant environmental and health consequences if not properly treated (Chojnacka et al., 2021; Hu et al., 2011). Focusing on the solid residues produced, we propose the valorization of these wastes by giving them a new life in the field of additive manufacturing (AM). AM technologies, such as fused filament fabrication (FFF), an extrusion-based technology, can provide innovative solutions for the conversion of tannery waste into useful products. In order to evaluate this AM technology, we are required to produce several composite materials with different polymeric matrixes and different leather waste content. Although the primary focus of this study is the application of the FFF technology, another AM technique will be explored, which is binder jetting, that allows for a higher percentage of incorporation of leather wastes (< 95 % in weight)
Three different matrixes were proposed with them being polylactic acid (PLA), polyvinyl butyral (PVB) and starch-based blends. The three matrices were chosen to contrast different sources and end-of-life and will allow different applications within the FFF technology. As for our filler material, leather scraps supplied from the national tannery industry were grounded to a fine powder (<100 μm) and were incorporated with different ratios ranging from 10% to 40% in volume depending on the matrix. A Brabender type mixer was used to prepare all leather-polymer composites (LPC).To evaluate the overall performance of the produced LPC, thermal, mechanical, and morphological analyses were performed. The selected LPC formulations were then extruded into filaments of 1.75mm of diameter in order to evaluate the printability. The non-isothermal crystallization behavior of LPC was also studied and fitted into non-isothermal kinetic models. Crystallization behaviour is a key step in any extrusion-based AM technology. Overall, the results showed that leather residues acted as a nucleating agent, increasing the degree of crystallinity and crystallization rate of the produced LPC. In high contents of leather incorporation mechanical properties are significantly lower and lose their flexibility. This effect opens the door to studying the addition of coupling agents to improve the interaction between filler and matrix.

Keywords: *Additive Manufacturing, Leather wastes, Polymeric composites, Waste valorization*

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Chicken feathers valorization regarding keratin-based biomaterials for biomedical applications

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Abstract. Chicken is one of the world's most consumed meats. Its industrial processing results in a high amount of feathers waste, highlighting the necessity to develop sustainable ways of waste valorization. The highest component in chicken feathers is keratin (90 wt %), a fibrous protein with applications in cosmetics and biomedical field [1,2]. Although keratin recovery from feathers has been reported in the literature, keratin presents low solubility in common organic solvents, due to the inter- and intramolecular disulfide bonds in sulfur-containing amino acids, which makes the traditional methods inefficient [1,3]. Overcoming this, we have used aqueous solutions of acetate-based ionic liquids (ILs) as greener and more efficient solvents [1,4]. ILs are salts with lower melting temperatures than inorganic salts [1,3]. More specifically, we have used 1-ethyl-3-methylimidazolium-acetate ([C2C1im][C1CO2]), 1-butyl-3-methylimidazolium acetate ([C4C1im][C1CO2]) and cholinium acetate ([N111(2OH)][C1CO2]) to dissolve chicken feathers in an aqueous solution of IL (80 wt %) in a solid:liquid weight ratio of 1:20 w/w, at 100 °C, for 4 h, enabling a complete feathers dissolution. Keratin recovery was optimized (achieving a yield of around 92 wt %) by varying the coagulant solvent (e.g. water and ethanol), the amount of coagulant added and the time. Keratin was collected, washed with water, and then dried at 50 °C [1,4]. Considering the challenges of industrial applications for ILs (due to their cost), we evaluated the IL recovery, achieving around 94 wt %. We also performed a techno-economic assessment of the developed keratin recovery process, indicating that the minimum selling price achieved for keratin is 22 $·kg-1, making this process suitable for cosmetics and biomedical applications [4]. Keratin film was processed and characterized by physico-chemical and mechanical analysis. Regarding biomedical applications, we evaluated the cytotoxicity of keratin film in macrophages, monocytes, keratinocytes, and fibroblasts. Keratin film did not present any cytotoxicity for these cells. Furthermore, the in vitro wound healing study showed that the keratin film improves the proliferation of keratinocytes and fibroblasts, accelerating wound healing at 16 h [1]. The results obtained in this work demonstrate that acetate-based ILs are attractive solvents for keratin dissolution, opening the door for the development of more sustainable recovery processes, and keratin film processing for use in the biomedical field.

Keywords: *poultry industry waste, ionic liquids, biofilm, sustainable process*

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Ionic liquid-based aqueous biphasic systems as effective platforms for human serum pretreatment and breast cancer biomarkers extraction

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Abstract. The detection of biomarkers in body fluids enables an earlier detection of breast cancer (the most diagnosed type of cancer worldwide) contributing to increase survival rates (Ludwig ; Weinstein, 2005). Measurement of the protein epidermal growth factor receptor 2 (ERBB2) levels in human serum plays an important role in the management of breast cancer (Shamshirian et al., 2020). Up to now, due to the low concentrations in human serum, the accurate detection of biomarkers such as ERBB2 is still limited by interferences caused by highly abundant proteins, namely human serum albumin (HSA) and immunoglobulin G (IgG) (Lee et al., 2019). Therefore, it is critical to introduce a sample pretreatment step in the analytical protocol to deplete IgG and HSA before quantification (Lee et al., 2019). Aqueous biphasic systems (ABS) stand out as promising sample pretreatment and biomarker extraction techniques due to their water-rich and tunable nature (Mendes et al., 2023). However, conventional polymer-based ABS suffer from high viscosity and limited polarity range, usually providing low selectivity (Kim et al., 2015). Due to their high structural versatility, ionic liquids (ILs) can be finely tuned to overcome these drawbacks, while improving the efficiency of ABS in sample pretreatment and biomarker extraction (Pereira et al., 2020). In this work, we investigated ABS comprising two ILs as compared to conventional ABS for the simultaneous depletion of HSA and IgG at the interphase and extraction of ERBB2 in one of the aqueous phases. Results showed that the most efficient ABS composed of two ILs completely depleted IgG and 69% of HSA at the interphase, outperforming most conventional systems. Moreover, ABS were applied in the extraction of ERBB2 and the best ABS comprising two ILs was more efficient than conventional ABS, allowing to extract 93% of ERBB2 in the top phase. In conclusion, ABS containing two ILs demonstrated to be more efficient than conventional ABS due to their higher capacity to deplete IgG and HSA while simultaneously extracting ERBB2, showcasing their potential to improve breast cancer biomarkers analysis.

Keywords: *Breast cancer; Biomarkers; Sample pretreatment; Aqueous biphasic systems; Ionic liquids*

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Purification of protein-based biopharmaceuticals using polymer-based aqueous biphasic systems

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Abstract. Biopharmaceuticals have become effective clinical treatment modalities for a wide range of diseases due to their multiple advantages over traditional pharmaceutical products, such as higher specificity with fewer side effects. Over the period comprised between 2018 and 2022, 180 distinct biopharmaceutical products were approved both in the USA and/or EU, accounting nowadays for 443 individual products with current active licenses while reinforcing their importance in modern science (Walsh ; Walsh, 2022). Among the approved therapeutic proteins, the role of interferons (IFN) should be highlighted, which were first approved in 1986 and more than 30 years later, remain viable options for the treatment of cancer, multiple sclerosis, and chronic hepatitis C (Castro et al., 2021). In comparison with traditional pharmaceutical products, access to biopharmaceuticals to the worldwide population remains restricted due to their complex manufacturing. Over the years, efforts have been made to improve the biopharmaceuticals manufacturing processes as well as to reduce the production costs, relying on improvements both at the upstream and downstream levels, respectively, the stages dealing with the production itself and the recovery/purification of the target product (Castro et al., 2021). In this sense, the main goal of this work is the development of a modified K. Pastoris strain capable of secreting IFN-2b in high amounts, as well as efficient IFN-2b recovery processes from the culture media. Regarding the upstream stage, it was evaluated the effect of supplementing the culture media with low amounts of triblock copolymers and polysorbates, being observed that small amounts of Tween 80 (0.1wt%) significantly increase the levels of IFN-2b in the culture supernatant. Afterward and for downstream optimization, aqueous biphasic systems (ABS) composed of polypropylene glycol (PPG) 400 g/mol and polyethylene glycol (PEG) of varying molecular weights (MW) were applied for the recovery of IFN-2b. Results from distinct techniques (electrophoresis and dot-blot) demonstrate that polymer-based ABS are an efficient tool for the recovery of IFN-2b with high yield, and depending both on the molecular weight of PEG and the selected mixture point, the partition of the recombinant protein can be tailored and adjusted as required. Interestingly, the target protein can be recovered in the PEG-rich phase for lower MW PEGs, or precipitates if polymers of high MW are applied. Therefore we were able to develop a strategy for an efficient secretion and recovery of recombinant protein from the culture supernatant, improving both the upstream and downstream stages of the manufacturing process.

Keywords: *biopharmaceutical; interferon alpha-2b; aqueous biphasic systems; polymer; recombinant protein; K. pastoris;*

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"Waste-to-wealth" approach towards the full valorisation of spent lithium batteries

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Abstract. The increasing number of Lithium-Ion Batteries (LIBs) generated by the electrification of transportation and developing climate change mitigating technologies presents a significant waste-management challenge but also a potential source of strategic and critical materials. (European Commission, 2020; Larcher ; Tarascon, 2015; Marcelo Azevedo et al., 2018) This research proposal aims to address this challenge by developing a "waste-to-wealth"approach for the recovery of valuable materials from spent LIBs.The proposed approach involves recovering lithium chloride (LiCl) from spent LIBs using excess hydrochloric acid (HCl) as a leaching agent. The recovered LiCl will be used as an input in an electrolysis cell to produce more HCl and lithium hydroxide (LiOH), thereby ensuring a closed chloride cycle. The delithiated residue will be repurposed as a catalyst, and the transition metals (TM) will be separated for recovery.The proposed work plan includes identifying leaching conditions that allow for the decorrelation of lithium from TM dissolution, purifying dissolved lithium from impurities, valorising the delithiated oxide as a material for degrading organic pollutants and dyes, valorising the delithiated oxide as a lithium sorbent, and recovering TM from the delithiated mixed oxide to obtain commercial-grade metal oxides or salts.This approach aligns with the Circular Economy concepts, which advocate for the full valorisation of waste streams along the waste hierarchy. By recovering valuable materials from spent LIBs, the proposed approach presents significant economic and environmental advantages. (European Commission, 2020; Fan et al., 2020; Larcher ; Tarascon, 2015; Zhang et al., 2018) Additionally, this approach presents a potential source of strategic and critical materials, which are essential for the development of advanced technologies. Overall, this research proposal presents a promising solution to the waste-management challenge posed by the increasing number of spent LIBs.

Keywords: *Hydrometallurgy, Circular economy, Waste valorisation, Lithium-ion batteries, Critical metals*

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Non-volatile solvents as a promising strategy to improve indoor air quality

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Abstract. According to the World Health Organization (WHO), access to clean air is an essential human right and a necessity for human health (WHO, 2021). However, air pollution is a serious threat to human health, being responsible for around 7 million deaths per year (WHO, 2021). This mortality is associated to several pollutants with both ambient and household emissions, such as gases, particulate matter, and volatile organic compounds (VOCs) (WHO, 2021). As such, because poor air quality is responsible for various diseases, improving indoor air quality (IAQ) must be a priority (WHO, 2021). Despite the existing guidelines to guarantee IAQ, other strategies should be employed whenever possible, including the reduction of pollutants at their source, air ventilation, and, if necessary, indoor air treatment (Luengas et al., 2015). Although several technologies can be considered for indoor air treatment, generally these possess some disadvantages such as high energy consumption, waste generation and harmful by-products production (Luengas et al., 2015). Therefore, new indoor air technologies are required to overcome these limitations. Among several new technologies and solvents that can be considered, ionic liquids and eutectic solvents have gathered special attention due to their high sorption capacity, unique thermophysical properties, and being easily tuneable by the simple combination of anions and cations (Yan et al., 2019). On top of their inherent characteristics, one can further enhance gas physisorption by preparing mixtures with positive deviations to ideality and, therefore, positive excess volumes (Martins et al., 2020). Furthermore, the absorption capacity of the selected non-volatile solvents (NVS) can be improved by immobilizing and encapsulating them in microcapsules, and afterwards by using a physical support for immobilization of said encapsulated solvents in the form of membranes (Silva et al., 2022).Therefore, the main goal of this work is to consider NVS that can remove indoor air pollutants, like gases and VOCs, taking advantage of their properties through the combination of absorption with membrane technology, thus creating a new and viable solution for the improvement of IAQ. To achieve this goal, the experimental work focuses on gases solubility measurements in different NVS mixtures using the isochoric method and gases membrane separation. Parallelly, optimizations are performed regarding the encapsulation of NVS, as well as the characterization of NVS that can show promising potential for gases absorption and, ultimately, be considered as an option for the treatment of indoor air.

Keywords: *Indoor air quality, Air pollutants, Indoor air treatment, Non-volatile solvents, Membrane technology*

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Recovery of platinum group metals from spent automotive catalytic converters

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Abstract. The Critical Raw Materials (CRM) list of European Union highlights Platinum Group Metals (PGM) - platinum, palladium, rhodium, osmium, iridium and ruthenium - as high supply risk materials (IEA – International Energy Agency, 2020). The production of automotive catalytic converters (CC) is the most relevant application of PGM (IPA - International Platinum Group Metals Association, 2012). CC are responsible for the neutralization of pollutants produced by combustion, consisting on a ceramic or metallic carrier coated with alumina (Al2 O3) and an active layer of PGM (Pt, Pd, and Rh). The substrate also contains metal oxides such as ceria (CeO2) and lower concentrations of other rare earth elements (REE). In recent decades, due to the increasing of global vehicle production and stricter environmental regulations, the number of spent automotive catalytic converters (SACC) has grown rapidly (ICCT - The International Council on Clean Transportation, 2017). As a result, SACC are now an important waste management challenge but are also a potential secondary source of strategic and critical materials. Despite their criticality and value only around 50% of PGM from SACC are recycled in the EU (Bahaloo-Horeh ; Mousavi, 2020).
The primary method used industrially to recover PGM from SACC is the pyrometallurgy. However, hydrometallurgy presents a more environmentally friendly alternative due to its ability to recover metals from low-grade sources, limited gaseous emissions, and milder process conditions (Saguru et al., 2018). Nevertheless, further advances in hydrometallurgy are still needed particularly in the leaching stage, where the use of highly acidic solutions can be hazardous. Thus, my PhD thesis aims to develop a sustainable, cost-effective, and efficient hydrometallurgical process that aligns with the principles of circular economy for the recovery and separation of PGM and REE from SACC. "Water-in-salt"electrolyte solutions will be used as lixiviants, while ionic-liquid-based aqueous biphasic systems (IL-based ABS) will be evaluated as a potential strategy for PGM purification and recovery. Ultimately, the work aims to reduce environmental waste production and transform SACC into a valuable source of raw materials through the integration of Molecular Dynamics simulations with experimental work.

Keywords: *Circular economy, Recycling, Critical metals, "Water-in-salt" solutions, Ionic liquids*

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A COSMO-RS based approach for predicting the solubility of vanillin in aqueous mixtures

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Abstract. Vanillin (3-methoxy-4-hydroxybenzaldehyde) is a phenolic compound, widely used as flavour that presents antioxidant activity (Arya et al., 2021) and anti-inflammatory effects (Cheng et al., 2017). Given that the solubility of vanillin in water is much lower than in organic solvents (Shakeel et al., 2015), increasing its solubility could allow a more sustainable extraction of vanillin from its natural source using aqueous mixtures, also benefiting the incorporation of vanillin into water-based products from pharmaceutical and food industries. In this regard, co-solvents and hydrotropes could be used to achieve this enhancement in the solubility.

In this work, the Conductor-like Screening Model for Real Solvents (COSMO-RS), a model based on quantum chemistry and statistical thermodynamics, was used to predict the solubility of vanillin in mixtures of water and organic solvents. Two vanillin conformers were optimized, one aiming to increase the intermolecular interactions and the other aiming to decrease intermolecular interactions by rotating the hydroxyl group inwards. The conformer weight was adjusted to fit experimental solubility data of vanillin in water or organic solvents. For the ternary mixtures, the conformer weights were calculated using a linear regression considering the conformer weights fitted for the pure solvents. The model required as input data only the experimental solubility in the pure solvents, enthalpy of fusion and melting temperature of the solute.

For all ternary systems tested, the solubility curves predicted by adjusting the conformer weight to solubility on the pure solvents were better than those calculated with the default distribution of the conformers by the model, that systematically predicted much lower maximum solubilities. The comparison of the solubility predictions and the experimental results indicates the model was able to better predict the interactions in solvents with longer carbon chains.

Keywords: *Phase Equilibrium, Solubility, COSMO-RS*

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New sustainable approaches to eco-recycling of polyesters wastes into novel (bio)degradable polyesters.

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Abstract. With the growth of bio-based polymers' research and development, the concern about their end of life is also growing, as some of them also tend to be persistent in the environment for many years. Poly(ethylene 2,5-furandicarboxylate) (PEF), derived from C6 sugars like D-fructose or D-glucose,(Loos et al., 2020) is widely known to be a viable alternative for conventionally used poly(ethylene terephthalate) (PET), mainly due to its relevant thermal and mechanical properties (Araujo et al., 2018; Gandini et al., 2009; Sousa et al., 2015) as well as standout barrier features, such as a 19-fold reduction in CO2 permeability compared to PET.(Burgess et al., 2015) Despite its expected large scale production soon, its end-of-life is generally overlooked.
Recently, we reported the design of a urea:zinc acetate (U:Zn(OAc)2) Deep Eutectic Solvent (DES) system for a continuous, mild, and close-loop recycling approach from PEF into recycled PEF (rPEF). First PEF was depolymerized by glycolysis using U:Zn(OAc)2 DES as reaction media under mild reaction conditions; repolymerization was then carried out in a novel one-pot approach, without additional catalysts or purification steps, yielding rPEF with a 69 % yield. When titanium(iv) tert-butoxide (TBT) was added as a co-catalyst , a maximum rPEF yield of 91 % was achieved.
A process' optimization, showed that U:ZnOAc2 in a 4:1 molar ratio provided the best results with almost 85 % PEF depolymerization (based on PEF weight loss). Additionally, the main intermediate products were identified using advanced spectroscopic techniques, such as gas chromatography-mass spectroscopy (GC-MS).
The proposed recycling approach confirmed, for the first time, the potential of DES to catalyse PEF's de-/re-polymerization in a continuous way. Ongoing work comprises the optimisation of this greener recycling process including the assessment of the crystallinity and granulometry of the starting material. Furthermore, the process has also been tested in other polyesters such as poly(propylene 2,5-furandicarboxylate) (PPF), promoting a more circular approach also for these polymers' end of life.

Keywords: *Poly(ethylene 2,5-furandicarboxylate) (PEF), Deep Eutectic Solvent (DES), Chemical Recycling, Polymers' End of Life.*

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Aqueous Biphasic Systems: Novel Strategy for the Nasal Delivery of mRNA

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Abstract. Biopharmaceuticals play a crucial role in the treatment of various diseases and conditions that cannot be addressed with traditional pharmaceuticals. These types of drugs are derived from living organisms, such as bacteria or mammalian cells, and are used to treat complex diseases such as cancer, autoimmune disorders, and genetic diseases. In recent years, the field of vaccine development has undergone a revolution thanks to advances in nanotechnology, allowing the production of high-quality nucleic acids and the creation of efficient in vivo lipid-based delivery systems. In particular, in vitro transcribed messenger ribonucleic acid (IVT-mRNA), commonly referred to as "third-generation vaccines", hold immense potential to address clinical needs that have not yet been met. [1] In this PhD, nanocarriers were developed to enhance the delivery across the mucosal layer of the nasal epithelia. Moreover, a novel strategy for the delivery of biopharmaceuticals was developed, using aqueous biphasic systems (ABS) comprised of biopolymers with phase-forming components with gelling ability. The selected ABS are composed of a combination of gelatin and maltodextrin, biopolymers which are innocuous to human health and are proven to enhance the mucosal passage of nanoparticles. This novel approach allows a transfection rate of 90% in upper airway epithelial cells, indicating its promising clinical impact.

Keywords: *Biopharmaceuticals, mRNA, Nasal vaccine, Aqueous biphasic systems.*

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Chemistry

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Brines as a promising source of critical raw materials

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Abstract. Seawater is a complex mixture rich in several elements important to marine life and industrial use. The salinity of water is directly related to the number and concentration of elements in its composition. Brine is generally described as hypersaline water containing high salt concentrations (between 170 and 300 g/L) (Zavahir et al. 2021). Brine can be produced by human activities such as traditional salt extraction and in desalination plants and is still considered a waste. However, brine contains critical raw materials (CRMs) important for industrial use, classifying it as a resource-rich by-product. The CRMs listed by the European Commission and found in this matrix are Co, Li, Mg, B, and Sr (European Commission 2020). Sorption is one of the most efficient and widely used approaches to separating or recovering elements from water due to its low cost, wide range of applications and high efficiency for several metals, flexibility in design and operation, and the possibility of regeneration (Pereao et al. 2018). The use of chitosan as a sorbent has gained importance since it can be considered both an economical and environmentally friendly solution. However, chitosan in its original form is less suitable for practical uses given its relatively low mechanical strength. Therefore, chitosan-based materials have been chemically changed in order to improve stability and increase removal efficiency. The main objective of the present work is to develop a sustainable alternative to recover CRMs from brines using chitosan-based materials and to evaluate the selectivity and regeneration of materials, as well as to provide information on the behaviour of elements in solution and on the functional groups of materials.
Brine solution obtained from traditional salt extraction in Algarve, Portugal was characterized after dilution with acidified water (ultrapure water + HNO3 2 %). Results showed that the solution has a high CRMs concentration following the sequence of Mg>>> B>> Sr> Li. Removal of Mg, Sr, and Li was initially evaluated using chitosan powder in brine and the removal was less than 10 %, evidencing the complexity of the matrix. Different synthetic materials, such as graphene oxide-polyethyleneimine (GOPEI), titanosilicate ETS-4, and manganese-ferrite (MnFe2O4-NPs) were also evaluated. The highest removal was achieved for Sr using GOPEI, corresponding to a sorption of 13.1 mg/g of Sr.

Keywords: *Biosorption, critical raw materials, hypersaline water, circular economy*

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Study of light-matter interactions in organic luminescent materials with in situ illumination NMR

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Abstract. Since ancient times, our ability to perceive specific molecules through the colors they display has been crucial to our survival. We have relied on our perception of color to differentiate between a clear blue sky and a sunset sky or a green apple and a red one. Over time, our understanding of molecules has been directly linked to our perception of color. The development of physics enabled us to understand the nature of light and the significance of color, including how different colors witness molecular differences. Chemistry has built upon this fundamental knowledge to produce molecules that exhibit a range of colors and interact with light in various ways. [1,2] In our work we study how light shapes molecules (Figure 1), by observing transformations with in situ illumination Nuclear Magnetic Resonance (NMR) [3], we examined the photophysical properties of benchmark photochromic materials and Excited-state Intramolecular Proton Transfer (ESIPT) dyes, as well as employing computational calculations [2] to understand these fundamental mechanisms. Like artisans, with this work we want to sculp molecules, design and synthesize novel organic dyes and light-responsive materials in a smarter and more efficient way.

Keywords: *Photo-NMR, in situ illumination NMR, ESIPT, Photochromism*

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Moderate Pressure Pasteurization – a new methodology for raw pork meat nonthermal pasteurization

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Abstract. Raw meat is a highly perishable food due to its elevated water activity (aw), neutral pH and rich nutritional composition, which create an ideal environment for microbial growth and therefore raise significant safety and economic concerns (J. Simpson et al., 2019). Moderate pressure pasteurization, MPP, has been recently propose as a new slow, pressure-based pasteurization methodology for heat- and pressure-sensible food, such as raw meat (Lemos et al., 2022).
In this regard, pork minced was pasteurized using MPP (125, 165, 200 MPa) at uncontrolled room (15 to 25ºC) and refrigeration (4ºC) temperatures, to evaluate its efficiency. The results of microbial inactivation/pasteurization and quality parameters like colour were analysed. MPP gradually reduced inoculated microorganisms loads, Salmonella enterica and Staphylococcus aureus, up to 6.3 and 4.4 log units at 200 MPa, respectively, thus ensuring the meat's microbial safety. Even though higher microbial reductions were observed for other pressures, at 125 MPa/RT only mild colour changes were observed, very similar to raw meat. The combination of MPP with refrigeration temperatures neither improved microbial inactivation or colour retention.
These results hint MPP as an interesting methodology for raw meat pasteurization, for being capable of reaching microbiological safety without colour changes, a characteristic that no other technology is able to guarantee. Also, MPP has a reduced impact on the physicochemical parameters of raw meat such as pH, drip loss and water holding capacity. At last, this technology requires low energetic outputs for meat pasteurization, increasing its viability at industrial level.

Keywords: *Raw Meat; Shelf-life; Colour Preservation; Moderate pressure pasteurization*

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Development of a Modified Kröhnke Pyridine Synthesis

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Abstract. Pyridine is a useful precursor for the synthesis of multiple pharmaceuticals and agrochemicals, being also employed in chemical reactions as enabling solvent and/or reagent. The pyridine moiety is also an essential pharmacophore and can be found in more than 7000 existing drugs.[1] The Kröhnke pyridine synthesis is a method that allows the synthesis of these highly desirable nitrogen heterocycles. The mechanistic backbone of this methodology is the reaction of an ,-unsaturated carbonyl with an -pyridinium methyl ketone salt, commonly known as Kröhnke salt, through a Michael reaction.[2,3]
About 60 years old, this methodology did not suffer many evolutions since its first discovery. Therefore, we saw the potential to uncover unknown capabilities of this simple synthetic method. By using ether-tethered ,-unsaturated carbonyls, we could synthesise pyridines maintaining the pyridinium moiety that in the standard mechanism would leave during the formation of this heterocycle. This could open the door for the insertion of one amine group from the same nitrogen source that allowed the formation of the pyridine.
In this work, we present the development of a modified Kröhnke pyridine synthesis enabling the preparation of 2-amino-3-phenylpyridines (Figure 1). The optimized reaction conditions to synthesize these molecules will be described and discussed, as well as some limitations of this method throughout the reaction scope. To enforce the potential of this new methodology, we present some applicabilities of the obtained pyridines as well.

Keywords: *Pyridine, Kröhnke*

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A prospective nature-based process to recover technology-critical elements from complex aqueous mixtures

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Abstract. As the demand for electric and electronic equipment increases, so does the need for elements of high economic and technological interest such as rare-earth-elements (REEs), cobalt, lithium, and other technology-critical-elements (TCEs) [1]. Still, primary TCEs source causes serious environmental concern. Secondary sources (e-waste, acid mine drainage (AMD)) are also considered waste streams, however, these residues are a rich source of TCEs, which can be recovered and re-introduced into the production cycle [2]. The use of living seaweed as a biosorbent has been highlighted with the potential to recover TCEs from contaminated waters [3], yet most studies focus on removing a single element from simple solutions (synthetic water, containing one element or a small specific group of elements). The main objective of the present work was to evaluate and optimize parameters affecting the efficiency of the biosorption process performed by Ulva sp. in a complex mixture of contaminants: simulated lamp industry effluent (Y, Eu, La, Ce, Tb, Gd, Hg, Pb, Zn, Cu, Co, Cd, Pt) in a matrix with high ionic strength, at different contamination levels (10, 100 and 190 µg/L). Optimization followed the Response Surface Methodology with a Box-Behnken Design. In addition, the elements' behaviour in the solution was evaluated as well as their allocation in the seaweed (biosorbed and/or bioaccumulated).

Ulva sp. presented high removal efficiencies for all elements (central point conditions > 75%) except for Pt and Cd. Results for the central point showed a low coefficient of variation (< 1.2%), which guarantees the reproducibility and feasibility of the results. For REEs, at an exposure time of 24 h, the optimal conditions obtained for the evaluated response (removal, %) were: 5 g/L of Ulva sp. (fresh weight) at salinity 15 and an initial concentration of 10 µg/L, allowing to remove 71-87% of REEs from the complex mixture. The cell partitioning of the sorbed elements, via selective extractions with EDTA, showed that most of them were located on the external surface of Ulva sp.. Characterization methods, such as FTIR and SEM analysis, support EDTA results, exposing a clean seaweed surface post-washing procedure.

The present study revealed that living seaweed can be the basis of an efficient, greener, and low-cost technology to remediate complex effluents containing potentially toxic elements, REEs, and platinum group metals. Further investigation showed that Portuguese AMD have REEs levels in the same order as the ones herein evaluated, featuring a single process with several application prospects.

Keywords: *Seaweed, biosorption, technology-critical elements, response surface methodology, cellular partition*

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Bioinspired complex coacervate-based for underwater adhesives for biomedical applications

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Abstract. Tissue adhesives are a novel approach to replace standard techniques currently used on surgical closure [1]. Standard surgical closure techniques involve the use of invasive procedures which entails further drawbacks, specifically, secondary tissue damage, microbial infection, and fluid loss [2]. Several strategies have been employed to develop materials that meets all the necessary criteria to be used in clinical practices. However, most of the approved tissue adhesives fail into achieving adhesiveness under wet environments, since water acts as a boundary layer between the patch and tissue, reducing drastically their interaction [3]. Nonetheless, many marine organisms have orchestrated a powerful wet adhesion mechanism through covalent bonding and multiple supramolecular interactions [4]. In this context, complex coacervation, used by sandcastle worm to glue sand particles plays a major role in the mechanism behind natural adhesion [5]. Here, we propose the development of a complex coacervate, composed by chitosan and hyaluronic acid grafted with a thermoresponsive polymer (PNIPAAM). The smart complex coacervate exhibits tunable mechanical properties and fluid-hydrogel transition, which can be controlled through temperature variation. This characteristic affords the possibility of injecting the coacervate as a solution prior to tissue contact, where it subsequently undergoes a sol-to-gel transition, thus functioning as a tissue adhesive.

Keywords: *Surgical adhesives; Biopolymers; Tissue Engineering; Complex coacervates*

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Ru([9]aneS3(2-phenylquinoline)Cl2 as a potential discrete ruthenium complex against leishmania

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Abstract. Leishmaniasis is a parasitic disease that affects roughly twelve million people around the globe, with tendency to increase in incidence and geographical distribution in the coming decades. Pentavalent antimonium compounds and amphotericin B are the most widely prescribed medications to treat this condition but these drugs have severe toxic effects, causing anaphylaxis and death in extreme cases. For this reason, new treatments are urgently needed.
The use of ruthenium complexes has demonstrated to be a promising strategy, mainly because of ruthenium's unique set of characteristics such as redox properties and low toxicity due to chemical iron-mimic properties and transferrin binding. In tandem, the ligands play an important role in safety and activity against Leishmania. Examples include cis-[RuII(2-O2CR)(dppm)2]PF6 complexes (1) (R1 = butylbenzene; R2 = methyl(p-tolyl)sulfane or R3 = 2-methoxy-5-methylphenol) (Costa et al., 2017) and a group of ruthenium (II) complexes bearing lapachol (2) (Barbosa et al., 2014). For the family 1, small changes in the R group were shown to bring relevant changes in the ability to inhibit infectivity. Moreover, the use of labile ligands such as dimethyl sulfoxide (DMSO) and chloride seems to be a safer choice (Fandzloch et al., 2017) than, for instance, phenylphosphine groups. Another aspect to take into consideration when preparing ruthenium complexes is the oxidation state of the metal, with Ru(II) represents the bioactive form that is, consequently, more potent (Fandzloch et al., 2017).
This work aims at synthesising an active mononuclear Ru(II) complex bearing a tridentate ligand (trithiacyclononane, 9S3), two labile chloride ligands and an active alkaloid ligand, 2-phenylquinoline (Fournet et al., 1993). The choice of the face-capping tridentate ligand is because it can form air and moist stable complexes, as well as its well-established preparation (Marques et al., 2009): refluxing RuCl3 with DMSO, precipitation, and subsequent reaction with 9S3 in refluxing ethanol. This precursor can be isolated through crystallisation and used for the reaction with the 2-phenylquinoline ligand in ethanol reflux. Reactions are performed under nitrogen atmosphere and the resulted compounds will be characterised by 1H and 13C NMR, infrared spectroscopy (FT-IR) and mass spectrometry.
For future work we aim to synthesise ruthenium polynucleate complexes and metal-organic frameworks to upscale ruthenium coordination and possibly use it as drug delivers.

Keywords: *leishmania, ruthenium coordination compounds, multifunctional compounds, metal-organic frameworks, monodentate complexes, polydentate complexes*

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Ph-PMO with wall-embedded nitroxide radical for DNP-NMR

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Abstract. Solid-state Nuclear Magnetic Resonance (ssNMR) is a powerful technique for analyzing the structure and dynamics of solid materials. However, its sensitivity is often limited by low spin polarization and weak signals. Dynamic Nuclear Polarization (DNP) NMR can enhance the NMR signal by combining microwave (MW) irradiation and free radical polarization. However, DNP-NMR sample preparation typically requires a three step procedure: i) the dissolution of the polarizing agent, ii) impregnate the radical solution to the solid material and iii) solvent evaporation to obtain a homogeneously distributed polarizing agent in the sample. This methodology presents some general disadvantages such as limited polarizing agent solubility in the solvent leading to poor homogeneity and reduced DNP enhancement, instability or reactivity of the polarizing agent with the sample, time-consuming sample preparation, and the dissolution process can influence sample properties or contaminate it. Regarding the study of the surface of porous materials DNP-NMR has also some specific drawbacks such as: limited polarization transfer to the surface of porous materials, relaxation times of NMR signals in porous materials are often very short and surface/volume ratio is often large and radicals are sometimes larger than pore size thus hindering homogeneous polarization of the sample. To overcome these disadvantages, alternative methods for introducing polarizing agents to study porous materials are being pursued. Herein, we aim at inserting radical molecules into the structure of porous sorbents through the synthesis of Periodic Mesoporous Phenylene-silica (Ph-PMO) with a wall-embedded monoradical. PMOs have a unique hybrid nature, featuring a high concentration of organic groups in the wall. Despite its potential suitability for adsorption applications such as CO2 capture, there is limited research on PMOs in the literature, particularly with regards to NMR studies to characterize their pore surface chemistry. To reach our goal, an isoindoline nitroxide monoradical was first silylated and then co-condensated with the 1,4- bis(triethoxysilyl)benzene precursor in the presence of a structural directing agent. The different synthesis steps were followed by Electron Paramagnetic Resonance (EPR) to understand the radical behaviour since the moment it was added to a solution until being bound to the silica-based matrix. EPR measurements combined with X-ray diffractometry and -196 ºC N2 adsorption-desorption isotherms showed the success of the radical incorporation on the Ph-PMO pore walls. This study fills a gap in the existing literature regarding the incorporation of radicals in PMOs, laying the foundation for further research in this area.

Keywords: *PMOs, ssNMR, DNP, Polarizing Agents, Porous Materials*

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Synthesis and characterization of Zn(II), Cu(II) and Co(II)-flavonoid complexes with anti-diabetic potential

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Abstract. Diabetes mellitus is a chronic metabolic disease that has an alarmingly high global prevalence, and it is linked to several health risks, including cardiovascular diseases (World Health Organization, 2016). Current treatments have limitations and drawbacks, highlighting the need for new therapeutical strategies. Several studies reported the anti-diabetic properties of flavonoids, making them attractive for the development of new drugs with anti-diabetic effect (AL-Ishaq et al., 2019). In this work we synthesized novel metal complexes, with Zn(II), Cu(II) and Co(II), and the flavonoids chrysin, morin and quercetin. Different and less explored synthesis methods were tested namely, solvothermal and microwave assisted synthesis. The complexes were characterized using various experimental techniques, such as X-ray diffraction, FTIR and FT-Raman spectroscopy, UV-vis spectroscopy, elemental analysis, and thermogravimetric analysis. The anti-diabetic potential of the metal complexes is currently being evaluated and the most relevant results will be presented.

Keywords: *Diabetes, metal complexes, flavonoids, solvothermal synthesis, microwave assisted synthesis*

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Tetrathiafulvalene-based Covalent Organic Frameworks as cathodes for lithium batteries

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Abstract. Covalent organic frameworks (COFs) are an emerging class of crystalline porous materials constructed from organic building blocks linked by covalent bonds. Due to their great chemical and structural, COFs have received a lot of interest towards applications in gas sorption and separation, catalysis or sensing.[1] More recently, 2D COFs have received particular interest for electronics,[2] optoelectronics,[3] and energy related applications,[4] due to the possibility of 2D -conjugation. The porosity of the COFs, combined with the electrical conductivity derived from the 2D -conjugation can lead to exciting new electronic related applications, unattainable with either 1D polymers or inorganic 2D materials.[5]Tetrathiafulvalene (TTF) and its derivates are organic molecules with outstanding electron-donor and redox properties, making them the ideal candidates as building blocks for the preparation of redox-active COFs for electronic and energy-related applications.[2] Herein we present a new family of TTF-based COF with different building blocks, in order to study the influence of the spacer between the TTF moieties on the electrical conductivity. The neutral and doped TTF-based COFs were characterized by multiple spectroscopic techniques in order to fully understand the charge transport mechanisms occurring in these materials. Finally, some TTF-COFs were explored as organic cathodes for lithium batteries.

Keywords: *Covalent Organic Frameworks; Conductive Materials; Tetrathiafulvalene*

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New photo active hybrid organic-inorganic ferroelectric materials for information and communication technologies

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Abstract. The overwhelming development of information technologies over the last few decades has boosted the world economy while profoundly altering people's lifestyles. The computing capability of devices has significantly increased, along with the rapid evolution of numeric processing technology, which is mostly driven by transistor scaling, or downsizing, resulting in increased density. However, the physical limits of the thermal dissipation, known as the 'heat wall', are already an issue for the global $4.5 \times 10^1 USD/year business$[1, 2].
$The global burden caused by the development and surge of mobile communication, artificial intelligence, hybrid cloud, machine learning$
$In such a constricted scenario, a radically different, novel, and bio-inspired, computing architecture is needed, and that must be based i$
$In essence, the new memory materials need to address the basic computing functions˘ namely write and read operations˘ at a much faste$
$In this work, the proposed strategy will be based on the photoisomerization of a suitable building block, leading to multiple, stable, ferroel$
$New ferroelectric materials are being researched looking for self-build hollow 2D hybrid structures, based on the nitroprusside ion as t$
$Such a strategy and ensuing research have already produced materials with potential for digital memory application, and valuable know$

Keywords: *Ferroelectrics; hybrid organic-inorganic materials; crystal structure; digital memory.*

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Chromeno[3,4-b]xanthones: on the way to a new multitarget approach for Alzheimer's disease

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Abstract. The Alzheimer's disease (AD) is a complex multifactorial neurodegenerative disorder, mainly characterized for the progressive and unremitting memory loss and cognitive, motor, and functional capacity [1]. To date, there is no cure or prophylaxis for this neurological disorder, as the clinically available drugs only provide limited symptomatic treatment and do not alter the course of the disease [2]. In fact, since 2003, only two drugs have been approved for AD by the fast-tracked approval of Food and Drug Administration (FDA) [3,4]. However, due to its high cost (an estimated value of up to $26.500 per year), many experts believe that the number of people that will be able to get the drugs will be extremely limited, particularly low-income and middle-income countries (LMICs), with under-resourced public health systems [5]. For this reason, there has been a worldwide effort to develop an effective and more affordable therapy for AD, such as small molecules, which are cheaper, more convenient to administer and widely accessible. To address this issue, in 2021 we disclosed a novel class of multifunctional chromeno[3,4-b]xanthone derivatives [6]. Herein, we describe the lead optimization effort to establish a complete profile of these compounds in vitro, including design, synthesis, anticholinesterase and antiaggregating properties, molecular docking studies and saturation-transfer difference (STD) binding epitopes and cytotoxicity in human neuroblastoma cell line (SH-SY5Y).

Keywords: *nan*

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Efficient removal of antibiotics from wastewater by spent brewery grains-based activated carbon

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Abstract. The occurrence and fate of antibiotics in the aquatic environment is a critical problem as they can potentially and permanently damage ecosystems and human health due to the promotion of antibacterial resistance. Adsorption by activated carbon (AC) has been proven to be an effective methodology for the removal of antibiotics from water. The use of industrial wastes as AC precursors, such as spent brewery grains, contributes to the sustainability of these adsorbents, avoiding the use of non-renewable raw materials. In addition, such impact may be further reduced by the utilization of microwave radiation instead of conventional pyrolysis in the production of AC, since it allows for a faster and more energy efficient process. Aiming at its application in tertiary wastewater treatment, a spent brewery grain-based activated carbon (AC-SBG) was tested for the removal of sulfamethoxazole (SMX), trimethoprim (TMP), and ciprofloxacin (CIP) from wastewater from a municipal treatment plant (WWTP effluent). For this purpose, AC-SBG was produced following the procedure previously optimized by Sousa et al. (2022). and characterized by analyzing total and inorganic carbon analyses (TC and IC, respectively), point of zero charge (PZC), and N2 adsorption isotherms for the determination of specific surface area (SBET) and microporosity. After that, the optimized material was applied in adsorption studies in buffered ultrapure water (pH 8) and wastewater (pH 8, conductivity of 6.78 mS cm-1, and dissolved organic carbon of 13 mg L-1). Kinetic and equilibrium adsorption experiments were run under batch operation conditions. Also, the effects of competition in multicomponent systems (binary and ternary) and at four pH levels (4,6, 8 and, 10) on the adsorptive performance towards the three referred antibiotics were evaluated. The obtained results revealed that adsorption kinetics was fast (equilibrium attained within ~60 min) and equilibrium isotherms were adequately described by Langmuir and Freundlich models (R2 up to 0.995). However, matrix effects were observed in the equilibrium and competitive adsorption studies in the WWTP effluent, with a significant decrease of the adsorptive performance (up to 75%) in comparison with ultrapure water. As for the effect of pH, it was found that the matrix pH played a key role in adsorption by controlling the surface electrostatic interactions between pharmaceuticals and AC-SBG. Overall, the need of results on competitive adsorption in wastewater and on the effect of pH to obtain increasingly representative results for real systems were evidenced.

Keywords: *Spent brewery grain; Waste-based adsorbents; Fractional factorial design; Pharmaceuticals; Water treatment*

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Understanding CO2 sorption mechanisms in cellulose and chitosan aerogels

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Abstract. Carbon dioxide (CO2) is the primary greenhouse gas emitted by anthropogenic activities and is a major contributor to global climate change. Mitigating global warming requires a significant reduction in CO2 emissions. Several technologies have been proposed to remove CO2 from the atmosphere or flue gases, with amine-scrubbing being the most commonly used method at an industrial-scale. However, amine-based liquid absorbents have drawbacks such as poor chemical stability, environmental impact, and high-energy regeneration requirements [1]. An alternative technology uses solid adsorbents, which offer lower regeneration energy requirements and improved durability over multiple cycles, both of which are critical cost drivers for CO2 capture technologies [2].

Large-scale implementation of carbon capture technologies requires the availability of, low-cost and ultimately renewable, CO2 selective materials . Polysaccharide-based adsorbents meet these requirements, making them promising candidates for this use. Nonetheless, CO2 capture mechanisms in these materials remain largely unknown.

In this work, CO2 sorption mechanisms on cellulose and chitosan aerogels were investigated by solid-state NMR spectroscopy and DFT calculations. A combination of 1D 13C cross-polarization (CP), 2D 13C-{1H} LG-CP HETCOR and CP kinetics NMR experiments were performed to characterize confined chemisorbed and physisorbed CO2 species. First-principle DFT calculations aided the NMR assignments of different adsorbed CO2 species. Our results show that cellulose aerogels adsorb CO2 purely via physisorption processes, while chitosan aerogels capture CO2 through both chemisorption and physisorption processes. Chemisorbed species in chitosan aerogels were assigned as ammonium carbamate and carbamic acid species. These findings contribute towards a better understanding of the adsorption processes in these materials, and are a crucial step towards improving the performance of these biobased and sustainable solid sorbents.

Keywords: *Aerogels, Polysaccharide, Carbon capture, Solid-state NMR, DFT calculations*

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Dynamic HA-functionalized G-quadruplex based supramolecular hydrogels to bioengineer perfusable 3D constructs

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Abstract. DNA is a fascinating macromolecule in nature that can be used as a highly adaptable building block to accurately assemble sophisticated supramolecular nanostructures. Among them, G-quadruplexes, ubiquitous noncanonical four-stranded structures formed in guanine-rich DNA and RNA sequences which regulate multiple biological roles [1-3], have served as a source of inspiration for the development of supramolecular architectures for bioapplications owing to their distinctive self-assembling characteristics. The building blocks of G-quadruplexes are G-quartets (G4s), formed by Hoogsten-type hydrogen-bonding interactions between four guanosines (G) in a square planar arrangement and stabilized via metal coordination by resorting to alkali metal cations such as K+ and Na+. Furthermore, a higher-order self-assembly is achieved by the - stacking of the G4 monomers obtaining a columnar four-stranded helical structure, which can be extended to generate an entangled self-assembled nanofibrillar network capable of retaining a large amount of water leading to the formation of a supramolecular hydrogel [4].Herein, a novel dynamic hyaluronic acid (HA)-functionalized G-quadruplex supramolecular hydrogel denoting self-healing, thermo-reversible, injectable and conductive properties was successfully developed at physiological pH by exploring the hydrogen bonding and - interactions between four guanosines (G) coupled via dynamic boronate ester bonds to 3-aminophenylboronic acid-functionalized HA (HA-PBA) and stabilized by K+, as demonstrated by a combined experimental-computational study. Furthermore, the well-known instability of the self-assembled G-quadruplex structures was explored to produced interconnected, size and shape tunable perfusable microchannels when embedded in virtually any kind of photocross-linkable supporting matrices at physiological conditions, without the need for any chemical or physical stimuli. A higher number of viable cells and their migration towards the hollow microchannel were denoted by the microchannel-embedded 3D constructs when compared to the 3D bulk construct, which suggests their potential use as artificial vessels for enabling the diffusion of nutrients and oxygen essential for cell survival. The versatility imparted by the proposed approach opens new avenues for novel applications in drug delivery, tissue engineering and regenerative medicine.

Keywords: *G-quadruplex supramolecular structures; Hyaluronic acid; Boronic acid; Dynamic hydrogels; Biocompatible perfusable platforms*

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Synthesis of redox-active MOFs as electrode materials for energy storage devices

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Abstract. One of the main concerns of current society is reducing our dependence on fossil resources. One potential solution is to develop electrical energy storage systems such as lithium-ion batteries (LIBs) to store renewable energy. However, the energy density of LIBs is limited by the energy density of conventional electrode materials.[1] Metal-Organic Frameworks (MOFs) are composed of inorganic and organic building blocks linked by strong coordination bonds. Because both inorganic and organic moieties may be redox-active sites during the electrochemical process, they have the potential to be used as electrode materials in LIBs and fuel cells. MOFs have recently been studied as anode, cathode, and electrolyte materials for LIBs.[2] MOFs are usually insulators, and because of that much emphasis has been made on the construction of ionically and electrically conductive MOFs. An electrode requires high electronic conductivity with reasonable ionic conductivity, whereas an electrolyte requires high ionic conductivity.[4] The many organic linkers that may be used to construct multidimensional metal-organic frameworks offers up multiple options for boosting redox activity in such materials.

Keywords: *Metal-Organic Frameworks; Energy Storage; Li-ion BatterieS*

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Structural features and health effects of water-soluble organic matter from atmospheric fine particulate matter

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Abstract. Atmospheric particulate matter (PM) exposure has been recognized as a key public health issue, being associated with increased risks of lung cancer, cardiovascular, and respiratory diseases [1]. Moreover, PM exposure has been shown to affect the immune system, leading to an increased susceptibility to infections, or exacerbating other pre-existent lung diseases [2]. The main mechanisms through which atmospheric PM can affect the human health include the induction of reactive oxygen species (ROS) that trigger or exacerbate inflammatory responses, and/or PM related direct cytotoxicity [1]. These toxicological effects have been associated with PM concentration, and its composition in metals, solvent extractable organics, and water-soluble ions [3,4]. Although not receiving much attention by the research community, the fine aerosol water-soluble organic matter (WSOM) has also been recognized as capable of mediating cellular ROS generation [5,6]. Furthermore, WSOM can account for a significant portion of the overall fine PM mass, and it is therefore of great importance to better understand the impacts of the exposure to this PM fraction.
Therefore, this PhD work aims to: (1) establish a better understanding of the daily, seasonal and spatial variation of the chemical characteristics of the WSOM present in atmospheric fine particulate matter (PM2.5) collected in two distinct locations at the west coast of Portugal, within the district of Aveiro (an urban location and a rural location); (2) evaluate the direct cytotoxicity as well as the immunomodulatory and oxidative potential of WSOM from PM2.5; and (3) establish a link between the structural features of the studied WSOM samples and the biological effects they elicit.
The results available at this moment on the daily variations of PM2.5 concentrations show that slightly higher concentrations are linked with the night periods at the urban site, whereas higher levels are observed during the daytime periods at the rural setting. In terms of the seasonality of PM2.5 concentrations, slightly higher concentrations are observed for the summer season at the urban location, whilst higher values are associated with the winter season at the rural site. Regarding the spatial variation of PM2.5 concentrations, similar values were observed during the night periods in the summer season at both locations. During the summer day periods, however, higher PM2.5 levels were observed at the rural location when compared to the urban environment.

Keywords: *Fine air particles, Water-soluble organic matter, Chemical characterization, Immunology*

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Synthesis, characterization, and biological evaluation of novel natural-based chemotherapeutic metallodrugs

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Abstract. Chemotherapeutic metal-based compounds (metallodrugs), such as cisplatin, are known for having powerful anticancer properties. However, several of them have significant side effects as well as a high cytotoxic profile or lack of selectivity [1]. Natural products, such as flavonoids, are a valuable source of anticancer agents. They can modulate reactive oxygen species (ROS)-scavenging enzyme activities, participate in arresting the cell cycle, induce apoptosis, autophagy, and suppress cancer cell proliferation and invasiveness [2]. However, flavonoids are also known for having poor bioavailability, fast metabolic path, and low absorption rates. In this context, the synthesis of new chemotherapeutic metallodrugs incorporating flavonoids may represent an alternative way for the design of promising anticancer agents, i.e., not only with improved bioavailability (enhancing their solubility, dissolution rate and permeability [3]), but also with reduced general cytotoxicity, enhanced efficacy, and greater selectivity [4]. Different copper and zinc complexes with flavonoids such as chrysin, quercetin or morin, together with N-donor ligands (1,10-phenanthroline and 2,2'-bipyridine) were explored by solvothermal and microwave-assisted synthesis (poorly explored methods), and fully characterized by different techniques (e.g. powder and single crystal XRD, FTIR/Raman spectroscopy, elemental analysis, UV/VIS spectroscopy and thermogravimetric analysis). The biological evaluation of these metallodrugs against malignant and nonmalignant cell lines (e.g. CACO-2, MCF-7, AsPC-1 or healthy fibroblast, HDFn) was also already initiated in order to assess their cytotoxicity and selectivity and select the best ones to be incorporated into biopolymeric nanosystems.

Keywords: *Natural-based metallodrugs; flavonoids; solvothermal synthesis, microwave-assisted synthesis, antitumor activity; selectivity.*

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Solar-driven photocatalytic removal of antibiotics from wastewater using carbonaceous magnetic nanocomposites

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Abstract. One of the major public health risks of the 21st century is associated with the spread of bacterial resistance, to which the presence of antibiotics in the aquatic environment contributes. The development of efficient treatments for the removal of antibiotics from aqueous effluents is essential to reduce their entrance in natural waters. Some of the most consumed antibiotics, and therefore present in wastewater, are amoxicillin (AMX), ciprofloxacin (CIP), sulfamethoxazole (SMX) and trimethoprim (TMP), which are of have been included in any of the watch lists published in the context of the European Council Water Framework Directive (3rd watchlist (Decision 2020/1161) and 4th (Decision 2022/1307)). Sunlight radiation can be considered as sustainable way to effectively remove these antibiotics from wastewater, inducing their photodegradation. However, this type of treatment currently lacks the efficiency required for a widespread implementation. Thus, its application has been mainly laboratory-based. To enhance antibiotics' photodegradation under sunlight, this work aims to develop efficient photocatalysts with their subsequent application at a semi-pilot scale. As such, semiconductors (e.g., titanium dioxide) doped with carbon dots and imparted with magnetic properties, which allow for their easy recovery and reuse, are being synthesized. Currently, the work is focused on the production of the photocatalysts and the determination of the photolysis kinetics of the four mentioned antibiotics. Afterwards, the rate of antibiotics' concentration reduction in different water matrices and the photocatalysts' efficiency will be assessed in terms of mineralization and antibacterial activity reduction. Special attention will be given to the photocatalysts' reutilization, which is allied with the green chemistry principles and materials circularity.

Keywords: *Emerging Organic Microcontaminants, Photodegradation, Photocatalyst, Carbon dots, Antimicrobial resistance, Water treatment*

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Civil Engineering

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Geosynthetics for Sustainable Cities: 3D models and mechanical damage

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Abstract. Geosynthetics have increasingly been used as a reinforcement material in a variety of geotechnical engineering applications (e.g., roads, railways, foundations, steep slopes, retaining walls). Reinforced soil relies on the transference of stresses from the soil to the reinforcement elements. Thus, in design, it is key to understand how mechanical damage of the geosynthetics influences the stress-strain(-time) response of geosynthetics and the soil-geosynthetic interaction.
This project includes collecting high-quality experimental data, performing laboratory tests and from the supervising team, on the stress-strain response of geosynthetics and soil-geosynthetic composite, before and after damage. Tensile tests will be performed to access the in-isolation properties of the materials. Triaxial tests will be carried out to characterize the soil-geosynthetic interaction. Similar numerical tests, using the finite element method, will be carried out, implementing relevant constitutive equations. The tests will be validated using the experimental data collected. Parametric numerical tests will be performed. Finally, a general approach will be described to model common geosynthetic reinforcement structures, making use of validated nonlinear ; time-dependent models, aiming to contribute to a more efficient use of both geosynthetic and natural resources.

Keywords: *Geotechnical Engineering, Geosynthetics, Numerical Modelling, ABAQUS.*

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Study of Ravines in Collapsible Soils of Luanda, Angola

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Abstract. This paper aims to study the various forms of water erosion (rills, gullies and ravines) that have occurred on the "muceque"soils or red sands that dominate the top of the plateau of Luanda, Angola. The red sands are soils with collapsible characteristics and metastable structure, prone to erosion phenomena that have caused much damage to the foundations of buildings, roads and airfields, with significant socio-economic consequences for the Angolan population in several provinces of Angola. Soil erosion is a natural process which consists of the detachment of particles from the soil mass and their transport by erosive agents (water or wind) to another location. The thesis will be developed in six chapters: Introduction; Literature review; Research methodology (field and laboratory research, integrated analysis (soil erosion risk assessment)); Research results; Discussion and Conclusion. The literature review carried out to date aims, on the one hand, to strengthen the demonstration of the topic's relevance and, on the other hand, to identify some works that have been developed related to the problem under study. The literature review was conducted by accessing the following databases: Scopus, B-on, Science Direct, Google Scholar and Repositories. It is important to note that the literature review is under development, while the field research, laboratory research and integrated analysis will be developed later. The second part of the research (which includes field and laboratory research as well as integrated analysis) will be developed in two phases; the first phase will consist of field visits, mapping of the study area, collecting samples and carrying out field tests and experiments as well as the risk survey. The second phase will be dedicated to laboratory tests, risk assessment completion and thesis preparation. The ongoing research is part of the preparation for the PhD Thesis in Civil Engineering entitled "Study of Ravines in Collapsible Soils of Luanda, Angola". It is important to note that this study also intends to analyse some techniques of gully treatment and verify/test their use in muceque soil. However, this study intends to contribute to a deep understanding of the nature of the gullying phenomenon in this particular type of soil (red sands) and, consequently, to generate prevention/mitigation measures for the negative impacts resulting from the gullying problem.

Keywords: *Sheet erosion, rills, gullies, barrocas, ravines erosion, collapsible soils.*

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Micro-reinforcement of coarse granular aggregates

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Abstract. As railways around the world become more intensively trafficked, maintenance costs increase. Railway tracks have not changed significantly since their implementation in the XIX century. As a result of geology, ballast track can easily be adjusted to compensate for the swelling and shrinkage of a clay sub-base. However, ballast is made of particles and voids. Under cyclic load, particles will move and rearrange, generating contact forces. If these forces exceed a certain limit, there will be breakage, powdering, and other forms of ballast degradation. Thus, along time with the increase of the number of load cycles, ballast becomes degraded losing its desired functions and enabling deviations from the design geometry (Indraratna et al., 2011). Maintenance operations are used to restore the initial properties of the ballast and stop the continuous degradation process (Selig ; Waters, 1994). In the last few decades, several proposals have emerged to improve the performance of ballasted railway track. These proposals are centered generally on either impregnation with polyurethane, resins or bitumen, or the use of geogrid type reinforcements within the ballast and/or sub-ballast layers. However, these reinforcement techniques present some problems such as increased track stiffness and loss of ductility. In the case of reinforcement with geosynthetics, maintenance operations may destroy the reinforcements, making them ineffective. Therefore, the development of new track bed solutions that have better longevity and resilience and enable maintenance operations is key. Micro-reinforcement using engineered fibres or particulate inclusions such as tyre shreds has huge potential for improving the performance of coarse granular materials used, for example, as a road base or railway ballast (Ajayi et al., 2017; Arachchige et al., 2022). This PhD project aims to develop understanding of the micromechanics of micro-reinforced coarse granular materials. The form of the micro-reinforcement will be optimised to increase its effectiveness. The resulting understanding of how different micro-reinforcements stretch and deform, restrain the movement of grains and influence packing will be used to develop analytical models for the mechanical behaviour of the reinforced composite, which will be used to further optimise the form of the micro-reinforcing elements (at industrial scale) and inform future design guidance.

Keywords: *Ballast track, Triaxial test, Micro-reinforcement, Geosynthetics*

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Partition walls: Innovative approach through sandwich panels

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Abstract. Modern construction faces new challenges in the 21st century due to the increased demand for building construction and renovation. Manpower is insufficient, and the available resources are not optimised. As construction becomes increasingly industrialised, it is essential to evolve towards more sustainable and cost-effective solutions, and improved construction worker conditions [1]. This work proposes a new modular sandwich panel system – the wall panels are factory manufactured and sent to the construction site, where they are easily and promptly assembled to produce the interior partition walls. The principal advantages of developing new (sustainable) solutions are: construction speed (faster than conventional), costs reduction, increased quality control, resources optimisation, and increased sustainability [2]–[4]. This work's scope is the development of new constructive solutions based on the pillar of social sustainability: it can directly promote the enhancement of construction workers' health, safety, and quality of life. So it is anticipated that more people will be attracted to work in the sector, 80% fewer health issues, including accidents, when compared to conventional construction [5], [6] and a greater gender balance will be achieved. This study also includes a review and clarification of construction and sustainability concepts, which are often ambiguous. The modular sandwich panel wall presented in this research is made of extruded polystyrene board (XPS) core with three different facesheets options: gypsum plasterboard (PGC), fire resistant gypsum plasterboard (PGF) and magnesium oxide board (MGO). This research includes an experimental research for evaluation of the wall requirements in terms of mechanical resistance and stability, fire safety and airborne sound insulation between adjacent rooms. Due to the interfaces between the different materials, experimental testing is conducted to ensure the results' reliability [17]–[20]. Several studies have been conducted on the development of new solutions for load-bearing walls such as sandwich, composite and modular systems [7]–[16]. Mechanical resistance testing includes impact resistance tests, simple compression load tests, sanitary appliance load tests and endurance cycle load tests. Fire resistance testing allows to assess the integrity and thermal insulation maintenance of the panel wall. Acoustic experiments aim to determine the weighted standardised sound level difference (DnT,w) between adjacent compartments. Mechanical resistance tests show that the panel wall has acceptable mechanical performance, including the connections between the panel wall modules. Results demonstrate that fire resistance and sound insulation characteristics of the panel wall can be enhanced.

Keywords: *Sandwich panel wall; Modular construction; Interior partition wall; Experimental testing; Sustainability in Construction*

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Communication Sciences and Technologies

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Youth and New Media - Information Consumption and Political Participation

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Abstract. Considering that today's youth are the citizens that will make tomorrow's collective decisions, this study aims to analyze the relationship of young people residing in Portugal with the new media. Specifically, this study intends to understand the habits of information consumption and political participation and expression in online contexts, as well as which themes are relevant, to the younger generation. This is a relevant matter considering that social media is the platform in which young people conduct a more assiduous consumption of information, despite relying more on traditional media to report the news correctly (Pérez-Escoda et al., 2021; Russmann ; Hess, 2020) , since in social media the news simply "appear"among social and entertainment content (Peters et al., 2022). It is relevant to understand this phenomenon since news plays a key role in encouraging participation and building public opinion (Klopfenstein Frei et al., 2022). The veracity of information is a question on the order of the day, and exposure to misinformation content is a problem that concerns researchers and society in general because it generates disbelief in political and media institutions, such are emerging health risks associated with the consumption of fake news as anxiety and stress (Herrero-Diz et al., 2021).
For the development of this research, a mixed methodology was chosen, that is, qualitative and quantitative methods will be used, respectively the data collection instruments focus groups and survey by questionnaire. The research will highlight three age groups: teenagers (15 to 19 years old), emerging youth (20 to 24 years old), and young adults (25 to 29 years old) to analyze their relationship with these issues at different stages of youth. This study will be divided into three stages. The first stage will be a bibliographical analysis and contextualization of the population, the second stage will be a phase dedicated to the exploratory study through a focus group and the third stage will be dedicated to the construction and implementation of an instrument of data collection (a survey by questionnaire) with a sample so that these data can be studied statistically to describe and relate the variables under investigation. It is considered that that research results have the potential to contribute to the construction of media literacy and political literacy programs that will serve the new generations.

Keywords: *Youth, New Media, Political Participation, News*

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A Promoção da Empatia em Assistentes Inteligentes para iTV através de Comportamentos Proativos

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Abstract. The integration of voice assistants in devices belonging to the television ecosystem (Set-top-boxes, Smart TVs, ...), has simplified the accomplishment of more demanding tasks, such as the search for specific contents (Abreu et al., 2020). However, this type of assistants is restricted to merely reactive behaviours and present a reduced human and empathic dimension in relation to the users. In other application domains, there has been an increasing integration of proactive behaviours, which can counteract these barriers and, consequently improve the respective User Experience (UX). Therefore, it is considered that integrating proactive behaviours, in which the assistant is able to anticipate possible user needs and intentions (after analysing its context) (Zhang ; Sundar, 2019), could reduce user-assistant interaction effort in the TV context and bring an additional "human"layer to assistants. This will have the potential to make these systems more empathetic and lead to a more natural, friendly and efficient use and, consequently, to an improvement in UX. Considering this problematical, the following research question was formulated:
"What proactive behaviours can be integrated into an intelligent assistant for interactive TV to promote its empathy?"
In order to answer this research question, we intend to conceptualise, prototype and evaluate a set of proactive scenarios of a voice assistant for TV (used in the home environment) in order to promote its empathy and improve the associated UX. To this end, the development research method (De Villiers, 2012) is used, combined with an iterative user-centred design approach (ISO, 2019), in which each phase of the process focuses on user needs. The first phase, already completed, aimed to better understand the predisposition of users for this type of interaction (proactive) and how to design these behaviours. For this purpose, two focus groups were held (with potential users and experts) to discuss the relevance of a set of proactive scenarios for TV (illustrating situations of daily life of viewers) and get clues on how to design these behaviours in order to be efficient and avoid feelings of intrusion. The results showed that most of the idealized scenarios were relevant and useful for the participants, however it will be desirable that some characteristics can be preconfigured regarding the type of communication and the mediation of the intrusiveness of the proactive suggestions.

Keywords: *Assistentes Inteligentes, Proatividade, Ecossistema Televisivo, Empatia, Experiência do Utilizador*

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Sharing and visualisation of meteo-oceanographic information for the maritime safety promotion: a case study in the Aveiro's estuary

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Abstract. Besides coastal and oceanic navigation, maritime navigation also occurs in inland waters. In inland waters, it is frequent to find waterways with poor signalling, in which there are zones of very low depth that may result in vessels' grounding and loss of control with impact in its safety and on human life. In this context, the bathymetry and meteo-oceanographic conditions' knowledge and sharing have the potential to promote maritime safety and to allow the anticipation of decision-making and risk communication (D. M. Carvalho, 2023), which benefits longitudinally scientific research.

Ria de Aveiro, a lagoon located in the center of Portugal with inconsistent tidal levels, challenges navigation due to the channels' water depth that can differ at the same moment of the day (Dias et al., 2021; Picado et al., 2022). These phenomena and the channels' sedimentation still hinders the maritime activities in this lagoon (Lillebø et al., 2011), despite the installation of navigational aids on the Ria's main channels in December 2021 (Polis Litoral - Ria de Aveiro, 2021), excluding other streams and estuaries with high heritage and touristic value.

From the wide range of maritime technology available on vessels, the potential that sharing the meteo-oceanographic data acquired by navigators (Soares et al., 2019) can have on the maritime community and stakeholders (e.g. hydrographic institutes and academia) sometimes is disregarded. Therefore, combining the data sharing with a crowdsourcing approach to validate it through the navigators' experience (Di Luccio et al., 2020), can aid coastal and inland navigation.

Resorting to a case study methodology and a contextual design approach, a technological solution applied to a national case study, Ria de Aveiro, is being conceptualised, prototyped and will be validated, fostering maritime safety and tourist exploitation, which can be replicated in multiple other contexts. The inherent infocommunicational process, which can be hindered by external environmental factors (situational visual impairments, e.g., direct sunlight) (D. Carvalho, 2021), will be particularly focused to improve the navigators' experience with a technological system. This technological system is a low-cost solution, which will integrate IoT and crowdsourcing approaches, to promote maritime safety in inland and coastal waterways, through the acquisition, communication and sharing (in real time and deferred) of meteo-oceanographic data.

At this moment, a maritime navigation simulation station is being developed to support the algorithm development to access the sensor data and share it to an interface that will be conceptualised and validated by experienced navigators.

Keywords: *Maritime navigation, sharing and acquired data, Ria de Aveiro, IoT, inland waters, navigator-generated content*

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Playable Characters In Digital Games: A Model To Create Playable Characters Empathic Characters

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Abstract. The research aims to understand and systematize playable characters' attributes in digital games capable of triggering Empathy in the Player, pointing out as the main result the proposal of a methodology for the design of empathic playable characters. The problem that motivates the research is the lack of a methodology for designing empathic characters. However, a player's identification with a game character is a known and observed phenomenon. This research is conducted following Grounded Theory methodological principles wherein a first phase of the study, besides the bibliographical analysis, a document analysis of playable characters throughout the history of digital games is carried out. Then a survey is applied to gamers' online social networks to assess players' preferences regarding character characteristics. Based on the results obtained in the collection and the questionnaire, laboratory tests are carried out to quantify players' empathic responses to the behavior of the characters designed, considering the preferences measured.

Keywords: *Playable Character, Digital game, Empathy*

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O envolvimento de estudantes do ensino superior por meio de tecnologias de interação e estratégias narrativas em cabo verde

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Abstract. Abstrat
The communication between teachers and students in the teaching-learning process plays a fundamental role in the effective transfer of information and the formation of future generations (Freire, 1996). However, it is essential to ensure the active involvement of students in this process. Concerns have arisen among teachers regarding student engagement and concentration during classes, as well as the misuse of technology for non-educational purposes (Deci ; Ryan, 2013).
Based on the success achieved by some technological platforms in educational mediation, the objective of this project is to develop a platform that supports the teaching-learning process at different moments (Huang et al., 2019). To achieve this goal, experiments will be conducted with technological mediation using two approaches: one that has already been tested, for which there are several available tools such as Slido, Kahoot, and Socrative, allowing for specific questions to be asked during the teaching process (Wang ; Tahir, 2020); and a second innovative approach that uses narrative as a central element, involving characters, events, and fictional worlds, which play a crucial role in capturing students' attention and influencing their cognitive processes (Cunha ; Zagalo, 2008).
This research project will be conducted in Cape Verde, following the Design-Based Research (DBR) methodology, with the aim of understanding the relevance of interaction through narrative technologies in the engagement of higher education students at the University of Cape Verde. Qualitative and quantitative data will be collected through observations, questionnaires, and interviews with the participants. Data analysis will be conducted iteratively, allowing for the improvement of the platform's design throughout the process.
It is expected that this work will provide clear indicators of student engagement and contribute to a better understanding of how interactive technology, supported by narrative elements, can positively influence the teaching-learning process. Furthermore, it is expected that the developed platform will become an effective tool for promoting communication between teachers and students, thereby improving the quality of education in higher education.

Keywords: *Envolvimento, envolvimento de estudantes, design narrativo, design interação, tecnologias educativas*

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An infocommunication model for social and emotional learning of high school students: a multicase study in Aveiro and Barcelona

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Abstract. Digital technology can support social and emotional competencies development. The education laws in Portugal (2017) and Spain (2020) have highlighted the necessity of a "ready-for-the-future"student. However, common sense points that technology is doing the opposite and destroying mental health, mainly from adolescents.This study seeks to understand which infocommunication characteristics digital technology should contain to facilitate the development of social and emotional competencies upon 12 years of compulsory education. For this, it aims to deliver an infocommunication model, through consensus of elite using Delphi process (Gordon ; Pease, 2005), that can be applied in digital technologies to enhance social and emotional learning (SEL).SEL (CASEL, 2023) is based in results that improve mental wellness, healthy behaviors, and lifetime outcomes up to 18 years later (Taylor et al., 2017). The questions that arises are: given the emergency of the theme and the empowerment it can cause in society in general, can SEL be potentiated by using digital mediation? Taking in consideration the use of mobile phones in a personal sphere, what gaps can be filled in order to sup-port the adolescents to be socially and emotionally healthier?As main contributes, the research will (i) produce new knowledge with an Iberian infocommunication model that can potentiate SEL for adolescents; (ii) create a European multi-disciplinary approach both original and with social impact on society; (iii) correlate findings of studies in English, Portuguese, and Spanish.The method will combine a systematic literature review, survey application, visits to the schools, and conduct interviews with teachers and educational experts and combine the findings into a model.Also, to show the relevance of the theme, it is proposed a benchmarking of digital mobile apps in Google Play and Apple Store databases aims to enhance the capacity building for social and emotional competencies by using the Hirsh-Pasek scale (Hirsh-Pasek et al., 2015). These findings will also be part of the state-of-the-art.It is possible with this research to establish a landmark for the advance of knowledge and create a socio-economical impact in an interdisciplinary research field by consolidating an Iberian infocommunication model highlighting the characteristics of the technologies that are available, used, and present in the routine of class-rooms, showcasing the opportunity to engage and potentiate social and emotional competencies development.

Keywords: *Digital Technology; Social and Emotional Learning; Infocommunication Model; High School*

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Women representativeness and participation in the development of live streaming videogame culture: inclusion and gender equality

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Abstract. New ways of playing and consuming video game content have been the target of academic research as well as new interaction models associated with players, being live streaming one of the most recent phenomena (Orme, 2022). This type of entertainment has gained great popularity through live streaming platforms, so several studies explore the motivation that makes generate this phenomenon of audience between players and spectators (Taylor, 2018). Although these platforms are available to any community of gamers, this gaming experience in the live streaming model carries with it prejudice and discrimination towards women regarding access, acceptance and representativeness (Cullen, 2022). The norms of the live streaming culture, as well as the very resources of the streaming platforms, support sexist, misogynist and anti-feminist beliefs and behaviors still inherited from a culture still present in the videogame universe (Ruberg, 2021), which leads to believe that the space of women in this scenario is still restricted and labelled by misogynist standards (Cullen ; Ruberg, 2019).
From this context, the following research question was conceived: "How could an action plan contribute to combat the lack of representation of women in the participation of the development of the live streaming culture of video games generating more inclusion and less prejudice?".
Thus, this project aims to analyze the participation of women in live streaming, focusing on discrimination, exclusion, prejudice, and the female stereotype. It aims to build an equal action plan in broadcasting to minimize exclusion patterns and increase female representation in this context, encouraging female players. To this end, it will apply action-research methodology through collaborative and participatory design methodological approaches with female players and creators of live streaming content. The fieldwork will be divided into two phases, the first being a netnographic approach, with analyses of the live streaming transmissions, and the second ethnographic, in a cyclical way with the female players. The goal is to co-create the broadcast model with the target audience, evaluating its integration and operationalization with the female gamer community. This is expected to contribute effectively to the inclusion of women in the gamer culture and to break down barriers of gender discrimination.

Keywords: *Feminism, Genre equity, Inclusion, Live Streaming, Representation, Videogame.*

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Dig2Phy: Fostering the creation of phygital pedagogical approaches

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Abstract. Schools can be the changing point within a society shaped by the "double effect" of digital technologies that invoke transformations and challenges (Castells, 2023). The ongoing technological (r)evolutions that mark the current Information Era imply a continuous monitoring and adaptation towards the digital world, in particular by those in charge of the society's education: teachers (Ribeiro et al., 2020). Nevertheless, teachers' full integration in technologically-mediated infocommunicational processes is often hampered by technical, graphical, pedagogical and authorial barriers, time constraints, and the lack of technological and support infrastructures (Cravinho et al., 2022).

Concurrently, evidence suggests that students are more actively engaged in the learning process when teachers apply educational resources created by them (Castro, 2014). Moreover, the emergence of phygital (physical and digital) scenarios highlight the relevance of tangible approaches, which encourage the recovery of a (potentially decreasing) social interaction, since they promote a collaborative environment in the classroom and the development of transversal skills (e.g., decision-making and collaboration (Torres et al., 2021)). From the teachers' perspective, the students' engagement with the tangible resources can also act as a motivational driver to create their educational materials.

This research project aims to deliver a phygital solution that professionally engages Portuguese teachers of the 3rd cycle of Basic Education (7th – 9th grades) – by supporting them to autonomously handle digital technologies, embedding those in their teaching practices –, and promotes students' readiness for this century's challenges, such as the development of transversal skills, through the collaboration invoked in tangible scenarios. The Dig2Phy platform aims to assist the teachers in the creation of the tangible educational resources whilst promoting the development of their digital competencies, hence integrating the teachers' professional engagement in the practice of creating those resources. Simultaneously, based on the collaborative and attractive nature of tangible artefacts, as well as on the potential for students' academic success generated by the resources created by their teachers, the students' motivation regarding the application of the educational resources produced will be analysed.

Resorting to a design-based research methodology using mixed-methods, in a participatory design approach, teachers will be actively involved in the Dig2Phy platform's definition, design, implementation and evaluation, which aims to foster innovative phygital pedagogical approaches. Currently, through an online survey, teachers' digital competencies and pedagogical practices are being mapped, employing the DigCompEdu framework (defined and revised by experts from the European Commission), so that the Dig2Phy platform meets the teachers' needs and requirements.

Keywords: *Pedagogical approaches, Digital competency, Educational resources, Digital platform.*

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Digital health literacy in the decision-making of women with menstrual cycle irregularities: a study in the Colombian context.

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Abstract. Menstrual cycle irregularities are a common problem that can significantly impact women's health and well-being. Many women lack the information and resources they need to manage their condition effectively(4). This study explores digital health literacy (DHL) and its impact on health literacy and decision-making among women with menstrual cycle irregularities in Colombia (1,4). It adopts a multi-model approach that combines Social Cognitive Theory (SCT), the Integrated Behavior Model – Health Action Process Approach (IBM-HAPA), and Cognitive Load Theory (CLT). This approach allows for a comprehensive understanding of the cognitive-communicative factors that influence women's DHL through an intersectional lens(5). The study employs qualitative and quantitative data collection methods to gain insights into the socio-cultural context, individual experiences, and relationships between variables.The research involves the development of a face-to-face DHL educational program that targets specific communicative, cognitive, and behavioral processes identified by the analytic models. The effectiveness of this program will be compared with the use of digital platforms for self-management of menstrual irregularities in daily life. By adopting a comprehensive approach (3), the study aims to improve health outcomes, including health literacy and decision-making, while reducing health disparities among women with menstrual cycle irregularities.This research's primary goal is to explore DHL's impact on health literacy and health self-efficacy and their effects on quality of life, health outcomes, and health empowerment among Colombian women experiencing menstrual cycle irregularities. The proposed methodology adopts an intersectional approach, considering the intersecting factors of gender, sex, race, class, wealth, and ethnicity that shape Colombian women's experiences accessing healthcare and obtaining quality information (1,2,5).
This research aligns with the United Nations' Sustainable Development Goals (SDGs) of Good Health and Well-being (SDG 3) and Gender Equality (SDG 5) by addressing the digital health literacy and decision-making needs of Colombian women with menstrual cycle irregularities.
The study's current phase focuses on designing a face-to-face DHL program based on the multi-model approach. Pre-intervention measurements will be conducted before the intervention using DHL measures (eHEALS and TeLHS) and Self-Efficacy for Chronic Conditions Scale (SECDS). Subsequently, the intervention will be implemented, followed by post-intervention measures.

Keywords: *eHealth literacy, Women's health, Analytic models, Multi-model approach, intersectionality*

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Social Digital Games in Online Communities: The Impact on Older Adults' Digital Competences

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Abstract. As the world's population ages (WHO 2021), digital technologies also become increasingly ubiquitous for everyone (Eurostat, 2023). Digital games and online communities are part of this (re)volution, bringing new challenges in developing digital solutions that cater to this frequently overlooked ageing demographic for their preferences and needs in some of the most popular products (Nedeljko et al., 2021). Nonetheless, these two media – that have multiple benefits for active and healthy ageing (Sauvé ; Kaufman, 2019) – have not yet been studied in a synergetic way to impact older citizens' digital competences.
Therefore, resorting to an exploratory and mixed-method approach, following a Development Research Framework, this study aims to answer the research question "How can social digital games in online communities impact older adults' digital competences?". Aligned with sustainable development goals SDG#3, SDG#4, and SDG#10; and with the DigComp 2.2 Framework (Vuorikari et al., 2022) – which has great relevance in Europe, being at the basis of key competences for lifelong learning –, this project ambitions to contribute to digital and social innovation that potentially enables greater inclusion of ageing social groups in the challenges of today's digital society.
Divided into three phases, Phase-1 included a systematic review of the literature on the main topics that ground this research, and an (inter)national questionnaire to further characterize older adults' relationship and habits with (social) digital games – which, so far, received 390 responses.
Currently, Phase-2 involves conceiving and co-designing a social digital game prototype in partnership with Laboratório do Envelhecimento in Portugal. Through interviews, focus groups, creative techniques, and field notes, older adults' gaming habits and preferences are studied. Moreover, a questionnaire based on DigComp 2.2 was implemented and analyzed before interacting with technology. Additionally, 44 experts in ageing studies participated in a workshop to collect game-ideation results for the prototype. Currently, a digital social game prototype for the online community miOne (http://mione.altice.pt/) is being designed to improve older adults' digital competences.
Lastly, Phase-3 will assess the impact of the social digital game protype on older adults' competences, with the following expected results: (i) recruit and engage older adults with digital games and online communities; (ii) implement a functional prototype; and (iii) develop a model of recommendations for social digital games in online communities to improve older adults' digital competences. Also, this study aims to have an international impact by developing a product that meets the needs of wider audiences through a European Ph.D. program.

Keywords: *social digital games, older adults, online communities, digital competences, miOne.*

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Proposal of a communication model in serious games for maintaining the player's attention and interest, applied to a scenario of digital games in mental health

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Abstract. It is estimated that only 10% to 30% of players finish games (Matusiak, 2016), and the justifications for quitting are numerous from switching to a new game (Richards, 2020); its duration (Lovato, 2015; Richards, 2020) or decreased attention span (Lorenz-Spreen et al., 2019).
In the case of mainstream games, the impact of quitting is reflected in the game's reputation and in the sales value, while in a serious game the major consequence is related to the failure in passing the knowledge between the game and the player, thus not achieving the main objective of this type of game.
Framed in the area of Communication Sciences and Technologies (CTC), this research aims to develop a communication model that contributes to the mitigation of the dropout of narrative digital games, especially in serious games, by acting in the player's engagement.
At the methodological level, this proposal presupposes the construction of the communication model, with support in the analysis of case studies (Leedy ; Ormrod, 2005) of narrative digital games with higher completion rates, as well as in the collection of opinions of players and game designers, through interviews. Subsequently, a prototype of a playable serious game, in the domain of mental health, will be developed to demonstrate and validate the model. Additionally, will be carried out interviews with mental health experts in order to best address the topic at hand. In the context of testing, experience tests will be conducted on the prototype with the support of narrative digital game players. The entire project will be developed using the methodology Design-based Research (DBR) (Hoadley ; Campos, 2022).
The proposed model will be a contribution in the area of CTC and in the construction of scientific knowledge, namely in the scope of maintenance and engagement, for narrative digital games to be completed and, especially, for serious games to be able to make their communication effective and thus convey the pedagogical messages they intend, and the model can be replicated in the future. It is believed that the prototype will be an asset in demonstrating which approaches are appropriate to use when dealing with mental health games.

Keywords: *Narrative, Game design, Keeping attention, Information retention, Serious games*

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Empowering scientists to communicate science - the case of small-scale biological collections

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Abstract. Biological collections play an important role as non-formal educational environments that promote scientific literacy. They create more opportunities for people to be informed, interested, scientifically enlightened and able to make better choices in future. However, the managers and curators of small-scale (usually university) biological collections are frequently academic researchers that are not trained to communicate science to general public and have minimal resources and time to do so. The project here presented focuses on empowering these researchers with science communication tools supported by a digital platform and framed by a network communication strategy that will promote synergies and interaction among biological collections and with the public. The development of the network communication strategy is sectioned into three stages: science communication tools, digital platform, and pilot study. During the first stage, science communication tools for the context of biological collections will be developed and/or adapted from existent ones. Subsequently, in the second stage, a prototype for a digital platform will be designed to integrate these tools, as well as aggregate collections' general information. This will promote visibility and connection of different collections and their staff. In the third stage, the feasibility of the network communication strategy will be evaluated through its implementation in a real-context pilot study at the Biological Research Collection of University of Aveiro (CoBI) and the Insect Collection of University of Madeira (UMACI). With this project, it is hoped that efficient communication through biological collections will be facilitated, propagating the continuous flow of new information and communication of science. Consequently, it will also promote lifelong learning opportunities for both the public and the collection staff.

Keywords: *Scientific Literacy, Science Communication and Education, Biological Collections, Communication Empowerment, Digital Skills.*

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Evaluation of gamification strategies' impact in the information and communication services of cyclotourism for senior citizens

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Abstract. An interest in active and healthy ageing is being perceived (Bousquet et al., 2015) while senior citizens are becoming better consumers of digitally mediated products (Veloso ; Costa, 2021). However, even if a boom is observed in this field (Kostopoulos et al., 2018), there is still a lack of studies that address enjoyable activities, such as cycling and tourism and the impact on senior citizens' wellbeing. The aim of this study is to identify, conceptualize, implement and test gamified strategies that impact cyclotourism for active and healthy ageing. It intends to promote the development of physical and virtual cyclotourism environments that improve sociability, participation, and integration of senior citizens in communities; increase functional capacity and autonomy; preserve and enhance sociability through digital platforms; and inform and alter behavior towards sustainability.This exploratory sequential mixed-method research comprises a quasi-experimental study and is divided into a 3-step process. The first step is qualitative, and the research problem and intervention scenarios are analyzed and evaluated through literature review. The second step is quantitative and refers to the identification, development and testing of the gamified strategies in real and virtual contexts, where participants were divided into an experimental group (that tested the non-gamified experience, followed by the gamified experience) and a comparison group (tested the gamified experience, then the non-gamified). Participants aged 50 years or older were recruited to participate in indoor cyclotourism with virtual reality simulations and outdoor cyclotourism in Portuguese lanes and routes. In this step data was collected through scales and questionnaires (PANAS, EQ-5D-5L and xTAM). Lastly, the third step is mixed and related to the evaluation and comparison of results, crossing with the variables from the first step and results from the second step. Additionally, a set of interviews will be performed – with experts in the field of Game Design, Sustainable and Smart Cities, Mobility and Tracking Technologies, and Cycling Solutions – to complement the understanding of sustainability behaviors changes through gamified cyclotourism.It is expected that the effects of gamified cyclotourism strategies in both contexts enable not only the inclusion of the target audience, but also the recognition of sociability, health-related improvements and more sustainable habits. Moreover, it is expected that this thesis makes an important contribution to the information and communication field, through the creation of requirements and guidelines of gamified strategies, promoting active and healthy ageing. It can also lead to the encouragement and improvement of countries' infrastructure.

Keywords: *Active and Healthy Ageing, Cyclotourism, Gamification, Sustainability*

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Storytelling in women in IT communities: a empowerment and inclusion interdisciplinary study

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Abstract. Storytelling in women in IT communities: a empowerment and inclusion interdisciplinary study
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Abstract
Female tech communities have been some of the most important instruments of empowerment and inclusion in Brazil and Portugal over the past 12 years. These groups have common goals beyond the same language, such as the search for inclusion, education, empowerment of women in Science, Technology and Engineering professions in academia and in the job market. Based on an ongoing doctoral investigation, more than 100 groups were surveyed in these countries and informal monitoring was carried out in them for a year on the respective digital platforms (DP) in order to perceive organizational, operational and communicational characteristics. After this period, for about two years, case studies had been developed with São Paulo Women in Machine Learning and Data Science (full internal and external DP access), Minas Programam (transmedia storytelling model) and Geek Girls Portugal (interaction design study focused in Slack) to deepen the analysis in an ethnographic research method on internal and external DP, associated with participant observation, interviews and focus group. Fundamentals of Design Based Research (DBR) and design methodology guided the fieldwork.
The investigation question is "How the study of the human-computer relationship in female communities in technology, under the impact of transmedia storytelling, can it contribute to collective activism?". This research aims to: develop a theoretical model that fits the phenomenon of female technological activism in Brazilian and Portuguese communities.Based on the empirical work and the bibliographical survey that pointed out fundamental scientific domains for doctoral research – technofeminism (Wajcman, 2006) (Frade, Vairinhos, 2023), transmedia (Jenkins, 2009) and human-computer interaction (Carroll, 2013) – it reached preliminary results: relationship of problems and opportunities with the organization and impact of communities; classification of groups by objectives. A low-fidelity prototype intends to partially validate the framework, to propose the incorporation of transmedia and storytelling elements to improve and measure the impact of these groups' objectives.This research has the following contributions:• Filling a scientific gap in Technological Feminism studies in relation to the domains of Convergence, Cyberculture, Activist Transmedia, Storytelling, Interaction Design and human-computational relationship.
• Allow government entities, companies, educational institutions to carry out actions.
The research is framed in UN 2030 Sustainable Development Agenda objectives.
Keywords
Tech feminism; Online communities; Transmedia; HCI.

Keywords: *Tech feminism; Online communities; Transmedia; HCI.*

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Computer Engineering

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Skill Generalization in Reinforcement Learning

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Abstract. The goal of systems capable of generalising their knowledge is to learn how to handle complex new scenarios by selecting the relevant information from previous experiences. Humans and other life forms act on inherent assumptions concerning the nature of their current environment to predict the output of their actions when faced with new tasks. Generalization research focuses on finding methods to adapt appropriately to new, previously unseen tasks based on data already collected. Advances in this research field can lead to deploying autonomous agents that can learn from humans or even other agents in the real world. Our approach for learning transferable behaviours comprises three modules, and it uses a hierarchical model with discrete and continuous variables. This modular structure allows an independent training process for each stage. These stages are organized using a two-level temporal hierarchy. Our approach begins by extracting meaningful skills from the states of an expert trajectory, using a heuristic method, which are subsequently used by the skill learning and skill chaining algorithms. Leveraging the sequential order of the skills inside the demonstration, we propose a method to learn inter-skill transition policies to ensure the skills are appropriately chained. With this approach, we aimed to solve long-horizon sequential tasks with delayed rewards.

Keywords: *Reinforcement Learning, Deep Learning, Skill Learning, Skill Chaining*

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Context mixed reality for situated visualization – Enhancing the Situated Visualization Model –

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Abstract. Context mixed reality for situated visualization – Enhancing the Situated Visualization Model –
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Abstract. The context is critical in many areas, including visualization and augmented and mixed reality (AR/MR). Situated Visualization (SV), a method to represent data in a context, encompasses all the visualizations that change their appearance based on context, by considering the visualizations that are relevant to the physical context in which they are displayed [1]. AR/MR has the ability to display and interact with additional information, aligned with the real-world context. Therefore, SV is well suited for AR/MR and presents high potential in many situations, as is the case of supporting decision-making, collaborative tasks, situational awareness, assistance, training and maintenance.
However, the wide range of use of the SV concept, as presented in the literature, has led to inconsistent adoption of the concept and terminology [2]. Therefore, to take advantage of the SV and AR/MR connection and to ensure solid embracing of SV terminology and concepts, it is important to have a consistent and well-defined SV model. In particular, though some perspectives on the SV model have been proposed, such as space, time, place, activity and community [2][3], a complete systematization, covering the main definitions and perspectives has yet to be established. Hence, there is an urge to obtain a more comprehensive and updated description of the entire SV model.
This work examines and enlarges the established SV model in the AR/MR framework, and their respective perspectives and situatedness, with the aim of fostering some research discussion [4].
Keywords: augmented and mixed reality; situated visualization; conceptual model; perspectives[1] White, S.M. Interaction and Presentation Techniques for Situated Visualization. Ph.D. Thesis, Columbia University, New York, NY, USA, 2009.
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Keywords: *Situated Visualization, Augmented and Mixed Reality*

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Joint Optimization of Geometry and Texture for 3D Reconstructions Using RGB-D Data

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Abstract. Three-dimensional (3D) reconstruction is the creation of 3D models from the captured shape and appearance of real objects. It is a long-term topic of investigation and an active research subject in both computer graphics and computer vision fields (Kang et al.,2020), with numerous systems and algorithms, having gained importance in various areas, such as architecture, robotics, autonomous driving, medicine, agriculture, and archaeology. Indoor 3D models have great potential in object tracking and interaction, scene understanding, virtual environment rendering, indoor localization, and route planning, amongst others (Li et al.,2018;Zhou et al.,2018;Hermans et al.,2014}. The current state of 3D reconstruction of real-world scenes is still not adequate for many applications that require photorealistic quality, such as virtual reality (VR) and augmented reality (AR) experiences, and other human-centered applications. Furthermore, the best current solutions are very expensive, presenting high capital and logistical costs. The generation of indoor space models poses specific challenges due to the naturally complex layout of indoor structures, the intricate interactions between objects, clutter, and occlusions (Naseer et al.,2018). Sensor noise and outliers further complicate the reconstruction process, particularly in the presence of materials such as glass or mirrors, which are notoriously difficult to scan (Zhang et al.,2018;Liu et al.,2015). All these factors, and the complex relationship between illumination, materials, and captured appearance across the environment, make it quite challenging to produce indoor models automatically and robustly. This PhD aims to study and propose optimization-based methods for 3D reconstruction, resulting in complete virtual models with photorealistic quality. To this end, the proposed approach is to jointly refine geometry and texture. There are numerous variables, such as 3D geometry, camera poses and intrinsic properties, surface material, and lighting, that may be optimized. Hence, despite considerable efforts devoted to scene reconstruction, the problem remains challenging, given the extraordinarily large solution space. Our research has shown promising results in colour correction leveraging geometric data, and in the detection of reflective surfaces, allowing for the removal of noise in the model and realistic rendering of the light paths. Additionally, to gauge progress and showcase our results, we explored several objective metrics and their potential for textured 3D mesh quality assessment, comparing their performance in terms of correlation to the human visual perception of quality. Future work will involve the integration of these modules in a full 3D reconstruction pipeline, correcting texture and geometric anomalies to improve the quality and fidelity of the final reconstruction.

Keywords: *Computer Vision, 3D Reconstruction, Optimization, Color Correction, Material Estimation, Perceptual Metrics*

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Reliable and resilient 6G Edge computation through artificial intelligence

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Abstract.
To foster innovations in 6G Edge computation through artificial intelligence AI, the Portuguese government has taken a comprehensive approach to the policymaking, and recommendations on the adoption of AI in both the public and private sectors. Emphasis on priority areas with high Edge computing with AI potential is transport, manufacturing, agriculture, healthcare, and energy sectors. Edge and AI trust in autonomous cars may influence future government policies with innovative solutions in public and private domains. This research work will help provide research centers, businesses, and public organizations with shared knowledge.This research intends to boost the competitiveness of 6G Edge computation for vehicular networks and the automotive industry by resulting in increased automation and intelligence. This research work would lead to increased productivity, lower costs, and enhanced efficiency. Adopting objective and intelligent digital systems would also result in better decision-making, lowering the possibility of errors and expensive mistakes.

Keywords: *Reiliability, Resilience, Edge Computing, 6G*

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Establishing interaction Focus through Nonverbal Cues during Speech Interaction

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Abstract. Among humans, speech plays a vital role in providing an efficient and natural form of communication. However, communication goes beyond the verbal component, drawing on a wide range of nonverbal aspects, from how words are spoken to posture, gestures, or even facial expressions complementing or reinforcing the message (Saunderson et al. 2019). In a world where user-machine interaction is pervasive and growing, it's essential to develop new systems that can accommodate users' needs and provide innovative and attractive forms of interaction that can appeal to a variety of audiences. In this context, the consideration of nonverbal communication channels can potentially yield a more versatile, natural, and efficient level of interaction with machines. However, even though the literature has already addressed some nonverbal cues (e.g., gestures or facial cues), there are still a few challenges to be addressed regarding how these might be supported in our interaction with machines (Barros et al. 2023). Nowadays, smart environments are increasingly present in our lives and speech technologies play an important part in interaction scenarios since they are a non-evasive and natural form of interaction (Barros et al. 2022). When considering human-human communication, the destination of a message is established using a wide range of verbal and nonverbal cues including naming the person but, most often, this is done by just directing our gaze or even moving closer. However, when we consider speech interaction with systems (e.g., Alexa or Google Assistant), nowadays, they often require "wake-up"words (e.g., "OK Google") to understand that the message is directed to them, which is far from making the interaction between humans and machines as natural and efficient as it could be. In this sense, nonverbal cues can play a key role in setting the message destination more precisely in Human-Computer Interaction scenarios. In this work, we explore how an interactive system might be set as the target of a message, during speech interactions, by considering data from verbal and nonverbal aspects including speech, gaze orientation, head orientation and proximity enabling, for instance, that the system gets focus from the user just looking at it. Additionally, the proposed solution has been deployed as an interaction modality in the multimodal framework AM4I (Almeida et al. 2019) to support the interaction with a simple conversational assistant. This constitutes a first proof-of-concept of the proposal and materializes the grounds for its ongoing evaluation by users while interacting with the assistant.

Keywords: *Nonverbal Communication, Human-Computer Interaction, Multimodal Interaction, Focus of Attention*

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MEMORIA: A Memory Enhancement and Moment RetrIeval Application

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Abstract.
The continuous collection and storage of personal data, denoted Lifelogging, has gained popularity in recent years as a means of monitoring and improving personal health. One important aspect of lifelogging is the analysis of personal data (known as lifelogs) which can provide valuable insights into an individual's lifestyle, dietary habits, and physical activity. However, due to the variety of devices that can be used to capture these personal data, they tend to be highly heterogeneous, since they can include images, audio clips, coordinates, biometrical information or even documents [1].
This thesis explores several open challenges in the interdisciplinary research area of lifelogging.
The use of personal lifelogs can be beneficial to improve the quality of our life, as they can serve as tools for memory augmentation or for providing support to people with memory issues, through the visualization of lifelog data and contextual data extracted from personal lifelogs.
Several contributions have been made in this thesis, including the creation of solutions for pre-processing lifelogs, such as image quality assessment and filtering of visual lifelogs [2, 3], clustering of spatial coordinates obtained from GPS devices, and generation of trajectories based on these clusters. Additionally, transport mode classification, such as walk, car, bus among others has been developed to classify these trajectories.
With the extraction of relevant information from these lifelogs, a temporal event segmentation method based on hierarchical events has been developed, taking advantage of data previously processed in the system related to lifelog images. This segmentation can improve the search and retrieval of the lifelogs and the user interface for visualization and interaction of the lifelogger with the platform.
The final goal of this thesis is the development of a prototype lifelogging platform, called MEMORIA (A Memory Enhancement and Moment RetrIeval Application) capable of helping people in retrieving memories from their recorded experiences. The first version [4] was developed for participation in the Lifelog Search Challenge of 2022 , with the aim of evaluating this system and receiving inputs for future improvements, learning and gaining knowledge through this research community. Several performance and structural issues were identified. In response, significant changes were performed, such as pre-processing and image annotation, and new features were also incorporated, including event segmentation, more advanced search engine, free-text search, and location processing.
The MEMORIA prototype provides an open source and utilitarian lifelogging platform to support people in retrieving their memories and enjoying a more qualitative life.

Keywords: *lifelog, lifelogging, image processing, image annotation, data retrieval*

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Big spatial data integration and enrichment with provenance control

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Abstract. In the last few decades, we have witnessed a paradigm change in databases. For decades, the database environment was usually centralized. However, due to some technological developments, there has been a paradigm shift, and nowadays, the database field environment is more and more distributed. The in- creased use of devices (smartphones, GPS, among others) has led to a vast amount of data being generated daily, commonly called Big Data. A common characteristic of these data is the spatial components, which is a type of data with different characteristics compared to the standard. The volume of data brought many opportunities in knowledge discovery, as distributed and heterogeneous data may be combined and used to create high-quality models of events and phenomena.However, due to these characteristics, new challenges have emerged in data integration as well as questions regarding the origin and transformations involving the data. In an era where reliable data is vital, data provenance [1, 2, 3] becomes important to help understand the origin of the data and o infer data quality and veracity, which can be lost in the integration processes.This research question is: How to have data provenance in distributed environments? Consequently, this research entails an investigation involving dis- tributed and heterogenous databases while maintaining provenance information.From the solutions presented in the literature [4, 5, 6] for the centralised environment, it can be seen that it might be necessary to use annotations in the queries. In a distributed environment it is however important to understand if the query languages can be adapted to the annotations and how to use the annotation with so many different types of models and databases.To answer the research question presented here, a multiple-case-studies methodology [7] will be used in this research. This strategy is based on constructing theories and applying hypotheses in situations of multiple natures, leading to general results. The methodology tasks involve 1) literature review, 2) selection of the case study, understanding the requirements and data specification, 3) proposals formulations and 4) proposals evaluations.As a result of this research, a data provenance solution that can work in distributed environments, contributing to assessing the querying capabilities of existing languages and optimizers, as well as proposing required improvements and contributing to the different areas involved with the dissemination of the work, is expected to be formed.

Keywords: *Big Data, Databases, Spatio-temporal data, Data provenance, Distribtued databases*

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BioAnswer: Biomedical Information Retrieval and Answering System

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Abstract. Accurate and relevant information is crucial in biomedicine, where researchers, healthcare professionals, and practitioners need to stay up-to-date with the latest advancements, treatments, and medical technologies to make informed decisions in their daily tasks.However, the sheer volume and complexity of biomedical literature can make it challenging to quickly and efficiently find the necessary information. Furthermore, according to Klerings et al. [1], traditional information retrieval systems, which often rely on simplistic keyword-based approaches, can struggle to retrieve the most relevant documents. This is because these systems lack the understanding of the information need and cannot fully capture the nuances of the biomedical language. These limitations highlight the need for a more sophisticated biomedical information retrieval and answering system that can accurately identify and produce a supported answer to the users.In this work, we introduce BioAnswer, a Biomedical Information Retrieval and Answering System that leverages the latest advancements in Natural Language Processing (NLP) to create an intelligent retrieval answering system. BioAnswer is designed to help biomedical experts find the information they need in a more efficient way. To accomplish this, BioAnswer, firstly, leverages a neural information retrieval model [2] to identify the most relevant scientific articles that may contain the answer to a given biomedical question from the vast collection of peer-reviewed articles available on PubMed. It then uses an instruction transformer-based model [3, 4] to formulate a human-readable answer that is conditioned by the knowledge contained in the retrieved document.At the time of writing, BioAnswer is being used to participate in the BioASQ 11b international challenge [5], which evaluates the retrieval and generation capabilities of such systems. While the system has shown promising results, we identified some limitations that need to be addressed in future works. First, regarding answer quality, we acknowledge that if the retrieved document does not contain the answer, the generated answer may be misleading or incorrect. Additionally, inference times could be improved with the use of specialized inference code and larger computational resources.

Keywords: *Question Answering, Information Retrieval, Deep Learning, Language Model, Neural Relevance*

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CCAM Service Continuity in MEC federation scenarios

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Abstract. The emergence of Cooperative, Connected, and Automated Mobility (CCAM) is revolutionizing transportation systems around the world, utilizing advanced technology to enhance maneuverability, reduce pollution, and improve safety. CCAM is regarded as one of the most significant trends in the automotive industry today. However, implementing CCAM in Cross-Border Corridors (CBCs) or national Mobile Network Operators (MNOs) presents unique challenges that require innovative solutions \cite{el2022trust}.One of the most significant challenges in implementing CCAM in such scenarios is ensuring Service Continuity (SC) for mobile users, as maintaining SC is particularly challenging due to the diversity of territories, network coverage areas, international roaming agreements, and cooperative maneuvers involved. Addressing these challenges requires a comprehensive solution that encompasses the technical, operational, and regulatory aspects of SC \cite{barzegar2020service, agcurrent}.To tackle these challenges, a new architecture for CCAM SC was proposed and implemented, combining a federation of Multi-access Edge Computing (MEC) concepts to ensure SC in CBCs and amongst different MNOs. MEC provides a distributed computing infrastructure that enables efficient processing of data and services at the network edge, closer to the end-user. By federating MECs, SC can be maintained for mobile users, regardless of their location or the type of cooperative maneuvers involved.The proposed architecture leverages the benefits of MEC to provide low-latency, high-bandwidth connectivity between vehicles and the network edge, enabling real-time processing of data and services, such as cooperative maneuvering, traffic management, and vehicle-to-vehicle communication. Moreover, the architecture includes advanced security and privacy mechanisms to ensure the confidentiality and integrity of user data.

Keywords: *nan*

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@inproceedings{barzegar2020service, title="{Service continuity for CCAM platform in 5G-CARMEN}", author={Barzegar, Hamid R and El Ioini, Nabil and Pahl, Claus and others}, booktitle={2020 International Wireless Communications and Mobile Computing (IWCMC)}, pages={1764--1769}, year={2020}, organization={IEEE}}@article{agcurrent, title={Current 4G Networks Limitations Pleading for 5G for Cross-border CAM Services [5G-CARMEN]}, author={AG, Deutsche Telekom}}@article{el2022trust, title={Trust management for service migration in Multi-access Edge Computing environments}, author={El Ioini, Nabil and Barzegar, Hamid R and Pahl, Claus and others}, journal={Computer Communications}, volume={194}, pages={167--179}, year={2022}, publisher={Elsevier}}

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A Data-centric AI Solution for Detecting Burial Mounds in LiDAR Data

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Abstract. Mapping potential archaeological sites using remote sensing and artificial intelligence can be an efficient tool to assist archaeologists during project planning and fieldwork. This work explores the use of airborne LiDAR data and data-centric artificial intelligence for identifying potential burial mounds. The challenge of exploring the landscape and mapping new archaeological sites, coupled with the difficulty of identifying them through visual analysis of remote sensing data, results in the recurring issue of insufficient annotations. Additionally, the top-down nature of LiDAR data hinders artificial intelligence in its search, as the morphology of archaeological sites blends with the morphology of natural and artificial shapes, leading to a frequent occurrence of false positives. To address this problem, a novel data-centric artificial intelligence approach is proposed, exploring the available data and tools. The LiDAR data is pre-processed into a dataset of 2D digital elevation images (Guyot 2021, 103027), and the known burial mounds are annotated. This dataset is augmented with a copy-paste object embedding based on Location-Based Ranking (Verschoof-van der Vaart 2020, 293). This technique uses the Land-Use and Occupation Charter to segment the regions of interest, where burial mounds can be pasted. YOLOv5 is trained on the resulting dataset to propose new burial mounds (Berganzo-Besga 2021, 4181). These proposals go through a post-processing step, directly using the 3D data acquired by the LiDAR to verify if its 3D shape is similar to the annotated sites. This approach drastically reduced false positives, attaining a 72.53% positive rate, relevant for the ground-truthing phase where archaeologists visit the coordinates of proposed burial mounds to confirm their existence. The presented contribution is in accordance with the overall vision of the PhD research, which aims to establish comprehensive guidelines for efficient data management in the context of specific computer vision applications.

Keywords: *Archaeology; Object Detection; Deep Learning; LiDAR; Data-centric; Data Augmentation; Location-Based Ranking*

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Computer Science - MAP-i

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Vertical-aware and dynamic system orchestration

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Abstract. Modern Mobile Public and Private networks' evolution has been affected by the appearance of NFV and the move toward open network architectures. These consider using off-the-shelf customer hardware that makes up cloud solutions used by Telecom Industries. Industry Vertical Markets, also known as Industry Verticals or Verticals(TSG, 2020), refers to the businesses(e.g.: providers, vendors, suppliers) of specific Industry Domains. Since the plans for research into 5G were announced, several Verticals, e.g., Industry 4.0, Transportation, and Energy, have played a crucial role in the strategy defined by the European Commission for digitalizing and bringing automation to these different Vertical Domains (TSG, 2020; Connectivity for a Competitive Digital Single Market Towards a European Gigabit Society, 2016). The policies described by the European Commission towards that goal also created several funding calls through Horizon 2020 and Horizon Europe, which focus on bringing innovation to different sectors while exploiting experimental technologies like 5G and Beyond 5Gcommunication services as well as Mobile Edge Computing(MEC).Even though the different Verticals have been highlighted as essential for defining the various Communication Services to be provided, existing solutions for network automation and orchestration don't entail all of the characteristics of the type of service required by a particular Vertical. Moreover, they don't allow for flexible orchestration of the associated systems that compose the solution tobe offered as a Communication Service.This work presents the ongoing research work employing different network topologies and architectures, which were considered by the needs of different Vertical Industries(Industry 4.0, Transportation, and Energy) in the research projects I have contributed. The orchestration of these different static network architectures does not yet allow for variable/dynamic configurations. However, considering the concept and use of Network Slicing, it is possible to deliver tailoredcustom solutions to Industry Verticals.Existing contributions in this work focus on E2E 5G Slicing ; Orchestration, Machine Learning for NFV, Intent-Based Networking ; Network Automation,Open RAN and O-RAN Architecture implementations, Mec Federation, and Open RAN and O-RAN Architecture implementations, Mec Federation, and Vertical System Orchestration. This work discusses the different solutions researched and, in some cases, designed and orchestrated to tackle the need for industry-ready solutions from various stakeholders, leveraging the connection with Capgemini Engineering.

Keywords: *nan*

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Connectivity for a competitive digital single market - towards a european gigabit society (Commission Communication No. COM/2016/0587). (2016, Sept). EUROPEAN COMMISSION.TSG, G. (2020, July). Study on communication for automation in vertical domains (cav) (Technical Report No. 22.804). 3rd Generation Partnership

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Decentralized Security for Cooperative Maneuvers

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Abstract. Cooperative, Connected and Automated Mobility (CCAM) applications have the potential to enhance traffic safety and efficiency by using vehicular communications and vehicle automation technologies. Such applications can facilitate the decision and coordination of maneuvers among automated vehicles in a more efficient and secure manner than human drivers. However, this requires addressing the complexity of maneuver decision and coordination, which may be affected by wireless communication issues such as packet loss and misbehaving entities. Vehicular data, and specifically, maneuver data must be recorded for accountability purposes in case of any incidents or accidents.To address these challenges, a novel secure communication design has been introduced for the decision of general cooperative maneuvers and the distributed storage of related data using mechanisms based on distributed ledger technologies, combining the agreement required for coordinated maneuvers and the consensus required for distributed ledgers. The proposed system is designed to meet user and data privacy requirements while enhancing security and accountability. The system, called VERCO (VERifiable COoperation), employs a scalable geographical-based multi-layered blockchain architecture that supports high volumes of shared vehicular data. It is also potentially able to support other vehicular services.In addition to the blockchain architecture, an extension to maneuver coordination communication protocols has been developed to enable such vehicular blockchain-based architectures. The proposed architecture and communication protocol have been tested using hardware-in-the-loop (HiL) simulations with two ETSI ITS standard compliant on-board units (OBUs) deciding maneuvers in a lane-merging scenario. Experimental results show that the communication protocol is feasible, with an average delay of 34.68 ms, and that the proposed architecture is lightweight, with an average overhead of only 2.62 ms for two vehicles and less than 6 ms for dozens of vehicles.The proposed system offer a promising solutions to enhance the efficiency and security of CCAM applications. The VERCO blockchain architecture and the communication protocol for cooperative maneuvers offer scalability, security, and accountability while meeting user and data privacy requirements. The novel system that combines coordinated maneuver agreement and distributed ledger consensus also offers a feasible solution to handle large volumes of data generated by vehicles. These advancements can prove beneficial for the development and implementation of CCAM applications that can enhance traffic safety and efficiency.

Keywords: *Vehicular communications, Cooperative maneuvers, Data security, Consensus, Blockchain, Distributed ledgers*

Cultural Studies

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O papel da cerâmica chinesa na construção de uma imagem melhorada da China

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Abstract. Nos últimos anos, a China tem levado a consideração em Nation Branding, com a integração da sua cultura, para a construção e melhoria da imagem internacional do país. No contexto da iniciativa Uma Faixa Uma Rota e da estratégia Go global, um número crescente dos trabalhos académicos foca-se na importância cultural da cerâmica tradicional chinesa, como por exemplo, no contributo para a comunicação cultural entre China-Europa. Entretanto, encontram-se poucos trabalhos científicos dedicados à relação entre esse artefacto e a imagem nacional chinesa. Nomeadamente o papel atual e influência possível deste artefacto na construção da imagem chinesa na Europa. As relações diretas entre a Europa e a China começaram no século XVI com o comércio dos produtos chineses, incluindo a cerâmica. Apesar de ter perdido a vantagem única no mercado internacional de hoje, a cerâmica chinesa continua a fazer parte relevante da cultura chinesa e, na atualidade, a ter valores nas relações culturais entre China e Europa e na apresentação da singularidade da China.
Considerando tudo isto, desenvolveremos esta investigação para analisar a forma como este artefacto se pode assumir como instrumento cultural em nation branding, no caso da cerâmica chinesa em Jingdezhen. Além da análise do papel da cerâmica na construção duma imagem da China desde século XVI, centrar-se-á nas estratégias e ações relacionadas em torno da cultura cerâmica de hoje, com recurso dos métodos de análise documental, inquérito por entrevista semiestruturada e questionário. Será necessário ainda entender o mecanismo da receção do público-alvo sobre a cultura da cerâmica chinesa, para entender a viabilidade da cerâmica chinesa na dimensão cultural em nation branding.
Através do presente trabalho, esperamos contribuir para a área dos estudos culturais e das relações internacionais, para uma melhor compreensão nas relações culturais sino-europeia nos dias de hoje.

Keywords: *Cultura cerâmica chinesa, Jingdezhen, Nation Branding, Imagem da China, China-Europa*

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Cartography of Bear Resistances and Normativities: A Study in a Locative Media

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Abstract. In this investigation, we aim to cartography the resistances and normativities in individuals self-identified as Bears: men, mostly homosexuals, whose main characteristic is body and facial hair and a bulky body.
The idea of what makes someone a Bear is up for debate. Les Wright, a prominent scholar on this subject, talks about two main possibilities: the first focused on an alleged 'attitude' of kindness and tenderness, and the other focused on a specific body type – mainly fat and/or large body; abundant facial and body hair. However, Wright points out that each self-identified Bear subject fulfills the definition in his own way.
Our observation is towards users of the locative social network Growlr, an application for smartphones aimed at this audience. We intend to deepen questions related to the articulations between the processes of subjectivation and resistance in hybrid spaces, specifically in the context of Growlr, deepening the possibilities of interaction between urban and virtual spaces.
Growlr can be accessed by anyone using a smartphone, free of charge or through a monthly subscription, in exchange for benefits within the application, namely access to more users. The main objective stated by the tool is to enable 'real' encounters between men who have sex with men, whether straight, gay, or bisexual, who are geographically close. The application relies on the use of geolocation technology.
Our methodology is divided into three phases for further triangulation. In the first one, we carried out surveys disseminated through the application itself. The second phase consisted of collecting and analyzing public profiles of Growlr users. Finally, we will conduct interviews with those subjects who self-identify as Bears and who also uses digital platforms to build sociability. Our focus is on subjects living in the cities of São Paulo, Brazil, and Lisbon, Portugal.
So far, we have identified that it is difficult for fat men to recognize themselves in the monolithic image of the gay body. There is not a lot of representation in the media or in the gay community that makes a fat body desirable. It is through integration into this community that it is possible for "abject" bodies to reposition themselves, bearing in mind the possibility of overcoming difficulties and awakening desire.

Keywords: *Cultural Studies; Queer Studies; Gender Studies; Bear Studies*

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Gender and theater artists

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Abstract. In Portugal, for centuries, it was up to men to say what position women occupied in the performing arts. It was always men who assigned women to roles in plays they hadn't written or chosen, plays which, most of the time, represented women idealized by men, because the theaters were directed by men, the main performers were mostly male and the plays they acted in were written by men. Women were rendered invisible and kept away from such positions of power as those of directors, playwrights, or company directors.The present project focuses on Portuguese women artists in general, aiming to answer the following questions: Is there or is there not a high number of women in the world of performing arts? What role is allotted to these women and why do they not occupy places in the hierarchy considered by all of society to be places of power? And finally, can their life stories reveal the motivations behind this situation?This research has as its specific goal to identify and analyze the roles of Portuguese women artists and as its general goal to discuss theories and concepts related to gender issues and power relations in Cultural Studies, leading to effective societal interventions. In choosing to follow those methodological paths that provide the best fit between the object of study and the proposed objectives, the project has developed a multifaceted methodology.In order to pursue these research objectives, we conducted interviews with eleven women artists in order to try and understand what factors contribute to the fact that women who develop careers in the arts do not attain positions of power. The approach chosen is content analysis, which allows us both to validate and draw general conclusions from the reading of the interviews and to enrich the analysis by laying bare the contents and structures that enable us to understand why this situation has been a given and why it remains so today.
We conclude that, although all women accept that there is gender inequality in theater, some older interviewees justify this with an appeal to the notion of a meritocracy. The younger women, in contrast, are aware that inequality and the absence of women in places of power are something that has to be overcome, and they have already organized collectively to debate the issue.

Keywords: *Gender, Women, Theater, Power, Equality*

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Mulheres nas Bandas Militares em Portugal : Um estudo exploratório junto da Banda da Armada

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Abstract. Este projeto é um estudo qualitativo e exploratório, elaborado a partir do quadro teórico dos Estudos Culturais (Avtar 2007; Butler 2009; Bourdieu 1989;Foucault 1979 ; Hall 2013) que tem por objetivo principal compreender de que maneira se articulam nas mulheres da Banda da Armada as variáveis género e performance musical, em contexto fortemente atravessado por relações de poder, como é o caso do militar. Existem muitos mitos a cerca de um músico profissional: a figura do "virtuose", o "dom divino" ou que através de um treinamento sistematizado, com muitas horas de prática e repetições todos seriam capazes de alcançar o sucesso profissional, quando "na verdade, algumas pessoas, pela sua posição social, tem maiores oportunidades para desenvolver o seu talento." (Lewis, 2020, p.176).Uma das posições sociais à qual a autora se refere é o género. Tanaka (2018) afirma que, "quando falamos de mulheres na música estamos nos referindo a uma minoria que só nessa última década vem impondo sua visibilidade e tendo a coragem de enfrentar o sistema hegemônico com mais veemência" (Tanaka, 2018, p.13).Entre 1970 e 1980 ganha impulso o conceito de musicologia feminista (Cabedo 2009), a partir do qual se inicia um movimento para responder a lacunas como: onde estariam as mulheres durante todos os períodos da história música? o que faziam? qual a sua importância?
A carreira militar é uma oportunidade recente para as mulheres (Carreiras 1999, Monte 2020), sobretudo nas funções técnicas, como é o caso de tocar um instrumento. Somente em 2002, foi realizado o primeiro concurso na Banda da Armada portuguesa, aberto à participação de mulheres (Pereira 2008).O interesse académico pela temática das bandas civis e filarmónicas é recente, como afirma Pestana et al (2020), e a ligação entre as bandas civis e militares se deve principalmente ao fato de que a origem dos músicos militares reside justamente nas bandas civis e filarmónicas. Isto explica-se pelo fato de que as bandas funcionam como escolas de música por todo o país, inclusive nas localidades mais afastadas das capitais e dos grandes centros urbanos. (Correia 2006, Pereira 2008).
A investigação divide-se em três fase Revisão de Literatura; Trabalho de Campo; Análise e tratamento dos dados compilados e redação da tese.
Como principal resultado espera-se um conhecimento mais aprofundado das principais dificuldades e constrangimentos na integração das mulheres em bandas militares e produzir de forma colaborativa um manual de boas práticas, que possa ajudar a superar essas dificuldades.

Keywords: *Música e Género ;Mulheres na Música; Bandas de Música; Bandas Militares.*

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Comics at the Crossroads: an afrofuturist reading of the Orixá Exu

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Abstract. This summary analyzes the first chapter of the web series in comics Kairu-Edé: Guerreiro Fantasma, by Darwiz Bagdeve (2021), available on the platform fliptru.com.br. The narrative follows the young Kairu as he discovers his ori, "the divinity of each person's head and the bearer of his individuality" (Prandi, 2001,p.24). In this futuristic world, the states of the northeastern region of Brazil formed an independent nation.

Afrofuturism (Womack, 2013,p.9) is used to interpret speculative fiction inspired by Afrodiasporic Brazilian epistemologies. The methodology is guided by the notion of "crossroads" (Martins, 2021) to articulate the notion of "braiding" – linked to "iconic solidarity" – (Groensteen,2015) with the "caráter exusíaco" [exusiac character] (Simas ; Rufino,2019).

Assuming Exu as narrator and prologue, the narrative aligns comic book singularities with Yoruba cosmogony, producing cultural actualization and legitimation in terms of decolonial critique (Bernardino-Costa et al.,2020).

According to Groensteen, the "iconic solidarity" grounds the perception of the page layout in the comic as a networked composition. In this system, the "braiding" act as a bridge that "defines the internal series into a sequential plot" (Groensteen, 2015,p.154). In the analyzed chapter, interlacing operates without frames, relying on the "diachronic dimension of reading" (Groensteen, 2015,p.154), which is established in a page layout that interweaves the overlaps of the figure of Exu. In this way, the syntagmatic enchainment of the sequence functions simultaneously as a prologue to the story and as a reference to the role that the orixá plays in its origin stories. For as mediator, Exu is the channel of communication between gods and humans, "more than a simple character, Èù figures as an instauration vehicle of the narrative itself" (Martins, 2021,p.43). The option for this specific layout incorporates into the narrative project the "caráter exusíaco" [exusiac character]: dynamic, challenging, and unpredictable.

I propose that the initial chapter of Kairu-Edé: Guerreiro Fantasma (Bagdeve,2021) translates a significant part of the Exu's polysemy – performed in terreiros, quilombos, and other epistemologies of African matrix. Thus, the work updates terreiro knowledge when read by Afrofuturism. That is, it speculates about a future of Brazil from subalterns black cultures, challenging and re-enchanting in the "dimension of the cruzo" (Simas ; Rufino, 2019,p.27) epistemologies affected by colonialism. It is a "counter-strike" that resists "racism/colonialism" by "transgressing the Western canon" (Simas ; Rufino, 2019,p.22). Provoked by Exu, the comic engages in disputes over the "imaginary of the modern colonial world system" (Mignolo, 2005,p.33) that culminate in decoloniality.

Keywords: *Afrofuturism. Braiding. Crossroads. Comics. Exu.*

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Dor sem parto: que relações de poder revelam os discursos sobre o aborto no Brasil e em Portugal?

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Abstract. Este estudo investiga que relações de poder expressam os debates que há sobre as questões do aborto em Portugal e no Brasil. A pesquisa está sendo desenvolvida em contato com instituições a favor da criminalização – Federação Portuguesa Pela Vida (Portugal) e Associação Santos Inocentes (Brasil) – e a favor da legalização da prática – Associação Médicos Pela Escolha (Portugal) e Anis Instituto de Bioética (Brasil). Pretende-se que este projeto contribua para revelar como as organizações dos dois países se comunicam com o auditório ao qual se dirigem e como as questões de gênero são articuladas nessa retórica.
A partir dos recursos dos Estudos Culturais e da Comunicação Retórica, o estudo proposto está vinculado à questão problema: Quais relações de poder revelam os discursos sobre as questões do aborto no período inicial do governo de Jair Bolsonaro (2018-2020), no Brasil, e durante o segundo referendo, em 2007, para a legalização da sua prática em Portugal, tendo em conta as diferenças e semelhanças na comunicação pública verbal e imagética das organizações investigadas?
A metodologia deste projeto é baseada numa investigação qualitativa, preliminar e exploratória (Lakatos e Marconi, 2010), tendo como técnicas a pesquisa bibliográfica, a análise retórica da comunicação (Grácio, 2010), a análise do discurso (Amossy, 2006), bem como a entrevista em profundidade e a revisão de formas verbais e imagéticas articuladas em sites e redes sociais das instituições supracitadas para coleta de dados.
Apesar de o estudo ainda estar em desenvolvimento, é possível elencar os seguintes resultados parciais: as organizações desfavoráveis à legalização do aborto estabelecem um discurso mais pautado em emoções, como o medo, o amor materno, a empatia à vida humana, a culpa, bem como em valores ligados à religião e à ética médica; já aquelas que apoiam a descriminalização não demarcam emoções nitidamente expressivas. Suas estratégias argumentativas estão centralizadas na persuasão através da desmitificação de informações; em parte significativa dos movimentos sociais presentes nas redes sociais não são identificados recursos argumentativos, mas, sim, uma proliferação de discursos; há uma preponderância sobre a referência a valores religiosos de ambos os lados, contra e a favor da descriminalização; e, por fim, outro fator a ser considerado tem a ver com a predominância de pessoas brancas nesses espaços de troca de opiniões.

Keywords: *Aborto, Controle reprodutivo, Corpo feminino, Igualdade de gênero, Relações de poder*

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Graphic modulations for the biogeographical landscape of Ílhavo. A Cartography Project as design methodology.

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Abstract. This research proposal aims to design possible mappings for the complexity of the contemporary landscape. By approaching the concept of landscape as a support and material for existence, as a biological, political, and symbolic field, the intention is, through a cartographic project, to think about the territory in a lively and multidisciplinary way. To this end, it is proposed the development of a series of maps for the biogeographical landscape of Ílhavo, regarding the changes in the maritime horizon of the municipality in the last 100 years. When thinking about the project in the context of Design as an implementation methodology that values the territory and Design as a transversal representation tool, a strategy is proposed to support the practical unfolding of the project. The methodological strategy is based on in-site incursions, the survey of its cartographic collection, interviews, and dynamics that enable collaborative creation within the local community in order to contribute to the construction of dialogues between the different geographical, social, cultural and environmental dimensions. Therefore, this research is based on four main work process tasks: 1) Carry out a literature review regarding the cartographic project as a representation of the territory and as transversal support to achieve multidisciplinarity from Design; 2) Based on the cartographic collection produced for the project's focus region, assessment of the territory, interviews and strategies that enable collaborative creation with the local community, leverage the construction of new graphics that elaborate diversity, history, scientific knowledge, individual experience and transformations of the territory involving the different communities that cohabit the same site; 3) Work the subject of Drawing through a shared and broader construction of knowledge from different disciplines and how they can jointly devise new ways of exploring the local landscape. By that, highlight the importance of an insistent look at the world we live in that emerges through the map's dialogues about contemporary issues: climate change, technological advances, and how it affects our relationship with the space we inhabit; 4) Finally, propose the implementation of a cartographic project as a Design methodology that enhances the territory, since the cartography will result from the mediation between the selected materials, the experiences proposed in collaboration with the community and the contents presented individually, which will lead to the final production of the object that results from this investigation.Keywords: Cartography; Contemporary Mapping; Experience Design; Landscape; Maritime Horizon, Drawing.

Keywords: *Cartography; Contemporary Mapping; Experience Design; Landscape; Maritime Horizon, Drawing*

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O Design do Desapego e a Comunicação Publicitária para soluções sustentáveis.

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Abstract. O ser humano está subordinado a um processo de atualização contínua, uma vez que o futuro já não é um objetivo, mas uma realidade ao serviço do presente (Branzi, 2006). Associando esta perspectiva, o Design do Desapego (Carvalho, C.; Gomes, G.; Pombo, F., 2020) surge através da observação da modalidade atual de aluguer ou empréstimo de objetos em consonância entre a economia circular, a durabilidade (ou longevidade) emocional e design de serviço, no qual coloca o consumidor como protagonista do processo de reeducação do consumo numa sociedade holística. Este conceito é, por nós, qualificado através do distanciamento do objeto em sua posse e não do seu usufruto através do uso transitório num comportamento desprendido do objeto ou bem, enquanto coisa, mas não das suas experiências e vivências no contexto de uso, por exemplo. Os objetos e serviços passam a ter valor situacional e quem os usa já está ciente disto, exercitando um "comportamento desapegado".
Desta forma, o desapego ou distanciamento soa como paradoxo ao aproximar as pessoas do conceito do uso de objetos e serviços, mas afasta-as da aquisição ou posse na medida em que deixa o artefato acessível aos que não conseguem adquiri-lo. Tal percepção, associa o Desapego aos Wicked Problems (preocupação social ou cultural complexa de explicar e inerentemente impossível de resolver) visto que ocorre no ambiente do consumo e por consequência da sustentabilidade, na medida em que não é emprestar ou revender, mas simplesmente não ter a necessidade de possuir diante de um contexto de sociedade consumista. O termo foi definido primeiramente por Rittel e Webber (1973) e ligado à disciplina do design por Richard Buchanan (1992). No mesmo sentido da sustentabilidade, Manzini (2004) considera a perspectiva de que "o sucesso de soluções sustentáveis e o facto de serem adotadas globalmente pela sociedade depende de uma mudança na nossa ideia de bem-estar e na maneira como agimos para alcançá-lo" (Manzini, 2004:20).
Esta investigação propõe, para além da fundamentação do Design do Desapego, elaborar uma campanha publicitária experimental alinhada directamente com um dos Objetivos do Desenvolvimento Sustentável (ODS) elaborado pela ONU, designadamente o nº 12:Consumo e Produção Responsáveis. A partir da participação de um focus group, que represente diversas perspectivas, pretende-se contribuir para a comunicação do Desapego como um conceito e uma prática credível, empática, assimilável e com potencial de adesão como alternativa para um consumo mais legítimo, mais responsável e sustentável.

Keywords: *Design do Desapego, Wicked Problem, Publicidade, Comunicação, Sustentabilidade*

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Uma reflexão sobre o significado de inovação na cultura artesanal do ciclo do linho em Castelões

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Abstract. A prática do ciclo do linho em Castelões, Portugal, é totalmente artesanal e tem um grande valor cultural e social. Há uma série de particularidades que distinguem esta prática das outras culturas sobreviventes, sendo a mais importante a experiência das praticantes chamada de "da semente à toalha", em que cada artesã conhece todas as mais de 20 etapas da fabricação de linho - incluindo cultivo, tratamento das fibras, fiação e tecelagem. O ecossistema produtivo do linho é inteiramente manual, tornando-o um marcador cultural regional único e empiricamente singular. Entretanto, o declínio gradual do setor nas últimas décadas, devido a fatores históricos, socioeconômicos e tecnológicos, tornou a situação crítica, com poucos locais restantes de produção de linho em Portugal. Dessa forma, a continuidade desta prática além da atual geração de praticantes é incerta.

Este artigo descreve um projeto de intervenção liderado por uma pesquisa de doutoramento em Design, que tem como desígnio refletir sobre o significado de inovação em contexto de produção tradicional. O objetivo principal da pesquisa é destacar os valores incorporados em culturas artesanais, que geralmente são marginalizadas, mas que, de acordo com a pesquisa, podem ser fundamentais para a inovação social e individual.

A pesquisa de natureza etnográfica foi desenvolvida na AmaCastelões, entre meados de 2020 e início de 2023, baseou-se em observação participante e pesquisa-ação. A recolha dos dados deu-se por meio de entrevistas abertas não estruturadas, fotografias, vídeos e diário de campo da investigadora. No período inicial eram somente quatro as artesãs - com idades entre 70 e 87 anos – que ainda eram ativamente envolvidas na prática tradicional do ciclo do linho.

O artigo argumenta que o design pode desempenhar um papel importante na preservação e promoção de práticas culturais tradicionais. Além disso, destaca a importância da conservação e gestão do conhecimento empírico das artesãs sobreviventes como um valor patrimonial inestimável. A intervenção buscou criar condições e recursos para auxiliar a comunidade a se autopromover e inovar, na tentativa de garantir a sustentabilidade cultural do ciclo do linho, bem como valorizar o capital territorial ao angariar mais pessoas interessadas em aprender e continuar este legado tradicional - atualmente somam 17, entre mestras artesãs e aprendizes.

Em resumo, o artigo apresenta um exemplo prático de como o design pode ser usado como uma ferramenta para preservar práticas culturais tradicionais, criar condições para a sustentabilidade e promover a inovação em comunidades locais em um mundo em constante mudança.

Keywords: *investigação em design, design e território, ciclo do linho, inovação com tradição*

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Meio para a valorização do Design industrial em Estruturas de decisão empresarial

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Abstract. O tema de projeto de tese de doutoramento em design proposto, aborda o processo de decisão do design como ato de reconfiguração do artificial com acréscimo de valor intelectual e de propriedade numa tentativa de reconfiguração dos seus princípios e objetivos (Costa, 2022, p. 67). O estudo enquadra-se no contexto industrial LEAN e na identificação de oportunidade de desenvolvimento de projeto na documentação do processo.

Os mercados globais frequentemente definem a cadência e intensidade de fabrico de indústrias seriadas (Costanza-Chock, 2020), incluindo a produção criativa (Best, 2009), mas com métodos de desenvolvimento nem sempre claro, explícitos ou reprodutíveis. Em contexto empresarial na OEM portuguesa, o cliente não é o utilizador final, obrigando a uma constante readaptação de projetos para diferentes mercados. Neste enquadramento, as metodologias de design existentes parecem constituir uma resistência ao desempenho industrial (Almendra, 2010, p. 3). Isto leva a uma marginalização do valor acrescentado que advém da prática dos processos do Design (Muratovski, 2022, p. 72), embora se enquadre a atividade projetual numa das fases de cadeia de valor crucial (Duarte, 2021) para a indústria.

A proposta que se pretende estudar, parte de um caso de estudo de uma fábrica de equipamentos de frio em Portugal, e tem como foco uma abordagem operativa para a valorização do design em estruturas administrativas e consequente ascensão a um patamar de relevância de decisão por via da cadeia de informação e através de um procedimento projetual documentado.

Assim, como ensaio, pretende-se desenvolver um produto instruído por um conjunto de decisões documentadas, reunidas num sistema documental (SD) imagético, com diferentes níveis de leitura, revelando-se um instrumento dinâmico de gestão do design na cadeia de informação corporativo, gerando um histórico consultável, legitimando raciocínios inéditos específicos da prática do Design e contribuindo para transformar um conhecimento tácito em explícito (Gaver ; Bowers, 2012, pp. 40–49).

Keywords: *#Design industrial; #Indústria; #projeto; #Sustentabilidade; #Desempenho*

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Desenvolvimento de produtos à base de polímero com memória de forma através de fabrico aditivo e impressão 4D.

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Abstract. Abstract
O fabrico aditivo assumiu nas últimas décadas um papel preponderante na forma de conceber e desenvolver produto. Apresenta-se atualmente como uma tecnologia acessível que está intrinsecamente ligada ao caminhar da indústria para a era 4.0, onde é potenciada a eficiência e a flexibilidade da produção e o uso mais eficiente e sustentável de recursos aplicados a produtos.
Através da impressão 3D, conseguimos obter soluções de forma rápida, acessível e altamente customizável, com uma vasta gama de materiais, o que torna esta tecnologia atrativa, tanto nos campos de pesquisa científica como na sua incorporação na indústria.
A impressão 4D surge como uma evolução da impressão 3D, com a adição da dimensão temporal, onde através da utilização de materiais inteligentes, são aplicadas estratégias de programação de estruturas impressas, que, mediante um estímulo externo, alteram a sua volumetria, tornando-se estruturas dinâmicas, reversíveis e inteligentes.
Este avanço na tecnologia procura oferecer uma nova forma de conceber produtos. Combina várias áreas do conhecimento, desde o design de produto e engenharia complementados pela área da física e química. Recorre ao hardware já disponível e serve-se de materiais já utilizados na impressão 3D, como o caso dos polímeros com memória de forma (PLA, TPU E ABS).
Com a criação de estruturas planas impressas é possível anular o gasto de material no recurso a suportes de impressão, encurtar o tempo de produção, economizar espaço no transporte e logística, utilizar materiais renováveis que apresentam desempenhos vantajosos que se enquadram nos recursos de produção para o futuro das indústrias.
Atualmente, a impressão 4D está a ser desenvolvida nos setores da indústria automóvel, aeroespacial, biomédica, construção, mobiliário e eletrónica, com um grande potencial para a sua incrementação no setor dos bens de consumo, resultando em produtos sofisticados, personalizáveis, sustentáveis e acessíveis.

Keywords: *Fabrico Aditivo, Impressão 3D, Impressão 4D, Memória de Forma, Estímulos*

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Design as a facilitator to promote cycling in school journeys in Aveiro

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Abstract. The climate change that we are witnessing makes citizens co-responsible for creating solutions for the decarbonization of cities, where the mobility and transport sector is responsible for about 25% of emissions. In Portugal, trips to school are mostly made by car, contributing to an increase in problems related to safety, health and the occupation of public space. Education is a fundamental vector for changing mobility habits. Integrating bicycles into schools journeys offers benefits for children's health and well-being, increasing their autonomy, social skills and bonds with the community and public space. Considering that design can and should play an activating, mediating and facilitating role in complex collaborative processes, this research fosters, through design, the articulation of the school community, local authorities and civil society to promote the use of bicycles in daily commuting to school.

For this study, a survey was carried out through a mapping of twenty-five international projects, related to encouraging the use of bicycles by school-age children and involving the participation of the school community. The criteria defined were applied to this survey, which gave rise to a selection of five projects. This selected projects were analyzed through a multiple case study. Based on this study, a facilitating model was designed for the integration of the bicycle in the school, which the author called the Gobi model.

The Gobi model proposes collaborative work articulating the school community, local authorities and civil society, bringing together local entities for the reintegration of bicycle use in school mobility. Gobi model consists of four phases considered relevant for the reintegration of the bicycle in the trips to school: Awareness, Teaching, Incentive and Celebration. This model was applied during the month of May 2022, in four primary schools (6 to 10 years old) and two preschool (3 to 6 years old) schools in the Aveiro. 962 children, teachers, coordinators, assistants and families were directly impacted. For the application of the model the author designed a toolkit that facilitates to implement initiatives, oriented to each of the phases proposed in the Gobi model by school communities. After this initiative, information was collect to improve and redesign Gobi Toolkit.

With this research we intend to contribute, through design as a mediator and facilitator of collaborative processes, to a change in the paradigm of school mobility in the region of Aveiro, with the potential for replication to more schools in Portugal.

Keywords: *Design, Bicycle, Mobility, School, Community*

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Experiencing built heritage trough embodied experiences. The design of spaces and atmospheres.

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Abstract. The repurposing of buildings is an important concern in our contemporary society due to its relevance to sustainable development and tourism programs. Reusing buildings protects the environment, preserves cultural identity, and attracts residents and tourists. Many Industrial buildings embodying history and culture face conservation challenges that require attention for adaptation. However, most current studies on repurpose buildings focus primarily on the technical and architectural aspect. As interior designers, at the intersection of design and architecture, we create interior spaces that integrate functionality, aesthetics and an affective dimension. We adopt a human-centered perspective, considering the lived experiences of individuals using spaces of heritage buildings. To achieve this, we adopt an interdisciplinary théorical combining design with cognitive sciences and environmental psychology. Unfolding how design shapes spaces and experiences by creating sensory atmospheres that consider touch, sound, color, while cognitive and environmental psychology deepens our understanding of how individuals perceive and emotionally interact with these spaces.

Taking a point of departure in the above intersection between built environment and human experience, our research question is 'How can we design for repurpose of heritage building interior while taking into account human experiences beyond structural considerations?'

To support our research, we choose to study a specific case: Fábrica Centro Ciência Viva, a 19th-century industrial building converted into a science center in Aveiro, whose architectural value lies primarily in its intrinsic industrial features, such as high ceilings, machinery, pillars. We focus on micro-architecture, combining design, architecture, and furniture to explore sustainable strategies for optimizing space and creating engaging interiors with versatile devices. By exploring concepts like 'embodiment' and 'affordances', we analyze how the experience of designed interior space emerges from the interaction between individuals and the built environment.

Methodologically, this is done through a qualitative approach focused on Fábrica Centro Ciência Viva. We collect data through on-site observations and interviews. Can Micro-architecture adapt to changing needs and offers visitors engaging emotional experiences? Can its tactile, responsive and functional elements meet visitors' sensory and cognitive needs and foster a deep connection with cultural heritage? By integrating theory and empirical findings, we aim for better insights into visitor experiences and how to design user-centred interior spaces.

Our goal is to present innovative ideas on the use of micro-architecture in the repurposing of heritage buildings. Through an interdisciplinary approach, the exploration of repurposed heritage buildings offers captivating experiences that help strengthen community identity and promote cultural diversity.

Keywords: *Built heritage, interior design, micro-architecture, theory of embodiment, phenomenological experience, atmospheres.*

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Design e Cultura Material na Arte Makonde de Moçambique: uma abordagem de design participativo na produção iconográfica e de novos produtos

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Abstract. O design em Moçambique é uma área recente e carece ainda de elementos característicos que possam compor seu repertório. Vários designers têm tido debates acerca do design em Moçambique, da sua identidade e do resgate dos elementos culturais das sociedades. Com esta preocupação como ponto de partida, resgata-se a abordagem da cultura material makonde, uma das mais destacadas e que impressionam com suas qualidades artísticas. Nesta produção artística, os fazedores trabalham com instrumentos primitivos que são manuseados com muita rapidez e precisão, o que resulta em obras únicas. Sendo a cultura material um conjunto de artefactos que resultam da ação ou intervenção humana sobre a realidade física e que sejam apropriados culturalmente. Portanto, para nesta pesquisa releva-se a escultura, a cerâmica, as máscaras e as escarificações corporais.
Deste modo, estudar e compreender esta cultura vai ajudar a projetar produtos e serviços agregadores de maior valor à arte e ao artesanato, fortalecendo mais a sua identidade e permitindo uma melhor comunicação com as demais culturas, internas ao país e no estrangeiro. Entretanto, existem vários trabalhos académicos sobre a cultura makonde, mas sob o ponto de vista antropológico e não na perspetiva do design. Portanto, esta análise vai permitir que o design se aproprie dos símbolos e objetos, considerados signos culturais, no seu processo de produção.
Esta pesquisa, terá uma abordagem qualitativa e aplicada. Com relação a análise de dados, será usada análise de conteúdo. O método de resolução de problemas, será o de design participativo que possibilita a participação dos artesãos na produção iconográfica e na ressignificação de objetos culturais, desde a geração de ideias à tomada de decisão.
Com esta pesquisa espera-se que, a partir dos elementos identitários indispensáveis da cultura makonde, seja feita a produção iconográfica e a ressignificação de alguns objetos culturais que serão identificados e recriados a partir da abordagem participativa com os artesãos.

Keywords: *Cultura material makonde; Design participativo; Ressignificação; Produção iconográfica.*

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The design of furniture for collaborative workplaces to enhance a more creative work experience.

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Abstract. The evolution of mobile technology enabled the nomadism of lifestyles and changed the working routine for a more collaborative and hybrid model. Covid-19 pandemic accelerated the previous foreseen change to a more flexible work models, between remote and on site work. People go less frequently to the office, but when they go they are looking for a more collaborative work experience. The workplace requires new working concepts that are more cooperative and versatile to improve and facilitate moments of interaction, of sharing and of socialization between teams and the community. It intends to provide moments and experiences that the workers cannot have when working remotely. Furniture design plays a fundamental role in this context ensuring flexibility, dynamic and multifunctional workplaces providing the stability and functionality of workflows. In the Research Summit 2021 it was presented the global framework of this research which is the design of furniture systems to sustain sceneries of collaborative working and the execution of furniture prototypes in partnership with GUIALMI (Empresa de móveis metálicos S.A.), strengthening the approach of scientific research with Portuguese industry. In the Research Summit 2022, the framework regarding the design process of the project was analyzed by emphasizing the contributions of the research to the open science. For the Research Summit 2023, it is intended to discuss how to create a more creative work experience for collaborative and sharing workplaces.
This new typology of working experience requires workplaces more oriented to agile and spontaneous work, with a diversity of spaces and resources to create team areas, common areas and even individual areas. With this model it is intendedto offer people opportunities to choose how and where to work depending on their working needs, and helping to boost wellbeing and comfort.A modular furniture system is designed allowing to easily create diverse configurations that meet different purposes in the workplace. The proposal is also in line with circular economy and sustainable production standards, through the rigorous choice of materials and their profitability, the ease of disassembly and compact packaging to facilitate transportation. Therefore, this furniture system gives relevance to the materials to ensure a proper level of acoustics, comfort and flexibility, fundamental for a creative work experience.
Supervision Team: Dr. Fátima Pombo, Supervisor | Dr. Teresa Franqueira, Co-Supervisor

Keywords: *collaborative workplaces, furniture design, hybrid work, creative experience, materials*

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Circular Design — Contributions of Design to transition for Circular Economy through Waste Recovery.

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Abstract. Industrial waste produced by human activity has recorded values higher than its disposal capacity through industrial reintegration. Despite the increase in plastic recycling quotas (21%) in Portugal1, its percentage is still low compared to the waste produced (538.1 (103 t) in 2021)2. The rise of thinking based on the Circular Economy proves to be opportune for the development of added value artefacts, allowing (Circular) Design to respond through sustainable solutions, promoting resilient practices, and fostering the Portuguese industrial fabric by implementing the aesthetic viability, the symbolic and commercial value of products designed using waste, in this specific case, mixed plastic waste. Recently, Circular Design has emerged as a new frontier in sustainable design research through collaborative efforts (between industry, academia, and government) to bring us closer to circular material flows, widely accepted as the most promising strategy for human beings to stay within planetary limits, with the offer of economic, social3, and cultural benefits. The concept is expected to grow in the coming decades in line with the Circular Economy Package, which highlights the relevance of better design for the circular economy4,5. This research, developed within the scope of the PDD UA (Doctoral Program in Design at the University of Aveiro) and methodologically supported by Research for Design6, aims to produce artefacts conceived through reflective practice7, abductive research8, and annotated drawings9, whose draws results constitute "evidence"of the creative use of new knowledge in Design research athwart the project10. The development of a new appropriate aesthetic intention centred on the ideals of ecocentrism, represented by the ecological as a visual symbol, is proposed. Research for Design is also aesthetic due to its unique character, which is evident in the artefacts, preconfiguring communication, and producing knowledge through the design project itself11. Through aesthetics, human beings can be encouraged to adopt a reconciling attitude with nature and, through it, with themselves12. These products will provide the industry with eco-innovative artefacts, allowing for greater disposal of waste and its subsequent integration into the economic cycle. The design will therefore act as a cultural mediator, promoting innovation both within the discipline and in the commercial sphere13, to promote the Design of an ecological and environmentally conservative society14, namely through carbon retention. This research encourages innovation in the Portuguese industrial fabric through Design, promoting competitiveness, sustainability, and economic, social, and environmental development.

Keywords: *Circular Design; Research for Design; Aesthetics; Circular Economy; Waste Recovery.*

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Education

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Teaching experimental sciences program in primary education: from curricular organization to learning assessment

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Abstract. Promoting science education has the ultimate goal of contributing to the development of scientific literacy for all citizens. It is consensual that science teaching should start from the early school years. This is the premise on which this project is based. In Portugal, research and teachers training in early science teaching is still a recent reality in terms of research (just over two decades) and, despite the recognition of the importance of this area, the provision of adequate quality resources is scarce. The studies conducted during this project also demonstrate the need for curricular change in a perspective of developing scientific literacy. In fact, we intended to develop a Program for the Experimental Teaching of Science (PEEC®) for primary education. This offers a science curriculum component throughout the four years of schooling, 120 activities and resources underlying the learning of the curriculum proposal and proposals for recording instruments and assessment activities. All resources composed by the PEEC will be freely available on a website.As methodology we adopted the Educational Design Research, developed in iterative cycles (Design, validation, implementation, evaluation and redesign).The activities were implemented with twelve 1st CEB classes over two school years, with the participation of about 200 students and 14 teachers. The data collection instruments were limited to the instruments to record the assessment of children's learning (149 instruments completed), a questionnaire survey to teachers about the activities and teaching resources implemented (68 responses received.), the results of the assessment game (245 results) and a questionnaire survey to teachers about the PEEC components (10 responses received.).Preliminary analysis of the data from the two years of implementation suggests that:- The activities promote children's science learning at the level of knowledge, skills and attitudes and values;- From the teachers' perspective the resources are appropriate, original, and help them prepare and explore resources in the classroom with their children.- Most of the teachers continue to use the PEEC activities after the end of their collaboration in the project.These results show that the PEEC is a feasible and operational proposal in a real context in Portuguese primary schools.

Keywords: *Science education, Primary school education (6-10 years old), science activities*

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Municipalities and Schools: competences without competition in the local territory?

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Abstract. In order to the transference of competences to the municipalities from the central government, this study is very actual and necessary. With this study, we seek to contribute to deepening and systematizing knowledge about the process of transferring competences, the influence of "sociocommunity regulation" and the democratic management of Portuguese public schools. On one hand, the public school, with the assumption of universalization, school for all, equity and vehicle of social justice, conveyed by the normative discourse, on the other hand, the complexity in which the Schools have become, inside and outside, in interactions with the territories local, which in terms of action become models of democratic or managerial management. The finding seems to emphasize the concentration of local powers, going in the opposite direction to democratic decentralization.Understand the local territory of an educational community in a region of municipalities and schools, in the north of Portugal, as a builder of educational policies, through the perceptions of local educational actors, at a time when public policies tend to see the democratic environment as an obstacle to effectiveness and efficiency, instead affirming proposals of a more managerial nature and aimed at modernizing public administration. We will develop a qualitative study, interpreting and understanding actions and relationships, regulations that occurs between local education actors.The case study will be on north of Portugal, in a CIM (Intermunicipality Community) with eleven municipalities and thirty seven schools. As data collection techniques we favor document analysis and interviews in focus groups and individual, referring to content analysis as a data processing technique.The participants of this study will be designated as "privileged informants"due to the relevance of collecting data and perceptions of directors, presidents of general councils, president of the Chamber and other local and regional political decision makers who, through their perceptions, will characterize the management model implemented in public schools and the possibility of designing a new public school management model.

Keywords: *Public School Management; Local Educational Actors; Sociocommunity Regulation; Competences of Municipalities; Democracy*

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Grief Counseling: the specialized training in the portuguese context

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Abstract. Grief Counseling: the specialized training in the portuguese context
The research proposes to design a specialized training curriculum in Grief Counseling, adapted to the Portuguese context. Tasks will be carried out that allow: the characterization of the training reality of Grief Counseling in the international context, with evidence of increasing the competence and effectiveness of this formal intervention in grief; mapping the training needs of Portuguese professionals who, in the exercise of their professional activity, intervene with people in mourning; and the critical analysis of both contexts for the design of a curriculum for Grief Counseling Training, in the Portuguese context. The methodology adopted for this investigation is predominantly qualitative, with the application of the Educational Design Research (EDR) method, as we aim at the dual purpose of: solving a problem in a real context (the need to train professionals who work with grief processes); and generate lasting knowledge (the curriculum design). The techniques for data collection and analysis are analysis, inquiry and observation, associated with various instruments – interview, questionnaire, observer diary and focus group. The research is in phase 3 of the project which corresponds to the mapping of the training needs of Portuguese professionals. To this end, the Seminar Grief Counselling in Portugal 2023 - SALP was held, with a call for abstracts addressed to professionals in the areas of Education, Psychology, Health and Social Work. The abstract should relate a professional experience of intervention with individuals, families and/or communities in bereavement processes, the difficulties experienced and the needs for a better intervention. The abstracts will be compiled in the SALP23 Abstracts Book, for later content analysis and mapping of the training needs of these professionals. In the next phase we propose to co-create a specialized training curriculum in bereavement counseling for the Portuguese context.

Keywords: *Grief; Grief Counseling; Grief Counseling Training*

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Entre saberes e dizeres: o que nos revela uma experiência intergeracional?

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Abstract. Em dezembro de 2022, nasce o Bio-Carta, um projeto piloto intergeracional que procura promover a coesão social, a partilha de saberes e perspectivas sobre a natureza e as tradições locais, que conta com 112 participantes divididos em dois grupos, um composto por estudantes de diferentes níveis escolares e outro por idosos participantes do programa municipal Bio Sênior. No âmbito do projeto, realizam-se dois encontros mensais com cada grupo, nos quais se promove: a escrita e partilhas de cartas; oficinas interativas; encontros e vivências conjuntas. no final do ano letivo de 2023. será organizado um evento final alargado para a sociedade local. Concomitantemente ao projeto Bio_Cartas, desenvolvemos o nosso projeto de investigação, intitulado "Relações intergeracionais entre idosos e crianças: diálogos, práticas e perspectivas". Este projeto pretende produzir uma interpretação sobre os modos de conceber os saberes e conhecimentos, dentro de situações socialmente construídas e culturalmente demarcadas, compartilhados por indivíduos de diferentes culturas, idades e origens, recorrendo a uma didática da interculturalidade e a uma abordagem dialógica e colaborativa. Apoiando-nos nos paradigmas de relacionalidade e de reciprocidade e ancoradas na ética da alteridade, estamos, nesta etapa, imersas no projeto Bio-Cartas, com observação participante, capturando como os atores interagem entre eles e quais saberes e aprendizagens que elegem para serem partilhados. Ao nível da apropriação do que foi experenciado e vivenciado até àa presente data, observa-se que, durante este percurso, os atores têm se engajado na negociação e construção partilhada de saberes e conhecimentos em torno dos seus lugares de pertença e vêm -nos mostrando que muito da força (trans)formadora que gera novas práticas nos contextos complexos entre gerações é advinda da diversidade e multiplicidade de saberes, de perspectivas e de experiências partilhados no cruzamento e no encontro de processos reflexivos pessoais e coletivos construídos no seio dessa complexidade, permeada pela experiência que estão a vivenciar e pelos sentidos e emoções que estão sendo evidenciados que contribuem para o encontro de si no encontro com o Outro. O estudo tem demonstrado a importância de projetos intergeracionais na criação de oportunidades onde se valorizam, independentemente da idade, as singularidades das pessoas, seus saberes, suas aprendizagens, suas partilhas experienciais e transformadoras, reverberando igualmente sobre a relações que estabelecem a reconfiguração dialógica, na qual várias gerações possam discutir e contribuir com as questões estruturais da sociedade atual – de cariz ambiental e sociocultural.
Palavras-Chave: Intergeracionalidade; Diálogo intercultural; Sustentabilidade.

Keywords: *Intergeracionalidade, Diálogo intercultural, Sustentabilidade*

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Não nos vemos se não saímos de nós: educação bi/plurilingue e intercultural na fronteira entre Portugal-Espanha

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Abstract. As regiões de fronteira constituem espaços geográficos e sociais de proximidade e contacto com o outro, sendo privilegiadas para a criação de múltiplas possibilidades de encontro e para uma vivência plena da superdiversidade (Putsche, 2022). Contudo, elas caracterizam-se, frequentemente, pela assimetria de relações de poder e consequente desigualdade organizacional e social, o que poderá reforçar o seu entendimento enquanto espaços-limite geradores de constrangimentos (ibidem).
Considerando o elevado grau de intercompreensão entre as línguas portuguesa e espanhola, bem como o contexto de precariedade a nível demográfico e socioeconómico na fronteira entre Portugal-Espanha, esta surge como locus estratégico para a promoção de uma educação bi/plurilingue e intercultural que permita ressignificar as identidades plurais dos sujeitos e fortalecer a cooperação transfronteiriça e coesão social entre os países vizinhos. Assente nesta perspetiva, o nosso estudo integra a componente investigativa da edição piloto do "Projeto Escolas Bilingues e Interculturais de Fronteira" (PEBIF), que adota como parceiro a Organização de Estados Ibero-americanos para a Educação, a Ciência e a Cultura em articulação com os Governos de Portugal e de Espanha e quatro Comunidades Autónomas. Assumindo uma metodologia de investigação-ação-formação, o PEBIF pretende potenciar a criação de uma rede de escolas-espelho na fronteira luso-espanhola, convertendo-a num centro irradiador de conhecimentos, atitudes e práticas educativas inovadoras que fomentem o bi/plurilinguismo, a interculturalidade e a diversidade sociocultural da região. O Projeto desenvolveu-se em quatro fases: 1) identificação dos participantes e constituição dos grupos de escolas-espelho; 2) formação contínua online de professores; 3) co-construção e implementação, pelos grupos de escolas-espelho, de projetos de aprendizagem (PA) em turmas do 1.º e 2.º Ciclos do Ensino Básico; e 4) extensão do bi/plurilinguismo e da interculturalidade a outras zonas de fronteira. Adotando paradigma interpretativo e natureza qualitativa, o nosso estudo propõe-se compreender os contributos dos PA para a promoção de aprendizagens transversais e plurissituadas dos alunos implicados. Encontrando respaldo teórico num paradigma ontológico e experiencial da didática do plurilinguismo, analisaremos os PA, os recursos pedagógico-didáticos criados pelos docentes, as suas apresentações powerpoint, os materiais produzidos pelos alunos e os relatórios reflexivos dos professores. Para tal, atenderemos a uma visão de língua enquanto processo e sistema social que conduz o sujeito a repensar-se por meio das múltiplas literacias que com ele coabitam e no(s) espaço(s) físicos e sociais em que habita (Benson, 2021). Esperamos, assim, contribuir para a construção de quadros de referência e práticas educativas bi/plurilingues e interculturais replicáveis a outros contextos raianos.

Keywords: *educação, bi/plurilinguismo, interculturalidade, fronteira, aprendizagens.*

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Americanos para a Educação, a Ciência e a Cultura, no âmbito da bolsa de investigação com a referência BI/UI28/10011/2022 [16/01/2022 a 16/05/2022].

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Ambiente Multimédia no Ensino de Geometria Analítica em contexto Blended Teaching ancorado pela Sequência Fedathi

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Abstract. O Ensino (HB) ou Blended Teaching é cada vez mais presente nos sistemas educacionais em todo o mundo em diversas áreas do do conhecimento. No Brasil, a normatização da semipresencialidade, pela portaria nº 4.059/2004, permitiu a hibridização do ensino (da Silva, M. R. C., Maciel, C., ; Alonso, K. M., 2017).O HB incorporou-se às universidades brasileiras como uma estrutura de acesso à formação profissional aliada em diversas áreas (Cannavô, V. B., Habowski, A. C., ; Pinto, T. S., 2022).Utilizamos a plataforma Moodle na disciplina de Geometría Analítica utilizando a proposta de ensino Sequência Fedathi do Laboratório de Pesquisa MultiMeio, que tem como princípio pilar a busca pela mudança de postura, por parte do professor, perante seus estudantes na perspectiva de transcender o modelo tradicional de ensino (Borges Neto, 2018).A Geometria Analítica é uma disciplina da educação superior brasileira com uma abordagem complexa para os estudantes das diversas universidades brasileiras, a exemplo do curso de licenciatura da Universidade Estadual Vale do Acaraú (UVA), cidade de Sobral, no Estado do Ceará. A referida disciplina tem sido lecionada nos moldes tradicionais, corroborando no alto índice de retenção e desistência da disciplina. Essa problemática dá-se possivelmente pela dificuldade de absorção dos conteúdos no processo de ensino e aprendizagem dos conteúdos dessa disciplina.Diante da problemática apresentada, esta tese tem como objetivo utilizar a proposta de ensino Sequência Fedathi no modelo de EH na disciplina de Geometría Analítica (com abordagem vetorial), no curso de licenciatura em Física, na UVA- Sobral/Ceará/Brasil. Para isso, estruturamos o Moodle MultiMeios do Laboratório de Pesquisa MultiMeios da Universidade Federal do Ceará.A abordagem metodológica da presente investigação é de natureza qualitativa com método de investigação-ação, consistindo de três ciclos.Cada ciclo contempla a ministração da disciplina no modelo de EH estruturado no Moodle MultiMeios, com uso da proposta de ensino Sequência Fedathi, no curso de Licenciatura em Física na Universidade Estadual Vale do Acaraú (UVA) em Sobral/Ceará nos períodos 2022.1 e 2022.2.Até o momento, a experiência mostrou uma melhoria na apreensão dos conteúdos e maior interatividade entre alunos e professor. Entretanto, a investigação nos mostra mais desafios como as dificuldades estruturais da UVA no tocante ao acesso aos computadores modernos e internet de qualidade, bem como a imersão da proposta da Sequência Fedathi. Espera-se com a conclusão do 3º ciclo termos mais elementos para uma conclusão definitiva.

Keywords: *Sequência Fedathi, Ensino Híbrido, Moodle MultiMeios, Geometria Analítica*

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Desenvolvimento do Pensamento Crítico e Criativo no Ensino Superior: Formação Didático-pedagógica para Docentes

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Abstract. Resumo
As competências de pensamento crítico e criativo têm sido cada vez mais estudadas nos vários contextos educacionais, o que denota um interesse crescente nesta área. Estas competências são essenciais para a consecução de uma educação de qualidade e formação do cidadão global. No entanto, a sua promoção deliberada, explícita, sistemática e intencional requer, entre outros, o domínio de estratégias de ensino adequadas a essa finalidade. Apesar da importância atualmente dada ao desenvolvimento do pensamento crítico e criativo, existe um número relativamente limitado de estudos sobre a formação em pensamento crítico e criativo para professores e essa escassez é bastante acentuada se olharmos para o contexto angolano. É neste quadro que surge a investigação apresentada, no âmbito do doutoramento em Educação e que tem por objetivo conceber, implementar e avaliar um programa de formação focado em capacitar docentes para adoção de práticas pedagógicas que promovam de forma intencional e sistemática o pensamento crítico e o pensamento criativo. Pretende-se contribuir para a formação de cidadãos críticos e criativos que possam enquadrar-se no mercado de emprego cada vez mais desafiador e complexo. Esta investigação enquadra-se na natureza qualitativa, ancorada ao paradigma sociocrítico, assente no plano de investigação-ação. As técnicas de recolha de dados utilizadas para a consecução da investigação são a entrevista semiestruturada, o diário de bordo e o portfólio. A análise e tratamento dos dados recorre à técnica de análise de conteúdo com auxílio da ferramenta digital webQDA e a triangulação dos dados

Keywords: *Pensamento crítico; Pensamento criativo; Formação contínua de professores; Ensino Superior*

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The role of non-State actors in Portuguese education policymaking

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Abstract. Privatization and market-oriented education policies are being adopted by many countries - regardless of their cultural, political, or economic contexts - and are justified for many reasons. There is nevertheless broad agreement that this phenomenon is generating controversial opinions worldwide, mostly by the increasing role of non-State actors in education policymaking. In the context of my Ph.D. research, the present study is triggered by the need to identify and analyze reports, academic thesis, and other previous research about the topic in Portuguese education policymaking. For this purpose, a state-of-art literature review is conducted, through a content analysis supported by webQDA software. As a result, knowledge of the topic is deepened, and trends are identified.

Keywords: *Privatization; Non-State Actors; Public Education; Educational Policies*

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A formative proposal for initial teacher education based on STEAM Education and creative thinking through Challenge-Based Learning.

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Abstract. The 21st Century society increasingly demands the mastery of several transversal skills in order to keep up with the constant changes of the social, economic and global context (P21, 2017). As an important role in education process, teachers are required understand the impact on educating global citizens who should be able to exercise their rights and duties responsibly (Galvão et al., 2016). Therefore, it is crucial to enrich teacher education with diverse teaching and learning methodologies that develop knowledge, skills and value for teaching (Rodrigues ; Martins, 2018). Creativity is one of the most important skills to prepare the future generation to be real-problem solvers (Sanders, 2019). Therefore, we should develop, since early years, a cross-disciplinary perspective, and also collaborative, critical and creative skills in children (Shernoff et al., 2017).
This is a qualitative study, stated in a socio critical paradigm (Coutinho, 2013; Creswell, 1994). In order to answer the research questions proposed, we developed a Design-Based Research (DBR) (McKenney ; Reeves, 2012) project with three cycles of implementation of a pre-service primary school science teacher´s formative proposal based on STEAM Education that promotes creative thinking, staggered with two cycles of analysis and redesign of the strategy proposed. Each cycle of implementation was composed of two stages, every stage the learning experience were made through a different CBL project. We constant feedback, we have some preliminary results and set emergent changes for the next cycles of implementation. By the end of all data collection, a triangulated analysis will be made. The data was gathered by different techniques and instruments as: documentary compilation with a digital portfolio made from class activities; participant observation of the formative proposal implementation; focus group with pre-service teachers; a validated creative thinking test; and perceptions about education for creativity scales. During all stages, were used categorial content analysis (Bardin, 2009). The analysis still a ongoing stage.
Not all data is already analyzed, but preliminary results shows that the majority of pre-service teachers enhance the experience. These future teachers underscore several positive contributions on their professional development by learning through a CBL methodology. Were denoted a development of several softskills, science literacy, and teaching and learning methodologies/resources. The feedback received helped to improve, for example, the duration of cycles and the way of tutoring these graduation students. This project has been validated with academic community in many events and scientific publication during the last academic year.

Keywords: *STEAM Education; Creativity; Teacher Education; Active learning methodologies*

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Transition of students with intellectual and developmental difficulties from secondary to higher education

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Abstract. This research focuses on the development of teacher training. The training aims to discuss, from the teachers' perspective, the transition of students with Intellectual and Developmental Disabilities (IDD) from secondary to higher education. The training will be carried out in an online format, in a total of 6 weekly meetings lasting 2 hours and accredited by the CCPFC in Portugal.The research methodology adopted is of the case study type, being of a qualitative nature (Coutinho, 2018). It is hoped that this project may contribute to assisting educational professionals in the use of inclusive pedagogical strategies (Machado, 2022; Moreno et al., 2021: Moreno ; Maia, 2022: Ryan et al., 2019).

The Research Question aims to understand the potential of a collaborative in-service training program, regarding the ways in which secondary school teachers from public schools in Aveiro, Portugal, propose and develop pedagogical practices aimed at the inclusion and development of competencies of students with IDD, with a view to their transition process to higher education. As specific objectives, we aim: (i) To understand, from the teacher's perspective, the transition of students with IDD from secondary education to higher education and To understand the teacher's perception of the transition process of students with IDD from secondary education to higher education; (ii) To know what the pedagogical practices implemented by teachers are and how they are characterized as enhancing the transition process of students with IDD to higher education and, To understand how teachers interact with the respective multidisciplinary teams supporting inclusive education for the planning and implementation of pedagogical practices.

Considering these objectives, we intend to design, implement, and evaluate a collaborative continuous training, focused on the transition of students with IDD from secondary to higher education. In this context, we intend to know: (i) Which contributions emerge from the continuing education program at the level of pedagogical practice, focused on the transition process of students with IDD, and; (ii) Which are the indicators used by teachers to assess the effectiveness of the pedagogical strategies adopted by them, facing the challenge of contributing to the process of transition of students with IDD to higher education.

Finally, this research focuses on the aspect of education itself for the actors involved and the education system with a view to developing teacher training and promoting inclusion.

Keywords: *Teacher training; Students with intellectual and developmental disabilities; Secondary education; Higher education; School transition*

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Comics as a tool for Science Communication and Education: developing an interactive learning resource

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Abstract. Comics as a tool for science communication and education: developing an interactive learning resource.
Science is often seen as complex to understand by children because of its abstract essence, with specific details, sometimes difficult to visualize. Thus, there is a community of researchers doing an effort to understand how comics can help to communicate scientific concepts and educate students (Tatalovic, 2009; Hosler ; Boomer, 2011; Farinella, 2018; Mota et al., 2021a; Mota et al., 2021b). Comics, in the context of science communication and education, is usually associated with the term "science comics", that is, "comics which have as one of their main aims to communicate science or to educate the reader about some non-fictional, scientific concept or theme" (Tatalovic, 2009, p. 4).
Therefore, this Ph.D. investigation aims to understand how comics can be useful to communicate scientific concepts and what competencies can be developed during this process in children from Primary School. This is a multidisciplinary project, as it integrates didactic strategies from the Portuguese and Environmental Studies curriculum, disciplines from Primary Schools in Portugal.
The investigation is based on Research and Development (R;D) principles, combining Qualitative Research methods with the collaborative Design Thinking process, to understand different perspectives in the area. The research object is the development of an interactive didactic resource based on comics for science communication and education.
The resource has been developed (from its conception to implementation and impact assessment) in a non-formal learning space, a Portuguese science center – Fábrica Centro Ciência Viva de Aveiro – involving potential users and specialists in the area (children, monitors and science teachers, health professionals, science communicators and researchers in didactics).
The development process was based on three non-formal activities carried out at the science center with a group of 18 students from Primary School and 2 educators.
The data collection techniques are focus group interviews (with the specialists); observation (of the learning activities); group interviews (with children); and semi-structured interviews (with the science center educators).
The first results indicates that learning resources based on comics can be a playful and interesting strategy to achieve learning objectives from Portuguese and Environmental Studies in the same didactic activity.

Keywords: *Comics; Science Education; Science Communication; Non-formal Education; Health and Well-Being.*

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Peer observation as a strategy to improve teaching practices in higher education: an exploratory systematics literature review.

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Abstract. Abstract
The university teachers' lack of pedagogical preparation seems to be a major factor influencing higher education quality in Angola. The literature points to peer observation as a strategy that promotes the improvement of teaching practices. Therefore, the focus of this systematic literature review was to understand how peer observation has been carried out among higher education teachers and its influence in their practices.
The search strategy was based on the four phases of the PRISMA flowchart: identification, selection, eligibility, and inclusion. The articles indexed in the Scopus, Web of Science, B-on, Scielo databases, in English, and RCAAP in Portuguese, and published between 2012 and 2013, were analysed. The initial search resulted in a total of 76 potentially useful articles, 20 of which met the inclusion quality criteria.
The results indicate that peer observation is considered as an important tool to develop university teachers' competences. Moreover, it seems to promote interaction among them, involving knowledge sharing and reflection, thus being an essential strategy to improve the teaching/learning process. Considering the scarcity of studies on this topic in Angola, this practice should be implemented in the context of Angolan higher education institution that we will pursuit.

Keywords: *Peer observation; university; teaching practices; literature review*

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A participação das famílias na Educação Inclusiva no 1ºciclo

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Abstract. 1-Introdução:
A Educação Inclusiva (EI), implica a quebra de paradigmas por defender os direitos de todos os alunos. A Escola e a família devem procurar apoiar-se mutuamente sintonizando as suas contribuições.
Perceber como decorre a participação das famílias no processo da EI e quais são as estratégias usadas pela escola para promover essa participação é o principal objetivo deste estudo.
O presente estudo pretende aprofundar o conhecimento sobre a participação das famílias na EI no 1º ciclo, pretendendo conceituar participação, envolvimento e compreender as barreiras, os benefícios, e os facilitadores neste processo.
2-Metodologia:
Com base numa metodologia de Revisão Sistemática de literatura, foi realizada uma pesquisa nas bases de dados Scopus e Education Resources Information Center (ERIC), utilizando as palavras chave: participação, escola, família e inclusão.
Os critérios elegíveis para os estudos foram: (i) artigos ou capítulos de livros (foram excluídos blogues, livros inteiros e resumos); (ii) artigos/capítulos de livros de acesso aberto; (iii) terem sido publicados entre 2017 e 2021; (iv) redigidos em português, espanhol ou inglês; v) abordarem os pontos da EI, família, participação, envolvimento e escola. A análise dos estudos selecionados foi efetuada de acordo com a Declaração PRISMA (Liberati et al., 2009). De um conjunto inicial de 134, foram identificados 12 artigos que satisfazem os critérios de inclusão para esta análise.
3-Resultados:
Os estudos demonstraram que a participação das famílias é essencial no sucesso académico, sendo também uma forma de as famílias se envolverem no processo de inclusão, tendo impacto no desenvolvimento cognitivo, social e emocional das crianças.
Quando os professores usam estratégias como: tarefas logísticas e acessórias, atividades extracurriculares, convívio, organização de espaços e de recursos/materiais que promovem a participação (Assefa ; Sintayehu, 2019; Ballido-Cala, 2021).
As famílias contribuem para uma inclusão efetiva, permitindo o estabelecimento de uma comunicação saudável, garantindo que a criança receba o suporte necessário, tanto em casa como na escola (Erol ; Turhan, 2018). Os estudos destacam as seguintes barreiras que prejudicam essa participação: o preconceito, a dificuldade socioeconômica, falta de tempo, baixo interesse familiar, a falta de comunicação e a percepção dos profissionais de educação sobre a importância desta parceria (Arce, 2019; Odongo, 2018).
Os resultados deste estudo evidenciam, ainda, a necessidade de desenvolver projetos e recursos que promovam a inclusão no 1º ciclo, permitindo que a escola trabalhe em colaboração com as famílias para responder às necessidades das crianças e para promover a inclusão de todos os alunos (Arce, 2019).

Keywords: *Educação inclusiva, Família, Inclusão, Participação, Necessidades Especiais.*

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Generations generate action - The importance of educating for sustainability and biocultural diversity in different contexts

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Abstract. Educating in the present times requires that conditions are met that allow the adoption and development of educational practices that pay attention to issues that threaten the well-being of species inhabiting the planet. In this case, we direct the research to sustainability and biocultural diversity issues in an educational context. Biocultural diversity is considered of high pertinence for sustainability as it promotes the development of links between all inhabitants, habits, and habitats (Parodi et al., n.d.). Thus, through contact with the community and the local context, the subjects will have the opportunity to understand the importance of biocultural diversity to the well-being of all living beings and the planet (Dodman, 2014; Maffi, 2012; Merçon et al., 2019; Skutnabb-Kangas et al., 2003).

As such, this paper discusses research developed in different educational contexts, in this case, teacher education, kindergarten, and primary school. The development of empirical work in these three areas foresaw an intervention at the level of teacher education that would allow these teachers to develop competencies enabling them to intervene in an educational context. The empirical context of direct work with children aimed at the adoption of biocultural diversity practices could promote sustainability through its pillars.

This project aims to understand and work around different ways of educating for sustainability through biocultural diversity, highlighting the importance of biocultural diversity and the perception of the links between biology-culture-language which are considered fundamental for sustainability due to their potential to solve problems through diversity. The research is framed within the interpretative-constructivist paradigm and relied on several data collection techniques. Data collection was developed in two moments (Batista ; Andrade, 2021. One of them online, in this case, teacher education, given the pandemic situation in which we found ourselves, and the other in person in a kindergarten and primary school context based on projects initially developed by teachers in the training program.

We should emphasize that these projects were implemented in a short period which is a conditioning factor insofar as working on biocultural diversity and sustainability requires daily practices that really contribute to the transformation and adoption of behaviors aimed sustainability. The implementation of the projects allowed us, in turn, to understand ways of intervening in an educational context favorable to children's learning, through the promotion of experiences in the community, in parks and pine forests, or through the exploration of realities and ways of life of subjects in different contexts.

Keywords: *education for sustainability, biocultural diversity, early years education, teacher education*

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Assessment of problem-solving competence in engineering students: a literature review

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Abstract. Problem solving competence (PSC) is one of the key competencies of the 21st century. An engineering professional needs to solve complex problems in his/hers daily professional life. The PSC assessment in engineering education becomes relevant for those who want to promote the development of this competence. The present study is framed within the doctoral research project: "Digital game-based learning and problem solving in the teaching of Engineering and Industrial Management", which involves a literature review. It is intended through this systematic literature review to answer the following research questions: [1] Which problem solving dimensions can be used in the assessment of this competence in Engineering students? [2] How and with which instruments can this competence be assessed in Engineering students? Literature was searched in Scopus, Web of Science and ERIC. The research involved the following phases: 1) definition of the purpose of the study, 2) comprehensive search to identify relevant studies, 3) application of the inclusion and exclusion criteria of studies, 4) critical evaluation of the identified studies to form the analysis corpus, 5) data extraction and synthesis, 6) presentation and discussion of results. The search resulted in 90 records that were checked for compliance with the inclusion and quality criteria. Nineteen records were selected to constitute the analysis corpus. The results show an incremental trend in publications of studies on PSC and a high variation in the number of participants in the studies. The systematised dimensions of PSC assessed in the studies were as follows: 1) understanding and exploring the problem, 2) formulating the problem, 3) planning and establishing resolution strategies, 4) implementing the resolution strategies, 5) reflecting on the solutions and critically evaluating them. The instruments used in the analysed studies to assess the PSC include either pre-existing questionnaires and questionnaires created under the study. Additionally, there are more assessment questionnaires from the students' perspective than performance tests. Another noted feature is the scarcity of studies with a mixed or qualitative approach, thus, there is a marked trend towards the use of quantitative approaches. Finally, only one instrument was submitted to validation, more specifically, expert validation. In view of the above, a gap is identified in the literature analysed regarding the creation, validation, and application of instruments for the assessment of PSC based on students' performance.

Keywords: *Engineering education, Problem-solving competence, Assessment*

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Nas fronteiras da formação contínua: construção colaborativa de uma prática docente intercultural e bilíngue nas raias entre Portugal e Espanha - Aspetos metodológicos

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Abstract. Nossa investigação insere-se no Projeto Escolas Bilíngues e Interculturais de Fronteira (PEBIF), uma iniciativa da OEI, com coordenação científica das Universidades de Aveiro e Complutense de Madrid, que envolve os Governos de Portugal e de Espanha, mobilizando, ainda, as Consejerías de Educación de Andalucía, Castilla y León e Extremadura. A finalidade do PEBIF é promover a cooperação entre Portugal e Espanha nos domínios educativo, social e económico da fronteira, através de uma educação de qualidade que inclua competências associadas ao bilinguismo e à interculturalidade.

A primeira edição do PEBIF decorreu entre outubro/2021 e maio/2022, contando com 37 professores-participantes, de 10 escolas da raia luso-hispânica, organizados em 4 grupos de escolas-espelho, localizadas em Bragança-Zamora; Guarda-Miróbriga; Elvas-Badajoz-Cáceres; Vila Real de Santo António-Huelva. A formação, perspetivada como investigação-intervenção-formação, deu-se em torno da prática pedagógica dos professores-participantes, orientados à elaboração e implementação, junto dos seus alunos (primeiros anos de escolaridade), de um projeto de aprendizagem (PA) intercultural e bilíngue, concebido a partir de uma problemática comum.

Com o objetivo de refletir sobre os contributos do PEBIF ao nível da (re)significação da prática pedagógica dos professores, destacadamente no tocante ao bi/plurilinguismo e à interculturalidade da fronteira, acompanhamos todo o processo formativo, focalizando um dos grupos, o par de escolas-espelho Bragança-Zamora, composto por 4 professores de Portugal mais 4 de Espanha. Deste acompanhamento, resultaria uma amplitude de dados (diários de bordo da investigação, gravação das sessões síncronas de formação, materiais diversos produzidos pelos professores), pelo que recorremos à técnica Narrações Multimodais (Lopes et al, 2019; Lopes ; Viegas, 2021) para a produção, organização e consolidação dos dados, de sorte que obtivemos um documento único, intitulado narrativas multimodais e polifônicas de uma investigação na fronteira entre Portugal e Espanha (NMP), o corpus desta investigação.

Apresentaremos o processo de constituição desse corpus, consubstanciado em uma coletânea de 27 narrativas, cronologicamente estruturadas, focadas nas manifestações dos atores e/ou outros intervenientes, ao longo do processo formativo. Cada narrativa traz em si episódios, respaldados em elementos multimodais, significativos e relevantes, relativos às i) sessões de formação, online/presenciais, conjuntas/restritas ao grupo; ii) atividades educativas desenvolvidas no âmbito do PA; iii) visitas realizadas pelas investigadoras ao terreno da investigação. Este NMP, encontra-se, atualmente, em processo de validação pelos professores-participantes e formadores diretamente implicados na investigação, e veio a cumprir três finalidades: recolha dos dados, organização do seu armazenamento e sua transformação no sentido de serem mais facilmente visualizados e manejáveis.

Keywords: *Formação contínua de professores. Projeto Escolas Bilíngues e Interculturais de Fronteira. Narrativas multimodais.*

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Educação CTS promotora do Pensamento Crítico, em contexto de aprendizagem cooperativa

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Abstract. Enfrentamos riscos para o futuro da Humanidade e para a própria vida no planeta, sendo urgente reinventar a Educação para enfrentar desafios comuns (UNESCO, 2022). Os desafios que se colocam à Educação, perante uma sociedade em constante mudança, implicam que a escola se ajuste ao que o mundo precisa, preparando os jovens em função dos cenários desconhecidos, incertos e imprevisíveis

A Sociedade atual é profundamente marcada pelos avanços da Ciência e da Tecnologia e seus impactos em todas as esferas da vida quotidiana. Compreender a Sociedade e o papel da Ciência e da Tecnologia exige como objeto de estudo as próprias inter-relações CTS, sendo que, neste âmbito, a construção de estratégias didáticas que concretizem esse propósito é um desafio de futuro (Martins, 2022).

A Educação CTS promotora do Pensamento Crítico e potenciadora de competências de Aprendizagem cooperativa contextualizadas num mundo em mudança, como a interação com tolerância e empatia, a negociação e aceitação de diferentes pontos de vista, emergentes pela premência de se adotar novas formas de estar e participar na Sociedade, afigura-se basilar na formação de cada indivíduo de modo a ser capaz de tomar parte informada nas decisões e cursos de ação que afetam o seu bem-estar e o da Sociedade como um todo. A Educação CTS e as aprendizagens a alcançar serão um contributo para uma educação de qualidade, considerada fundamental para promover desenvolvimento humano, social e económico, traduzida de forma explícita no quarto ODS, da Agenda 2030 para o Desenvolvimento Sustentável

Esta investigação apresenta a finalidade de desenvolver (conceber, produzir, implementar e avaliar) recursos didáticos e materiais para alunos do 7.º ano de escolaridade, com orientação CTS promotora de capacidades de Pensamento Crítico, em contexto de Aprendizagem Cooperativa, na disciplina de Ciências Naturais. Segue um plano de investigação-ação, considerado mais viável e coerente para focar as questões do currículo em ação, caracterizado por ser situacional, interventivo, participativo e autoavaliativo, com um objetivo principal focado na inovação e mudança.

Como técnicas de recolha de dados destacam-se o inquérito por questionário, entrevista semi-estruturada, a observação com recurso a listas de verificação, a análise documental das produções escritas dos alunos. Como resultados esperados, os recursos desenvolvidos deverão contribuir para uma maior compreensão acerca das interações CTS, com promoção das capacidades de pensamento crítico e competências de relacionamento interpessoal dos alunos.

Keywords: *Educação CTS, Ciência-Tecnologia-Sociedade [CTS], Pensamento Crítico [PC], Literacia Científica, Aprendizagem Cooperativa [AC].*

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Desenvolvimento e avaliação de aprendizagens musicais baseadas em problemas: Caminhos em torno da criação e composição

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Abstract. Este estudo enquadra-se num Doutoramento em Educação e pretende discutir possibilidades de ensino, aprendizagem e avaliação, no currículo de Música do 3.º Ciclo do Ensino Básico, centradas na Aprendizagem Baseada em Problemas, e na criação e composição como caminho para o seu desenvolvimento. A procura de desenhos didáticos e estratégias de avaliação consentâneas com os princípios da enunciada abordagem, delineou a investigação-ação realizada. O trabalho decorreu durante um ano letivo e centrou-se numa turma do oitavo ano lecionada pela professora-investigadora. Participaram também os restantes professores de Música da escola, que desenvolveram, em duas turmas, uma experiência orientada de acordo com os princípios em estudo. Como técnicas e instrumentos de recolha de dados, utilizaram-se o diário da professora-investigadora, a filmagem de aulas, e o inquérito por entrevista a alunos e professores. Os resultados apontaram para desenhos didáticos inspirados em ideias e construtos como audiation, thinking in sound, pensamentos criativo e divergente (coordenado com o convergente), trabalho cooperativo, aprendizagem por desafios e professor como guia. Por outro lado, destacaram-se estratégias de avaliação partilhadas e construídas por professores e alunos, contemplando o processo e o produto dos trabalhos, assim como competências musicais e de interação social, e momentos de auto e heteroavaliação. Constrangimentos derivados da adaptação inicial dos alunos, assim como do trabalho sonoro a acontecer simultaneamente num mesmo espaço, são também referidos. Feita uma análise dos dados obtidos através das entrevistas aos alunos, registou-se uma valorização do trabalho de grupo, pela promoção da partilha de opiniões, do esclarecimento de dúvidas, e do desenvolvimento da confiança, da criatividade e de competências sociais. Para além destas ideias, a avaliação das aprendizagens foi destacada positivamente pelo feedback da professora ao longo da realização das atividades e pela participação dos alunos na construção do seu processo de avaliação. A visão dos professores ressaltou a promoção do "saber ouvir" e do "saber criar". Para estes, as tarefas realizadas permitiram aos alunos saírem da sua "zona de conforto", com vista à construção de saberes ao longo do tempo, e à partilha de aprendizagens e sua avaliação. Considerando como inovações da experiência a metodologia de trabalho e o processo de avaliação, reforçaram como benefícios o desenvolvimento de aprendizagens do domínio da criação e composição (e restantes de forma holística), do trabalho de grupo com promoção de autonomia, e da descentralização do processo de avaliação do professor com envolvência dos alunos, embora com referências a dificuldades sentidas na sua operacionalização.

Keywords: *Aprendizagem Baseada em Problemas; Avaliação; Educação Musical; Criação e Composição*

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Education for Linguistic and Cultural Diversity: path traveled so far, research impact and research sustainability

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Abstract. Research impact and research sustainability are in the epicenter of researchers' and policy makers' discussions, reverberating in various scientific areas. Governments, research funding agencies and researchers themselves are increasingly aware of their responsibility to ensure sustainability, but also to assess the impact of funded academic research. A topic that has channeled high funding for studies developed under its scope is Education for Linguistic and Cultural Diversity, since it's a concept that has guided national and European language education policies. This focus originated a considerable amount of independent and scattered projects throughout the last 20 years. Thus, a need to take stock of the knowledge built from these projects, aggregating and systematizing it, has emerged. Besides, being part of Humanities and Education, the path to demonstrate their impact and sustainability is diffuse, as the research value isn't always understood and recognized, unlike what happens in some Exact Sciences. In order to seek answers for this discussion and to contribute to bring the compartmentalized information together, our study aims to identify national and European funded projects, in the 2000-2020 timelapse, and developed on the Education for Linguistic and Cultural Diversity field. Thereafter, characterize them in terms of studied topic, research goals, target audiences, methodological design and obtained results. Moreover, this analysis will provide recommendations to foster educational research impact and educational research sustainability. After resourcing to the databases of "Fundação para a Ciência e Tecnologia", "Fundação Gulbenkian", "Community Research and Development Information Service" and "Erasmus+", 45 projects out of 952 met the defined criteria and were selected to analysis, in the light of a validated meta-analysis instrument. Lately, some of these will be selected to be part of an empirical stage, where their coordinators will be interviewed and other relevant actors from the projects will participate in focus groups. Apart from providing an overview of the finished work in the studied area, the preliminary results show that, except for the generality of Erasmus+ ones, projects lack planned and efficient impact strategies in terms of science communication and dissemination, during their development and after their end. This is a fault that affects the projects research transfer to relevant stakeholders and to the community in general, diminishing their impact and compromising their sustainability.

Keywords: *Education, Linguistic and cultural diversity, Research impact, Research sustainability*

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Reconstructing the images of languages and the Other of a school community through an awakening to languages approach: an overview of the road travelled so far

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Abstract. Migratory movements, the advance of technology and globalization have turned contemporary societies into patchworks of linguistic and cultural diversity (Huver ; Macaire, 2021; Lourenço, 2013) that demand individuals to develop specific skills in order to be able to appreciate that diversity and interact with it (Lüdi, 2022). Since images of languages and the Other can serve as facilitators of contacts with the diversity of languages and cultures or can lead to attitudes of rejection of such contacts (Castellotti et al., 2001; Krimpogianni, 2020; Paye, 2020), the field of Language Didactics has been concerned about the impact of these images on the (lack of) predisposition for language learning and on the establishment – or avoidance – of these contacts. Considering this panorama, we developed a case study in which we diagnosed the images of some members of a school community (9th-grade students, tutors, teachers and staff) through a survey that was applied between June and October of 2022. Data were collected and analysed with SPSS. The results showed that there were negative images circulating in the community, mainly regarding: i) languages that were considered as "ugly", "difficult", "useless" and "without political importance" (German, Hindi, Japanese, Korean, Mandarin and Russian); ii) and some peoples who were seen as "sad", "disorganised", "hostil", "ugly", "noisy" and "selfish" (Arabians, Chinese, Germans and Russians).
With the aims of deconstructing these images and promoting awareness concerning linguistic and cultural diversity, an intervention program aimed at the members of the community was designed collaboratively with teachers of the school between the months of November 2022 and January 2023. The program followed an Awakening to Languages Approach, defined by Candelier et al. (2012) as a way to promote a shift in the way languages and cultures are seen by promoting the knowledge of world's languages and cultures, the appreciation of the repertoires of the individuals and the development of positive attitudes. The program was implemented during the second semester of the school year (February to June 2023). The proposals were discussed, adapted and reformulated with the teachers and there was a concern in assuring that they were aligned with the national curricula and regulatory documents.
Some of the preliminary results of the intervention program suggest students acquired some knowledge, mainly concerning the existence of different alphabets in the world, the geographical distribution of languages and the difference between Chinese and Mandarin and between the denominations "Brazilian" and "Portuguese from Brazil".

Keywords: *Images of languages and the other; Awakening to Languages Approach; School community.*

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A qualificação profissional de pessoas com deficiência intelectual como contributo para a sua inclusão socioprofissional

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Abstract. No decorrer da história, a vida das pessoas com deficiência foi marcada pela intolerância, invisibilidade e assistencialismo, culminando em exclusão-segregação dos ambientes educacionais (Minayo et al. 2020). Atualmente, a educação inclusiva fundamenta-se na concepção de direitos humanos, conjugando igualdade e diferença como valores indissociáveis. Contudo, a inclusão educacional da pessoa com deficiência ainda é permeada de obstáculos, sendo a deficiência intelectual a que enfrenta os maiores desafios. Estudos apontam que no Brasil esse grupo apresenta menor índice de alfabetização e expressivo número de estudantes restritos a Escolas de Educação Especial, sem terminalidade e acesso à profissionalização (Frederico ; Laplane 2020). Assim, o objetivo deste estudo é implementar no Instituto Federal do Rio de Janeiro - IFRJ, um curso de Qualificação Profissional, para estudantes com deficiência intelectual, segregados em uma Escola da Associação de Pais e Amigos dos Excepcionais - Apae, em prol da sua inclusão socioprofissional. O estudo enquadra-se no paradigma sócio-crítico, de natureza qualitativa, e classifica-se como investigação-ação. Serão sujeitos estudantes e professores da Qualificação Profissional e empresários locais. Na recolha de dados serão utilizados questionários e entrevistas, validados e pré-testados. Após parecer favorável dos Conselhos de Ética da Universidade de Aveiro e do IFRJ, aplicou-se um questionário a 37 estudantes da Apae, com idade entre 16 e 63 anos, para conhecer interesses e expectativas por formação profissional no IFRJ. Os dados revelaram que 97,3% dos estudantes tem interesse em participar de cursos no IFRJ. Dentre os cursos propostos, 41% apontaram Operador de Supermercados como curso de maior interesse, seguido de Cumim 24%, Padeiro 16%, Salgadeiro 11%, Pizzaiolo 5%, Masseiro 3% e Atendendente de Lanchonete 0%. Estes dados, ratificam a importância do IFRJ ofertar Qualificação Profissional cuja exigência de escolaridade, seja o ensino fundamental I, para atender a demanda dos estudantes da Apae. Definido o curso, elaborou-se o Projeto Pedagógico, embasado no Guia de Cursos de Formação Inicial e Continuada do Ministério da Educação, já aprovado no IFRJ, com início previsto para agosto de 2023 e duração de quatro meses. Uma capacitação que discutiu sobre deficiência intelectual, educação inclusiva, desafios, metodologias e troca de saberes com profissionais da Educação Especial e Profissional foi realizada no IFRJ para professores que atuarão no curso. Espera-se validar essa abordagem inclusiva de Qualificação Profissional e, disseminá-la na Rede Federal e Apaes, estabelecendo parceria entre estas instituições, além de contribuir para a formação profissional e inclusão socioprofissional da pessoa com deficiência intelectual.

Keywords: *Deficiência Intelectual, Educação Especial, Formação Profissional, Inclusão.*

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História da Ciência e Tecnologia no contexto da educação STEAM: um projeto de educação não formal para o desenvolvimento da literacia científica em alunos da educação básica

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Abstract. O presente projecto de investigação, em desenvolvimento no Brasil, pretende contribuir para o desenvolvimento de competências e letramento científico, de acordo com a Base Nacional Comum Curricular, ultrapassando dificuldades que têm sido identificadas. A introdução de episódios da história da ciência e tecnologia na implementação de abordagens STEAM apresenta-se como uma alternativa para implementar projetos multidisciplinares contextualizados à realidade dos estudantes, com foco em metodologias ativas e com o objetivo de instigar a curiosidade, desenvolver a criatividade, o pensamento crítico e o trabalho colaborativo, fomentando o interesse dos alunos pelas carreiras científicas.A inclusão da História da Ciência e da Tecnologia, no ensino de ciências, tem vindo a ser aconselhada, devido ao seu potencial em contribuir para contextualizar as situações-problema, aproximar a ciência dos interesses dos alunos, tornar as aulas mais reflexivas e trabalhar questões relacionadas à natureza da ciência.Considerando que existem objetivos em comum e que projetos de educação não formal podem contribuir para potencializar a educação formal, oferecendo práticas de aprendizagem mais flexíveis e atraentes aos jovens do século XXI, formulou-se um projeto de educação não formal para atender alunos da educação básica brasileira. As atividades aconteceram em encontros semanais através de uma abordagem STEAM inspirada em episódios da História da Ciência e da Tecnologia, com palestras, leitura de textos, reprodução de experimentos e atividades maker. Os temas trabalhados incluem a invenção do fonógrafo, a utilização da energia solar e o plano inclinado de Galileu.O estudo está baseado em três ciclos de um plano de investigação-ação, dois deles já executados. Coletamos dados através de testes objetivos, formulários abertos, posters e power points produzidos pelos alunos, apresentações dos alunos em sala de aula, entrevistas e relatórios do pesquisador. Os resultados preliminares, analisados por testes estatísticos não paramétricos, estatística descritiva e análise de conteúdo, indicam que houve melhoria do nível de alfabetização científica dos alunos, com impactos sobre o entendimento de conceitos e termos técnicos e científicos, sobre o entendimento da natureza da ciência e sobre as relações entre ciência, tecnologia e sociedade.

Keywords: *História da Ciência e da Tecnologia, Educação STEAM, Ensino de Ciências, Educação não formal, Literacia Científica.*

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Vocational Education: a contribution to more inclusive, innovative and sustainable societies

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Abstract. The communication aims to present the current status of the research project "Social In(ex)clusion pathways in Vocational Education: Towards a socio-educational proposal with and to its protagonists", namely, in what concerns to the importance of this educational subsystem to the construction of more inclusive, innovative and sustainable societies.
Despite having historical earlier origins, the pedagogical-curricular model of Professional Courses was created in Portugal, about three decades ago, with the aim of offering a more practical and specialized training response, in order to reduce the high rates of early school dropout. It is, therefore, relevant to discuss its role in the democratization of education and in promoting the inclusion of young people at risk of social exclusion. However, nowadays, Vocational Education and Training, in general, still faces the stigmatization associated with school failure paths and the vulnerable socioeconomic context of most students. School, therefore, often reproduces social inequalities. On the other hand, there is a clear growing trend of young people looking for a more practical educational alternative that satisfies their interests and allows them to qualify themselves to a specialized labour market or continue their studies at a higher level, aiming for social mobility.
The research fits itself into the sociocritical paradigm and a qualitative approach is being developed. The content analysis of the data obtained through semi-structured interviews to students and school leaders discloses relevant findings to the study of the students' trajectories, pointing out the heterogeneity, the diversity and the plurality, both of students' profiles and their school and post-school trajectories. The results also highlight the constraints associated to Vocational Education, in Portugal, namely in what far its stigmatized image is concerned, and the future challenges that arise. Besides that, the communication sumarizes, in particular, the participants' perceptions on the possible contribution of Professional Courses to issues related to inclusion, innovation and sustainability.
Thus, taking into account the social, political and economic transformations experienced globally and the goals established by the 2030 Agenda for Sustainable Development, it is concluded that Vocational Education is likely to be analyzed not only as a space for inclusion, equity and social justice, but also as a relevant path to the construction of a more innovative and sustainable society.

Keywords: *Vocational Education, Social Inclusion, Inovation, Sustainability, 2030 Agenda*

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Art Noveau heritage towards Education for Sustainable Development: a mobile augmented reality game under the EduCITY App

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Abstract. The urge for an effective Sustainable Development has enabled the recognition of new resources, as Heritage. In fact, since the 1970s, the relevance of Heritage, tangible or intangible, has been recognised as a space of memory, identity (Choay, 2021), learning and action for the global development of the society (CE, 2005). By promoting and valuing, in specific, built heritage, it has been possible to preserve the past while creating bridges to the future. This process, not always linear, has a special impact on the dynamism and development of cities. Cities must be safe, sustainable, accessible, enhancing creativity and providing wealth for all (UN, 2015). Combining the potentialities of Heritage with the fundamental role that Education plays as an enhancer of change, it becomes essential that Education takes place in new realities and spaces that are not restricted to schools grounds (UNESCO, 2021). To this end, Technology, especially through the use of mobile devices, allows educational spaces to emerge in the proximity of the experiences of students and their families. Combining Mobile Learning with the potential of Augmented Reality, we are witnessing a connection between (new) educational spaces and (new) realities simultaneously. Hence, this research aims to promote key competences for Education for Sustainability (Wiek et al., 2011) through the use of smart technology, such as Mobile Augmented Reality Games based on challenging paths that takes education out of the school grounds in an interdisciplinary way. For this purpose, an educational mobile game will be developed, comprising Aveiro Art Noveau built heritage raising awareness about its protection, reinforcing its value and importance for the community. This educational mobile game is part of the EduCITY mobile app, which arises in the scope of the R;D project "EduCITY", which allows the creation of a smart learning environment in the city of Aveiro. The game contents will be triggered near the Art Noveau style landmarks around the city. The game development follows the dynamics of design-based research, considering several cycles of improvement, under a pragmatic approach of mixed paradigms and methods (Creswell ; Creswell, 2023). Data will be collected through the development of a quasi-experimental, sequential and explanatory research plan involving four classes (experimental and control groups) and their teachers. Data will be triangulated using surveys and focus groups. Findings are expected to contribute to Education for Sustainable Development through the role of built heritage as an innovative resource that can be useful worldwide.

Keywords: *Cultural Heritage, Education for Sustainable Development, Mobile learning; Augmented Reality, EduCITY*

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Electrical Engineering

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DL-based Channel Estimation for the 6G Physical Layer

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Abstract. The emergence of sixth-generation (6G) wireless communication technology will create new opportunities for innovative research exploring the potential of machine learning (ML) techniques in wireless networks. In these scenarios, the development of ML-based channel estimation algorithms is demanding in order to enhance user experience and achieve reliable, high-speed data transmission over the expected 6G wireless networks. To accomplish this, we propose the estimation and mitigation of channel and hardware impairments using ML techniques in several complex wireless scenarios, such as cascaded channel systems [1] and relay systems with phase noise [2]. Additionally, a new implementation framework was introduced by us to real-time hardware implementation of ML-based algorithms [3]. Therefore, this study aims to develop novel ML-based channel and hardware issues estimation algorithms that are feasible for real-time implementation for the next generation of wireless communications.

Keywords: *channel estimation; convolutional neural networks; phase noise; FPGA.*

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Concealed target tracking using enhanced radar techniques

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Abstract. Concealed object detection in foliage scenarios has numerous applications of interest, namely search and rescue missions, border control and military operations on forest environments. This work was motivated by the lack of practical studies on such topic.

This paper reports the results of concealed object tracking performed by a polarimetric radar that is based on a Swept time-Delay Cross Correlator technique. The STDCC radar presents significant advantages over OFDM and PN, especially in the receiver front-end with a recovered baseband signal yielding bandwidth of a few kHz (i.e. two orders below). Furthermore, this work benefits from a novel architecture with an all-digital radar waveform generation, reducing the cost and complexity. The STDCC radar waveform generation is fully reconfigurable and controlled by a MatLab app generating two orthogonal sequences that will be used in each radar polarisation component.

An indoor scenario with multiple trees was chosen to assess the radar detection capabilities. A tetrahedral corner reflector that is widely used in radar benchmarks was used as the object to be detected. The corner reflector detection was tested, starting with a non-concealment and going up to three trees concealment scenario.

The corner reflector was successfully detected on all positions and with a measured attenuation expected according to literature models.

Keywords: *RADAR, STDCC, FPGA, Concealed detection*

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Optimization of CV-QKD Systems for Field Deployment

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Abstract. Continuous-variables quantum key distribution (CV-QKD) allows secure distribution of symmetric cryptographic keys using off-the-shelf equipment[1-3]. CV-QKD was first implemented using Gaussian modulation (GM). Despite being theoretically optimal, GM demands high-capacity random number sources and is difficult to achieve in practice. Discrete modulation (DM) avoids GM's practical complexity[4-5], and was recently shown to approximate GM's performance considering high-order probabilistic constellation shaping (PCS) M-symbol Quadrature Amplitude Modulation (M-QAM)[6]. We showed the ability of M-symbol Amplitude and Phase Shift Keying (M-APSK) to approximate GM in the finite-size regime[7]. Nonetheless, a gap still exists between M-APSK and GM. M-APSK and M-QAM were experimentally demonstrated secure for DM-CV-QKD against collective attacks in the finite-size regime[8-9]. However, no comparison has been made between them. Moreover, these, as most CV-QKD experimental demonstrations[8-11], were achieved offline, due to the computational cost of digital signal processing (DSP) and post-processing. Most implementations do not reconcile the data for key extraction, misleading the achievable key rates by not acknowledging the frame error rate (FER). Furthermore, a gap exists in state-of-the-art literature regarding the reconciliation in higher-order DM-CV-QKD systems. Moreover, state-of-the-art literature assumes a fixed value of reconciliation efficiency, without a proper analysis of this assumption[6,18], thus over or underestimating the key rates. It is our goal to study the security bounds of DM-CV-QKD systems considering the true value of the reconciliation efficiency and estimating the FER of the system. For such, we consider PCS DM with 256 symbols in the finite-size regime. We show that conventional and hexagonal 256-QAM yield higher performances than 256-APSK, being indistinguishable in performance from GM for high distances[12]. Moreover, the extraction key rate can be maximized through proper SNR optimization considering the reconciliation efficiency and the FER of the system[12]. The minimization of the FER does not assure key extraction or key rate maximization. The use of pre-defined fixed-rate reconciliation algorithms prevents achieving maximum key rate capacities. Proper optimization of the reconciliation algorithm is required. We intend to apply different reconciliation methods to higher-order DM, considering both fixed and adaptable methods, for proper optimization of the reconciliation method. Experimentally, we will develop a real-time complete DM-CV-QKD system for symmetric keys extraction both in laboratory and in the field. This using pilot tones and polarization diversity coherent detection for frequency and phase mismatches and polarization drift compensations. From this, we will implement a real-time CV quantum oblivious key distribution system for secure multiparty computation.

Keywords: *Quantum Key Distribution; Quantum Oblivious Key Distribution; Continuous Variables; Protocol Simulation Platform; Field Deployment; Real Time Implementation.*

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Timely and reliable localization based on optical camera communication

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Abstract. Indoor positioning technologies have long been the focus of research, mainly given that technologies such as GPS do not perform satisfactorily in this context. Several alternatives are already available, such as WiFi, Zigbee, Bluetooth, Infrared, Ultrasound and UWB, but most of these preset either a low accuracy or a prohibitive installation and maintenance cost (Brena et al., 2017). As a promising candidate for indoor positioning, Visible Light Positioning (VLP) systems have emerged as inexpensive and highly accurate, using visible light sources as beacons for the position estimation and a camera as the receiver (Dawood et al., 2021). Furthermore, existing lighting infrastructure can be adapted to serve both as illumination sources and beacons, reducing deployment costs. Since most light fixtures on a given space tend to be similar, a technique for distinguishing them is to take advantage of the fact that most cameras take a picture one row or column at a time, resulting in a time difference between them - the rolling shutter effect - which can be used to implement optical camera communications (OCC) (Saeed et al., 2019). While the low number of samples is problematic for medium and large distance links, we can leverage this to transmit simple packets of data, such as an identifier for each fixture, as well as implementing optical wireless links with applications in 6G wireless networks and Internet of Things scenarios (Chowdhury et al., 2019; He ; Zhou, 2022). Another challenge is link failure due to line-of-sight loss. This work aims to explore and propose new techniques for camera-based VLP systems. More specifically, the objective is to explore new OCC techniques that increase the maximum distance at which the communications can be successful, by exploring new modulation schemes and information recovery techniques, and new localization algorithms for improved accuracy and timely position estimation, extending the existing techniques to larger scenarios. This will be achieved through sensor fusion and machine learning, with algorithms that provide estimates using inertial measurements and statistical prediction. Other approaches, such as image correlation and using neural network models, are also expected to contribute in increasing the system accuracy and robustness. At the same time, the reliability improvements will be combined with approaches to reduce the processing time, guaranteeing the timely behaviour of the system.

Keywords: *Optical communications, Indoor positioning, Localization, Robotics, Rolling Shutter, Camera*

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Analysis of Fabrication Tolerance of Hybrid Modulation Transmitter using Programmable Photonics

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Abstract. Intense demand for high-capacity networks, driven by novel applications such as 4K/8K video streaming, 5G mobile networks, the Internet of Things (IoTs), and cloud networking has put pressure on the need for an upgrade of bandwidth-limited optoelectronic components [1].
With Photonic Integrated Circuits (PIC), higher capacity transceivers can be guaranteed while minimizing the losses, footprint, and power consumption. On another vector, the use of complex modulation formats such as pulse amplitude modulation and quadrature amplitude modulation (QAM), leverage an improved Spectral Efficiency (SE) to increase the transceiver throughput [2]. Although electronics provide very mature platforms for integrated Digital to Analog Conversion (DAC), the development of multi-level DACs with a high Effective Number of Bits (ENOB) is ultimately bandwidth and latency limited, which paves the way for a new type of DAC, such as the oDAC [3].
One major setback of oDAC-based transceivers is the deviation of passive couplers that are used in the design. These components are highly susceptible to any slight interference in the light movement which can however lead to fabrication errors [3].
In this work, we have used programmable photonic circuits (PPC) to analyze the impact of imprecise coupling factors in the production of oDAC-based transceiver for PAM4 optical signal generation.
The oDAC comprises two parallel fast MZM, an optical splitter and combiner, two slow phase modulators (PM), placed after each MZM, and a CW-laser, which generates and splits optical light into the parallel MZMs. The MZMs can be driven with either PAM-2 or PAM-4 electrical signals to form higher other modulated signals. The binary electrical signals are digital input streams, which can directly be generated from the complementary metal-oxide semiconductor (CMOS) integrated with the photonic chip [4]. Further advantages of the oDAC scheme are its flexibility and programmable possibilities [3]. As a result of these, 2/4/8/16-ary PAMs as the case may be, are all possible with the scheme.
Using the PPC, a Monte-Carlo simulation was carried out using a Gaussian profile of errors of size 1000 samples and variance between 0 and 10% for PAM4 signal generation. The result shows that level 00 is unaffected due to the introduced variance since this level implies an absence of light during transmission. The 11 level on the order hand has about an 80% reduction in the input variance while both the 01 and 10 level start to overlap as we increase the variance.

Keywords: *Optical digital to analog converter-oDAC, Programmable photonic integrated circuits-PPC, Pulse amplitude modulation 4-PAM4*

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Beamforming Metasurfaces for Telecommunication Applications

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Abstract. Antennas play a significant role in wireless communications between portable devices. This demand for wireless techniques to transmit information increases rapidly due to the increasing number of devices and data transfer rate. Even in indoor applications such as hospitals [1], wireless data transfer technologies will soon become inevitable. Thus, using 5G or beyond to connect several contactless devices may become one of the most exciting academic and industrial research tasks. However, advanced beamforming methods should be developed for such applications due to the limited penetration range of 5G or beyond signals in complex environments and the presence of multiple reflected and scattered fields. This research will discuss a beamforming architecture based on Programmable Metasurfaces (PMS) for use in future telecommunications. Particularly, metasurface-based (MS-based) beamforming and massive Multiple-Input Multiple-Output (MIMO) antennas have the potential to accomplish the high spectral efficiency demands of next-generation wireless standards and are particularly convenient for multipath-rich environments. Additionally, reflecting beamforming PMS operates by controlling the local reflection phase while omitting amplitude information. By optimizing the reflection phase distribution using different algorithms, side lobe levels are minimized. The acquired phase distributions from the optimization simulations can be used to train a neural network to realize dynamic adaptive beamforming to track and control communication beams with predefined characteristics.A novel structural approach for intelligent, reconfigurable antennas based on beamforming PMS enhanced with AI methods has been first proposed in [2], [3], with a goal to combine signal processing implemented in software with quasi-optical processing realized directly within the PMS layers. The reflected beam direction is changed by applying external dc voltages, which create a reflection phase gradient on the structure. Practical realizations of this concept will enable real-time dynamic channel propagation estimations and adaptive beamforming using trained AI networks. Machine Learning (ML) and ANN approaches have been under constant growing attention in the recent literature. In present days, promising applications of AI are actively considered in various areas of technology, including wireless communications. Due to the ability of ANNs to organize and elicit valuable information from complex, high-dimensional, and noise-contaminated datasets, using these networks for wireless communication systems will lead to notable operational benefits. Adaptive beamforming for mobile links reduces interference levels and energy consumption, extends coverage, and offers an improved solution to enable highly mobile applications. Traditionally, such beamforming is achieved by multiplying signals on radiating antenna elements by beamforming weights determined according to the channel state.

Keywords: *Telecommunications, Beamforming, Optimization, Neural Networks*

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Machine Learning Approaches for Complexity-Aware UHD 360° Video Coding

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Abstract. The growing demand for video services, and in particular omnidirectional video, such as augmented reality, 4K/8K video, self-driving vehicles, smart surveillance, etc, has led to a significant increase on the share of video on the global internet network traffic. In fact, video content accounting for approximately 70% of internet traffic in 2017 [1], and "video and other applications continue to be of enormous demand in today's home"[2]. This is deriving the effort for more efficient video coding standards for video in general, and omnidirectional video in particular.

To meet this demand, JVET released the Versatile Video Coding (VVC) standard in July 2020, natively supporting omnidirectional video, and offering a coding gains of about 30% to 60% compared to the previous HEVC standard [3, 4]. However, this increased coding efficiency comes at the cost of significantly higher computational complexity, making the VVC Test Model 5 to 8 times more complex than HEVC [3, 4]. This complexity increase poses challenges for the widespread adoption of new coding standards. As a result, several low-complexity methods for VVC have already been proposed in the literature [5], but very few have focused on omnidirectional video specifically, which is the subject of my thesis.

Thus, after a thorough study of the relationship between the most ubiquitous omnidirectional projection (equirectangular projection, or ERP), and the coding complexity, it was found that coding complexity tend to be higher near the equator regions and lower near the poles, due to the geometric characteristics of ERP [6]. Therefore, in order to leverage this, Extremely Randomised Trees (ERT) models were used to, in conjunction with other spatial and contextual features, decide whenever a given Coding Unit (CU) should be split, or if it could be skipped, which results in less complexity. This approach resulted in a complexity reduction of 56.25% and a BD-Rate increase of 1.37%.

Another approach to reduce the impact of VVC's complexity is to efficiently parallelise the coding process. Thus, a load-balancing scheme was proposed at the frame level [7]. This approach uses a combination of Principal Component Analysis and ERT models in order to predict the complexity of each Coding Tree Unit pre-emptively. Then, the frame is grouped into four slices, so that each slice has roughly the same total complexity. This achieves a 8.5% gain over evenly splitting.

Finally, other complexity reduction methods based on the relationship found in [6] are under being researched.

Keywords: *vvc, complexity reduction, video coding, omnidirectional video*

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Cooperation strategies between service and shuttle mobile robots for always-on operation

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Abstract. Cooperation strategies between service and shuttle mobile robots for always-on operationMojgan Ghanbari*, Pedro Fonseca*, Amaro F. de Sousa** DETI-Departamento de Eletrónica, Telecomunicações e Informática, University of Aveiro, Aveiro, Portugal* IT-Instituto de Telecomunicações, Aveiro, PortugalThe economy is shifting towards technology-based approaches to enhance efficiency and quality in various industries. Artificial intelligence and robotics are gaining huge attention popular, particularly in healthcare, manufacturing, and service sectors. Among them, service robots (SRs) that are mobile are highly considered due to their adaptability and flexibility, valued for their availability and promptness. For this, the correct task and power management is critical to their autonomy and timely assignment completion. Therefore, researchers aim to optimize task management and their associated energy consumption to reduce charging time while enhancing their performance and efficiency.For that regard, researchers such as Wang D., et al. used deep reinforcement learning approach for coordinating multi-robot systems in complex environments [1], while T.A. Sami et al. introduced a genetic algorithm to manage energy consumption in multi-mobile robots [2]. Moreover, Y. Kang developed a primal-dual hybrid gradient algorithm based on mean-field game concepts to address path and task allocation in multi-robot systems with an increasing number of robots [3]. However, to knowledge of author, no comprehensive work have been done to establish a solution for the challenge of continued task performing through constantly supplying energy to the robots by another group of robots, namely shuttle robots (ShRs). Therefore, the goal of this work is to provide a well-round real-time decision-making optimization algorithm for task allocation and path planning in a multi-robot system. This workplan purposes to combine various approaches to create a social network system that enables non-stop operation with enhanced task performance. The system will use intelligent real-time decision-making algorithms and protocols for different levels of a pyramidal robotic tree system to insure optimal yield from service robots while considering the characteristics of their tasks and assigned missions.Keywords:Mobile robots, Intelligent mobile network, Power management, OptimizationAcknowledgements:Mojgan Ghanbari, acknowledge financial support from FCT through the Ph.D. grant ref: UI/BD/153382/2022.

Keywords: *Mobile robots, Intelligent mobile network, Power management, Optimization*

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Energy Systems and Climate Changes

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Integrated impact assessment of liquid green fuels from electrochemical biogas conversion

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Abstract. The European Commission has set ambitious objectives for achieving climate neutrality by 2050, aiming to decarbonize all economic sectors and increase the use of distributed renewable energy technologies and the integration of various green energy carriers (European commission,2020). Among these, transportation poses a significant challenge in terms of energy consumption and reduction of greenhouse gas (GHG) emissions. Exploring alternate technologies, such as the production of synthetic, high-energy-density liquid fuels derived from renewable sources (European efuel Alliance, 2020), appears promising. However, concerns regarding their environmental impacts and feasibility persist, as evidenced by the contradictory reports on their sustainability (Okeke et al., 2020) (Navas-Anguita et al., 2019).

This study aims to quantify the overall impacts associated with the production and use of these liquid green fuels through the electrochemical conversion of biogas. It seeks to address the following questions: (i) What is the potential of liquid green fuels derived from electrochemical biogas conversion for applications in transportation modes that are difficult, such as aviation and shipping? (ii) What are the environmental impacts of liquid green fuels when evaluated using a life cycle concept? (iii) How do consumers perceive these liquid green fuels compared to hydrogen and/or electric mobility?

The sustainability aspects will be analyzed through an LCA, which will examine the environmental impacts, and a feasibility study, which will address the economic impacts of these fuels. Furthermore, a policy review will be conducted to identify the mechanisms best suited for the transition from conventional fuels to liquid green fuels.

In conclusion This study provides an integrated perspective on the environmental impacts of liquid green fuel technologies by combining research on fuel synthesis and production, and life cycle impacts and economic feasibility. The results contribute to our understanding of the service quality, life cycle impact, and energy efficiency of these fuels from a sustainability perspective, while considering key societal aspects.

Keywords: *Liquid green fuels, Electrochemical biogas conversion, Life cycle assessment, Mobility*

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The urban water cycle and the challenges of climate change: (re)thinking the articulation with city planning

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Abstract. Managing water resources, essential for human life, economic activities, and ecosystem functioning faces enormous challenges in a changing climate. It is known that water availability is not evenly distributed in the territory or in time (He et al, 2021). The effects of climate change, namely through extreme phenomena such as droughts or floods, make the management process even more complex. Research and related dissemination become increasingly essential to support decision-makers, water service providers, and communities for more robust climate change adaptation, infrastructure design, and operation in a potential new urban landscape (Vinagre et al, 2023). There is also a clear need for further studies and practice on the relationship between the various actors, particularly those managing the territory and water services, towards a collaborative response to the challenges of climate change. The main focus of this work arises from the confluence of three topics: water resilience, city planning and water scarcity. It aims to define and enhance the best way of articulation between water service providers and spatial planning authorities for urban planning to contribute to greater water resilience of cities in a context of water scarcity. After the definition of the state of the art, the formulation of the analytical model will be based on case studies, interviews with experts and questionnaires to water management entities and municipalities. Data analysis and presentation of results will follow up. The scope of the research will focus on the national context but will seek to collect knowledge, good practices and learnings acquired in other contexts.

Keywords: *climate change; adaptation; sustainable urban water management; city planning; urban planning; urban water management*

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Climate Change and Water-Energy-Food nexus in Mozambique: Assessment and Decision Support Tools

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Abstract. This thesis project aims to design an integrated management strategy for the Water-Energy-Food nexus (WEF) in Mozambique, impacted by increasing natural and human pressures and in particular by climate change. Several studies, including the IPCC reports, indicate that the nine major river basins and their respective affluents will be significantly affected by climate change over the coming decades that could affect the three dimensions of the WEF nexus (Herold and Sawada, 2012; Fecher et al. 2017; Muringai et al. 2022)). This reinforce the need for the development of tools and models to assess both the socio-economic impacts of this situation and the effectiveness of adaptation measures to reduce the climate change impacts (Chisanga et al. 2022). Under this thesis a management model for the WEF nexus will be designed by implementing hydrological models: SWAT (Thavhanaa et al. 2018) and AquaTool (Andreu et al. 1996), as decision support tools, for the historical period (1981 - 2022) and future climate projections (up to 2100), using data from climate models and information from the study area characteristics. In alignment with the objectives of the work, a crop-specific water balance model (GeoWRSI) was used to determine the Water Requirement Satisfaction Index (WRSI) for the historical period indicated above, analysing the main climatic events effects, such as drought and floods experienced in Mozambique. The results obtained with the GeoWRSI model for different planting seasons (October-March) indicate, on average, WRSI values less than 50 and probabilities for planting and cultivation of maise and rice about 20% in the country's southern region. Centre-north generally showed relatively high WRSI values around 80-95 and a probability of 80%, indicating that the chances of meeting crop water requirements at different planting seasons are relatively higher. However, some zones in Manica, Sofala and Zambezia provinces present a marginal satisfaction of water requirements and, therefore, are also prone to natural disasters. Overall, the results achieved attribute the vulnerability degree to the effects of climate change notable due to the damage observed in the main crops in the southern region by drought and by floods in the central region, contributing to the decline in the Global Food Security Index (GFSI) for Mozambique, currently occupying 94th position out of 113 countries in total, and with permanent-significant challenges for the achievement of the indicators provided for in the SDGs of the United Nations Agenda 2030, Goal: 2, 6, 7, 10 and 13.

Keywords: *WEF Nexus; Watershed; Climate change; Hydrological models; WRSI; GFSI; SDGs*

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Assessing the Environmental Impact of Shared, Automated, and Electric Mobility Coupling Agent-Based Modeling and Life Cycle Assessment

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Abstract. The transportation sector is actively seeking inclusive, innovative, and sustainable solutions to address mobility challenges. Shared Automated and Electric Vehicles (SAEVs) have emerged as promising technology to enhance future mobility. However, there may be unintended consequences, such as increased demand for driving and attracting rides from other transportation modes, including public transit. The extent of these consequences is significantly influenced by the deployment strategies and user behavior, which may potentially undermine or overshadow the efficiency gains and environmental benefits of SAEVs.To comprehensively understand this phenomenon, this research proposes a conceptual framework that integrates Agent-Based Modeling (ABM) and Life Cycle Assessment (LCA). Life Cycle Assessment is a well-established approach for exploring the environmental impacts of products or systems. However, it may not accurately forecast the implications of emerging technologies due to its reliance on predetermined assumptions and its inability to account for the dynamic and complex nature of human decision-making processes (Gutowski, 2018). Therefore, in order to fully capture the complexity and stochasticity of human behavior, ABM represents a crucial tool (Hicks, 2022). ABM has been widely used to model demand and supply interactions in detail and examine system impacts from different perspectives. When combined with LCA methods, ABM offers an opportunity to gain insights into environmental impacts by better understanding how changes in individual behavior and technology adoption can influence environmental outcomes (Alfaro et al., 2010).Although ABM has been applied in various research areas for behavior-driven modeling in LCA, its applicability to the transportation research field remains unexplored. This study aims to fill this gap by applying ABM to the transportation research field and providing methodological guidance and interpretation of the potential benefits of this approach. The results of this study could offer valuable insights for policymakers in making informed decisions about the future of transportation systems, contributing to the development of societies, and promoting sustainable mobility solutions.

Keywords: *Shared, Automated and Electric Vehicles (SAEVs); Life Cycle Assessment (LCA); Agent-Based Modeling (ABM)*

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The Health Consequences of Air Pollution in Rapidly Developing Cities: "A Case Study of Dubai"

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Abstract.
Air pollution is a global environmental issue that poses a significant threat to human health (World Health Organization, 2021). It is a major environmental challenge faced by rapidly developing cities around the world. The problem persists and has become increasingly serious in recent years due to rapid urbanization and industrialization, which have led to increased emissions of air pollutants into the atmosphere. Dubai is one of the most rapidly developing cities in the world. However, rapid development has come at a cost with increasing levels of air pollutants in Dubai.
This study will discuss the sources of air pollution in Dubai, such as energy like transportation, manufacturing industries and construction, agriculture like agricultural soils, industry including mineral, metal, chemical industry, and waste such as solid waste and waste incineration. Moreover, this chapter will identify the specific pollutants like NO2, SO2 and particulate matters (PM). It will also explore the health consequences of air pollution such as respiratory and cardiovascular diseases, as well as asthma and chronic destructive pulmonary diseases with the estimation of the number of premature death by considering statistical analysis of air quality data and relative risk functions from the literature an AirQ+ software tool for quantifying the health burden and impact of air pollution and several mitigation measures will be suggested and a cost- benefit analysis will be made. The regulations and policies that the government has put in place to address air pollution will also be examined. For example, the Dubai Supreme Council of Energy has developed a strategic plan to reduce carbon emissions and improve air quality. Furthermore, this study will investigate the relationship between air pollution and hospital admissions for non-communicable diseases, including respiratory illness which are responsible for the majority of deaths worldwide.
Air pollution is a serious issue in rapidly developing cities like Dubai, with significant health and economic consequences. Although the government has taken steps to tackle the problem, much more needs to be done to reduce pollutants emissions. This study can help individuals understand the seriousness of air pollution as well as the potential health consequences associated with exposure to air pollutants. This information can help policymakers develop strategies to reduce air pollution and its related health impact. Additionally, the study can increase public awareness of the issue and push them to take action to reduce it through their own actions for the sake of a healthy and clean environment.

Keywords: *Air pollution, health effects, air quality measures, emission sources*

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Green Public Procurement driving sustainability in High Education Institutions

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Abstract. Green Public Procurement (GPP) means that public authorities seek to purchase goods, services, and works with a reduced environmental impact throughout their life cycle with the same primary function. This research explores GPP in Higher Education Institutions (HEIs) to understand how it can drive sustainability. The following questions will be addressed: 1. What factors influence the adoption of GPP in HEIs? 2. How are HEIs implementing GPP, particularly in Portugal and the Netherlands? 3. What are GPP's barriers and challenges in HEIs? 4. What impacts are GPP bringing towards sustainable HEIs? 5. How does GPP enhance sustainability in HEIs? The methodology includes qualitative and quantitative data collection and analysis in Portugal. HEIs are critical to understanding the impacts of GPP on sustainability transformations. This study will likely provide a holistic approach for the HEIs to adopt GPP for minimal environmental impacts and support to ensure sustainable consumption and production patterns. This research work will contribute to the following goals of the UN Agenda 2030 and the Sustainable Development Goals. Goal No. 12: Ensure sustainable consumption and production patterns. Goal No. 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable, and inclusive institutions at all levels. Goal No. 17: Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development.

Keywords: *environment, sustainable, supply chain, organizations,*

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A Dark Fermentation Process for Hydrogen Production from a Synthetic Substrate

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Abstract. Hydrogen (H2) has the potential to be an incredible source of environmentally friendly energy. Hydrogen was previously considered a valuable gaseous commodity and raw material, mainly used in oil refining and fertilizer production. However, H2 is also a renewable energy source, derived from primary sources like methane, water and a consequence of chloralkali plants as a by-product in salt water electrolysis. Various methods of producing H2 that utilize different sources, such as wastes are being investigated. Moreover, H2 can store more energy per unit of weight than any other fuel, making it an ideal choice for storing energy. Hence, H2 could make energy systems more flexible by better-aligning energy production with consumer needs [1], [2]. However, economic considerations and potential risks associated with H2 production have made it difficult to commercialize. In this regard, one of the promising methods is producing H2 from biomass. In the present study a productive process of H2 from biomass using the anaerobic digestion (AD) technique with a dark fermentation approach, was developed. Lactose was identified as an effective component of cheese whey effluents for the production of H2, being used as a substrate. Also, anaerobic sludge was obtained from the Aveiro wastewater treatment plant, and a combination of a mineral medium (e.g., Magnesium sulfate heptahydrate (MgSO4.7H2O) and Potassium hydrogen phosphate (K2HPO4)) was used to enrich and increase the H2 production potential. The results showed that a large volume of biogas (>2200 ml) was produced in three days. On the other hand, to maintain the quality of the hydrogen produced, it was essential to avoid the production of methane, which is a major component of biogas. In this regard, gas chromatography was used for biogas evaluation, and its results showed that heating the sludge for two hours at a temperature of 105 °C was successful in halting the production of methane in biogas. Furthermore, only 5% of biogas was composed of CO2, resulting from the decomposition of organic materials, whereas H2 was the main component (95%) of the produced biogas.
This project aligns with multiple United Nations Sustainable Development Goals (SDGs). These goals include SDG Goal 7 (ensuring access to affordable and clean energy), SDG Goal 12 (promoting responsible production and consumption), and SDG Goal 13 (taking action to combat climate change).
Keywords: Renewable Energies, Hydrogen Production, Dark Fermentation, Anaerobic Digestion, Synthetic Cheeses Whey Effluents.

Keywords: *Renewable Energies, Hydrogen Production, Dark Fermentation, Anaerobic Digestion, Synthetic Cheeses Whey Effluents.*

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Sustainable Synthesis of TiO2/g-C3N4 Nanocomposite as a Photocatalyst for Wastewater Treatment

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Abstract. AbstractWater contamination is becoming an increasingly pressing threat. Massive amounts of contaminated wastewater with dangerous contaminants are being released into natural water sources on a daily basis. In the past few decades, there has been a great interest in using nanotechnology to perform photocatalytic environmental remediation, which involves the utilization of organic, metal and non-metal based semiconductor photocatalysts to photodegrade pollutants (Raaja Rajeshwari et al., 2022). In this regard, Titanium Dioxide (TiO2) and its nanocomposites are known as promising choices. TiO2 is a low-cost, chemically stable material with a wide band gap and low toxicity. Graphitic Carbon Nitride (g-C3N4) has also drawn a special attention for its special physicochemical properties in the removal of environmental pollutants: being a cost-effective, non-metallic, polymer-based light-activated substance, G-C3N4 can be utilized as an efficient photocatalyst in wastewater treatment (Chen et al., 2020). The present work aims to create a strategy for the synthesis of a TiO2/g-C3N4 nanocomposite through a sol-gel process, assisted by microwaves during the calcination step. Titanium isopropoxide (TTIP) and melamine were employed as the primary components for the production of TiO2 and C3N4, respectively. Also, for the nanocomposite synthesis, C3N4 was synthesized separately and added to the precursor of TiO2. X-ray diffraction (XRD), gas adsorption using the Breuneur-Emmet-Teller (BET) isotherm, scanning transmission electron microscopy (STEM), and UV-VIS spectroscopy were employed to analyze the properties of the synthesized nanoparticles. XRD revealed that the synthesized materials comprised a combination of 13% anatase and 87% rutile. According to STEM analysis, the synthesized particles of TiO2/g-C3N4 presented spherical and rounded shapes, with an average diameter lying between 7 and 27 nanometers. The specific surface area (SSA) of the synthesized TiO2 was determined as 90.1 m²/g, while the SSA of TiO2/g-C3N4 nanocomposite reached 168.6 m²/g. Furthermore, TiO2 and TiO2/g-C3N4 bandgaps for direct transition were determined to be 3.05 eV and 2.99 eV, respectively. These results showed that the use of microwave in TiO2 and TiO2/g-C3N4 synthesis did effectively substitute the calcination step. In addition, the utilization of microwaves to synthesize nanomaterials decreased the duration of calcination from two hours in an oven to only three minutes in the microwave, which also led to a decrease in carbon dioxide emissions.
The United Nations Sustainable Development Goals that are relevant to this project include: SDG Goal 7 (Affordable and Clean Energy) and SDG Goal 13 (Climate Action).
Keywords: Titanium Dioxide, Graphitic Carbon Nitride, Photocatalyst, Microwave Irradiation.

Keywords: *Titanium Dioxide, Graphitic Carbon Nitride, Photocatalyst, Microwave Irradiation.*

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Investigating the plant ecological and ecophysiological mechanisms of plant-soil interactions in biodiverse pastures of Central Portugal

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Abstract. Grasslands are one of the major vegetation types in Portugal, and pastures represent the major agricultural land-use type. Compared to Northern European Countries, pastures in Portugal are much more biodiverse, and are sown from diverse legume-grass seed mixtures. However, an increasing drought intensity is the strongest limiting factor of their productivity, whereas limited water resources and uneven rainfall distribution during the season additionally endangers their production.
The goal of this research is to study the ecological and ecophysiological mechanisms of plant-soil interactions of biodiverse pastures in different establishment phases and different grazing systems, as well as the agronomic practices that can improve their productivity during the establishment phase, with a special focus on biochar application to soil.
The research will comprise four phases, each aiming to investigate specific aspects of biodiverse pastures' productivity, ecophysiology, nutritional value, biodiversity, and water scarcity footprint. Both field- and pot- scale experiments will be used.
As there is uncertainty about which vegetation survey method is most feasible to study plant communities of biodiverse pastures, in the first phase the aim is to find the most efficient one. Thus, plant community composition of biodiverse pastures will be assessed via extended Braun-Blanquet phytosociological scale (Barkman 1964), point-intercept method (Jonasson 1988), and species-specific biomass separation (Lisner and Lepš 2020).
In second phase, the goal is to investigate if biochar-amended hardsetting soil improves pasture productivity in a community establishment phase through facilitating plant nutrient uptake and species-specific biomass growth, due to its positive effect on soil organic C and nutrient status, soil structural properties, soil water holding capacity, and the abundance of mycorrhizal fungi. The influence of biochar incorporation on alpha-diversity of a pasture plant community will also be analyzed. This experiment will be accompanied by two pot experiments in the third phase, aimed with answering to which extent the importance of competition vs. facilitation between grasses and legumes plays a role in establishing pasture community structure under biochar addition, and their dependency on soil nutrient availability and drought.
In the fourth phase, the aim is to assess whether different grazing systems (i.e. agroforestry pasture systems and different succession stages) provide feasible agronomic quality compared to traditional pastures. This will be assessed by analyzing plant ecophysiological performance, nutritional productivity, and community composition of these grazing systems. This research is linked with three categories of Sustainable Development Goals, namely 2. (Zero Hunger), 13. (Climate Action), and 15. (Life on Land).

Keywords: *biodiverse pastures; grassland ecophysiology; grassland ecology; legume-grass seed mixtures; biochar; plant water stress*

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BioBee - Can soil engineering with Biochar improve pollinator attraction cues, feeding and ground-nesting resources in sown biodiverse pastures?

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Abstract. Pollinator communities are declining worldwide, mainly due to habitat destruction, increased use of pesticides, and intensive agriculture (Centrella et al., 2020). Due to the important role of pollinators in multiple ecosystem services, it is necessary to provide abundant and diverse floral communities, safe food resources and promote shelter for pollinators, in line with the UN's SDG 15/13. Since biochar is being used to increase soil water retention plus nutrient content and improve soil structure for plant growth (Verheijen et al., 2010; Jeffery et al., 2011), we hypothesized that alongside plant health, flowers would also show improvement in their attraction cues and the nutrient value of pollen and nectar, when growing in soil amended with biochar, while also improving ground nesting conditions.

To test the hypothesis that enhanced flowers would attract more pollinators, the experimental setups were designed at two scales: 1) small scale with pots, testing control, biochar (4% w/w; field concentration), and four positive controls to quantify the potential mechanisms behind biochar (structure, water retention, pH variation, and nutrient availability) on flower attraction cues and nutritional value of nectar and pollen; 2) a field site with biochar plots vs control plots, in a sown biodiverse pasture in Covilhã, Portugal. In the field, flower-insect interactions will be monitored non-invasively using cameras. Ground nesting conditions for representative pollinator functional groups will be monitored directly by counting and describing nest entrances in the plots, and indirectly by monitoring soil humidity, microclimate, and penetration resistance. The insect community will also be studied using pitfall and sticky traps, (and transect walks) inside the study area, and in the habitats surrounding the plots - the grazed area and the agroforest - for a better understanding of the pollinator and insect community found in the farm.

A second pot experience will be done later to test the capacity of biochar to reduce pesticide bioavailability in soil, which would reduce the bioavailability of the chemicals by the plants, and consequently, reduce their trace concentrations in nectar and pollen stocks.

BIOBEE expects to demonstrate that by improving multiple habitat conditions linked to pollinator habitat use in pastures, biochar can lead to improving pollinator abundance and diversity while promoting more resilient ecosystems.

Keywords: *Biochar, Flowers, Native Bees, Portugal*

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High resolution inventory and projection of atmospheric emissions based on mega data and climate scenarios

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Abstract. Air pollution, along with climate change, poses the biggest environmental threat to human health, causing seven million premature deaths worldwide each year [1]. To minimize the impact of air pollution on health, it is necessary to have access to detailed information to develop effective mitigation strategies. Accurate atmospheric emission inventories are critical in estimating air quality levels under climate change scenarios [2]. However, air quality modelling (AQM) results often have uncertainties, as highlighted in future simulations, such as inaccurate emission values due to inadequate emission factors [3,4] and activity data [5], imprecise emission locations because of the coarse horizontal resolution of available inventories (between 0.1 and 0.5), unsuitable temporal and speciation profiles applied to annual atmospheric emission values [5,6].In recent years, the massive collection of big data has emerged as one solution to better analyse atmospheric emissions [7,8] and improving emission inventories. The main goal of this study is to develop high-resolution emission inventory and projections for Portugal under CC covering both classic atmospheric pollutants (PM10, PM2.5, NOx) and greenhouse gases (CO, CH, NO) based on big data, machine learning and AQM to develop high-resolution atmospheric emission projections for Portugal under climate change scenarios. The approach will improve the accuracy of the national emission inventory, and the emission projections of the most probable Shared Socioeconomic Pathways (SSP) scenarios for 2050 and 2100 will be disaggregated into high spatial and temporal resolutions.Additionally, machine learning algorithms based on the WRF-CAMx model application for past years will be developed to improve the accuracy of AQM under climate change scenarios.The research findings will provide detailed and precise emission inventories and projections for Portugal, serving as a valuable research and policy support tool for appropriate climate change mitigation strategies. By leveraging the power of big data and machine learning, this study aims to advance our understanding of the impacts of air pollution and climate change on human health and support efforts to address these global challenges. However, in this presentation only the literature review will be presented, that will synthesize findings on recent case studies and methodologies that use big data science to improve historical emission inventories and Shared Socioeconomic Pathways (SSP) scenarios to project future atmospheric emissions.

Keywords: *nan*

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Sustainable supply chain of novel and conventional (waste)water treatment technologies in Portugal

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Abstract. Abstract
Pollution of water resources with various types of pollutants is currently considered an issue of global concern which has resulted in the scarcity of clean water resources and severe environmental issues [1]. To address this problem, several various physicochemical and biological methods have been developed all over the world and introduced to the scientific community. However, most of them have not been developed for real applications. There can be a couple of reasons for this including the economic, and sustainability aspects. In fact, there are rare reports available in the literature including detailed sustainability, life cycle and economic studies to make enables the selection of the most sustainable and cost-effective studies [2]. This is especially of high importance because of some reasons. For instance, it has been indicated that although the application of advanced oxidation processes has advantages over conventional biological systems for the decomposition of recalcitrant organic compounds, they normally fail to satisfy the economic aspects. Furthermore, there the degradation products formed under such methods are even more toxic than the parent molecules [3]. Such observations are also of high importance in various life stages of wastewater treatment technologies which can lead to minimising the respective environmental impacts and optimizing their cost-effectiveness. The proposed PhD work will study the supply chain of various wastewater treatment technologies and covers the technical aspects of water and wastewater treatment technologies and sustainability aspects of the developed technologies and c) the supply chain and the commercialization of the water and wastewater treatment technologies in the Portugal territory. Such activities will result in outputs including a) the classification of various (waste)water treatment methods developed so far for the removal of various biodegradable and non-biodegradable pollutants, b) designing and defining the supply chain management flow for wastewater treatment systems and identifying the exact elements of the system, c) identifying the sustainability aspects which are important to be considered in adopting novel wastewater management systems, d) detailed techno-economic analysis of the methods developed for the treatment of effluents, and e) developing models to identify the most suitable wastewater treatment methods which are appropriate for Portugal. Recommending the most sustainable and appropriate technologies for the treatment of various types of effluents in Portugal.
Keywords: Wastewater treatment, Supply chain, Life cycle analysis.
SDG Goal 6: Clean Water and Sanitation
SDG Goal 7: Affordable and Clean Energy
SDG Goal 15: Life on Land

Keywords: *Wastewater treatment, Supply chain, Life cycle analysis*

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Smart valorisation of organic side streams for food and feed by the Black Soldier Fly using a circular economy approach

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Abstract. In the last decade, the black soldier fly (Hermetia illucens; BSF) has been one of the most widely reared species among all insects used as alternative protein sources. Its unique characteristics such as high protein content, bioconversion rates and versatility in terms of feeding substrates justify the relevance that this species has been receiving. Similarly, to traditional livestock production this new type of business model may use different approaches to production systems regarding feeding input regimes and feeding strategies and the organic wastes from supermarkets, agroindustry or restaurants gained interest to recover nutrients under a circular economy framework. Nevertheless, achieving high productive yields is a concern and the heterogenous nature of wastes brings uncertainties (Huis, 2022).This PhD work plan aims to assess the influence of different residues, as substrates, in bioconversion yields, assess the composition of the final product under nutritional aspects and compare the environmental impacts of insect protein production versus conventional sources. The first stage of the experimental work focused on a continuous feeding system and the potential effects of suboptimal feeding under different conditions of temperature and substrate moisture that may occur between food supply events. Several mono-vegetable streams were used as feed substrates ((wheat, pumpkin, apple, pomace, red onion, red cabbage, spinach) and the Hermetia illucens biological and bioconversion performances were assessed. The results showed that, in some substrates, the development of the BSF larvae is negatively affected, which means that the source of wastes used for feeding a black soldier production unit must be a concern.
Besides the economic efficiency inherent in an activity whose aim is to create a value-added product, one of the main driving forces of insect mass rearing is, as said, the possibility of waste treatment and nutrient recirculation in food systems. To establish itself as a strong and viable alternative to traditional protein sources, this new production model must be environmentally efficient. Life cycle assessment (LCA) is, possibly, the most robust tool to compare the environmental performance of this kind of project. Besides the multiplicity of methodologies among LCA studies one of the aims of this PhD work plan is to, is not only to carry out an LCA study but to compare the available studies that exist in the area and if possible, define a common thread between them (Smetana et al., 2021).

Keywords: *Circular economy, feedstock substrates, rearing methodologies, black soldier fly*

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Differences across neighbourhoods in the adoption and diffusion of nature-based solutions by property owners in Eindhoven, The Netherlands

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Abstract. The implementation of nature-based solutions (NBS) represents an alternative for urban areas to adapt and mitigate climate change impacts, improving urban climate resilience in cities. However, the success of their implementation in a determined region will depend on a positive rate of adoption. Previous studies, albeit few, have assessed factors influencing the adoption of nature-based solutions at the city level. It is argued, however, that the adoption of nature-based solutions differs across neighbourhoods, given underlying differences in bio-physical and socio-economic conditions. Hence, the objective of this study is to assess factors influencing the level of adoption and rate of diffusion of nature-based solutions across neighbourhoods in urban areas. To this end, the ADOPT innovation prediction tool is adapted to the case of green roofs in Eindhoven, The Netherlands. Based on on-line survey responses (n = 1023) differentiated across seven districts and their respective quarters and neighbourhoods, results show that the city-wide predicted level of adoption is almost 5% and that the time perceived to reach this percentage is approximately 17 years. Results show, however, large differences in the potential for adoption and rate of diffusion of green roofs across neighbourhoods in Eindhoven – with predicted levels of adoption ranging between 1% and 25% and rates of diffusion ranging between 10 and 30 years. These differences are explained by the potential for implementation (area of flat roofs), available information on and knowledge of green roofs, and risk and maintenance associated with green roofs. Hence, this study facilitates the definition of, not only, city-wide, but also, neighbourhood-specific strategies that more efficiently enhance the adoption and diffusion of green roofs in urban areas.

Keywords: *nature-based solutions; adoption; urban resilience; climate change; green roofs; adaptation*

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Smoke from wildfires in contaminated sites by radionuclides: a modelling case study

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Abstract. Smoke from wildfires in contaminated sites by radionuclides: a modelling case studyTobias Osswald1, Ana Isabel Miranda11 Universidade de Aveiro, Departamento de Ambiente e OrdenamentoIt is not common to simulate the smoke impact from wildfires radioactive regions, but it is very important to be ready to obtain maps of radionuclides concentration levels in the air. The objective of this research is to develop and apply a smoke dispersion modelling system able to assess this type of smoke events.In this scope, the DISPERFIRE smoke system, which is based on a lagrangean dispersion model, was adapted and applied to the wildfire that took place in 2016 in the Red Forest close to the Chernobyl Nuclear Power Plant. This wildfire started on the 15 of July of 2016 and lasted for 2.5 days. The region is contaminated with radionuclides, due to the nuclear accident of 1986, that were scattered and dispersed in the air alongside with the wildfire smoke.Data from emissions of five different isotopes (Cs-137, Sr-90, Pu-238, Pu-240 and Am-241) with a detailed spatial and temporal distribution for the whole region, based on empirical data of the level of contamination in the forest and on wildfire progression simulations carried out with the FlamMap model was used. The total emissions amount to 58 GBq distributed among the isotopes.The concentrations of each radionuclide over the course of the event was estimated with the DISPERFIRE smoke modelling system at a horizontal resolution of 10 m in a 3.5 km x 1.6 km domain. The heat released by the flames is used to estimate the smoke plume rise while the emissions at each cell and at each time-step obtained from the FlamMap wildfire dynamics simulations provide the amount of each radionuclide to be emitted. The dispersion is calculated using the lagrangean formulation, where each particle represents a given amount of the emitted radinuclides. Particles are advected by the joint effect of the mean wind and a random motion.The local levels of radionuclides reached dangerous levels for the human health near the wildfire location. The developed methodology will allow for a better preparedness and response to wildfires in forests contaminated with radionuclides.keywords: wildfire emissions, radionuclide emissions, smoke plumeThe following United Nations Sustainable Development Goals are aligned with this research: Nr. 3 - Good health and well-being Nr. 11 - Sustainable cities and communities Nr. 13 - Climate action

Keywords: *wildfire emissions, radionuclide emissions, smoke plume*

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Valorization of pyrolysis oils through fuel-blends

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Abstract. AbstractThe energy sector is looking for more sustainable transportation fuels to cope with the scarcity of fossil fuels and the environmental concerns related to the intensive use of these resources. Bio-oils produced by pyrolysis of residual biomass are promising precursors to the production of liquid fuels for the current transportation sector. However, their potential application is limited by some undesirable properties. For instance, the high-water content and strong presence of oxygenated compounds in bio-oils are two of the most important challenges to overcome. Besides, bio-oils have higher viscosity and density than conventional fuels and they are very acidic. Therefore, upgrading the bio-oils quality is of utmost importance to improve their fuel properties as fuel precursor [1]. Hydrotreatments are broadly recognized as the most promising upgrading routes to convert bio-oils into fuels [2]. However, their commercial feasibility still faces important drawbacks, namely the costs and risks related to the high pressures and the large hydrogen demand [3]. In this light, a medium-term solution based on increasing the sustainability/renewability of fuels through the blending of bio-oils fractions with conventional fuels (gasoline and petrodiesel) seems to be a more reasonable solution to the energy companies dealing with the current European and National targets. Although blending whole raw bio-oils with fossil fuels could not produce blends with the desirable fuel properties [4], few studies showed that blending selected fractions of bio-oils with conventional fuels may result in more sustainable fuel blends with the potential to meet the current fuel specifications [5][6]. However, the application of an integrated approach based on the fractionation/extraction of bio-oils and the sequent blending of selected fractions of bio-oils with conventional fuels is underdeveloped [7]. This research aims to produce transportation fuel blends through the blending of selected fractions of bio-oils with gasoline or petrodiesel, using low capital and operational cost fractionation/extraction techniques, such as solvent extraction, distillation, and column chromatography, among others. Thus, contributing to the increase of the sustainability of conventional fuel and ultimately to a greener energy pathway.Sustainable Development Goals:7 – Affordable and clean energy, 12 – Responsible consumption and production, 13 – Climate action

Keywords: *Residual biomass; Pyrolysis; Bio-oil; Fractionation; Blending; Fuels*

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The Role of Green Infrastructures in Improving Air Quality and Urban Microclimate

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Abstract. Air pollution is considered Europe's largest environmental health risk, with detrimental impacts on the urban population. About 96% of those living in the European Union's urban centers were exposed to levels of fine particulate matter above the World Health Organization's recommended health guidelines. Urban green infrastructures (GI) provide a solution for improving air quality and mitigating the impact of climate change. However, the GI requires careful consideration of placement and planning for maximum efficacy.

This work aims to enhance urban air quality and thermal patterns for current and future climate conditions by identifying ideal characteristics, configurations and placement of relevant GI. To achieve this, a Computational Fluid Dynamics model, OpenFOAM, will be used to numerically model the local influence of GI on microclimate and fine particle dispersion.

The final purpose of this work is, to contribute to the scientific community's knowledge while also supporting decision-makers in urban planning policies considering future climate scenarios. This will help to create cities that prioritize clean air and promote better health outcomes for residents.

This research contributes to the United Nations' Sustainable Development Goals (SDG):

SDG 3 Good Health and Well-being - by aiming to improve urban air quality, which is a key determinant of public health;

SDG 11 Sustainable Cities and Communities - by seeking to enhance the urban environment through the strategic placement and configuration of green infrastructure;

SDG 13 Climate Action - by mitigating the effects of climate change through the optimization of urban thermal patterns under present and future climate conditions.

Keywords: *Urban Atmosphere, CFD modelling, Fine Particulate Matter, Temperature, Climate Change.*

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Assessing the impact of urban morphology on emissions

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Abstract. Urban planning strategies can help mitigate climate change effects in cities and improve the quality of cities environment by providing a more sustainable development (Lindberg et al., 2013; Rafael et al., 2016). While there is still a debate on whether cities should be compact or sprawled, it is certain that urban morphology and land use have an impact on their environment (Rafael et al., 2017). Thus, the goal of this work was to assess how different urban morphologies affect air pollutant emissions (PM10 and NOx). To do that, three scenarios were developed based on demographical, socioeconomic, geographical and infrastructural parameters. The current urban morphology of the case study region of Aveiro is classified as equivalent to a dispersed city, therefore the three scenarios represent two compact city scenarios (focused city scenario with specialized cores, and the independent city scenario with self-sustainable, unspecialized cores) and one, more extreme, dispersed city scenario. To simulate the baseline and the scenarios for the road transport emissions, accounting for technological and behavioural changes, the travel generation model PTV VISUM (PTV Group, 2021) was used to represent the travel and distribution of trips between zones (whether they be urban cores or municipalities), integrating all relevant modes of transportation into one network model. The application of PTV VISUM estimates the number of vehicles and average speed of each road segment, which is a required input for TREM, a model that allows for an estimation of road traffic emissions with a high temporal and spatial resolution adequate for use in air quality modelling. For other emission sectors, the baseline and scenarios are simulated by changing the corresponding land use (i.e. industrial land use corresponds to industrial emissions).
By understanding how pollutant emissions are affected by changes to the urban morphology and land use, it is possible for urban planners to design their future changes with the best outcome in mind (United Nations, 2016).Aligned with SDO goals 11 and 13, this work will contribute to adopt and implement integrated policies towards urban sustainability, adaptation to climate change and resilience in cities, and support the integration of climate change measures into national policies and strategies.

Keywords: *Air quality; Urban Areas; Sustainable Development; Mobility*

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Policy instruments to mitigate negative impacts and potentiate expected benefits of Nature-Based Solutions for urban global change adaptation: an integrated environmental, economic and social analysis

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Abstract. European cities are facing environmental, economic and societal challenges, such as climate change, economic development and population growth and associated impacts and consequences for quality of life – requiring cities to adapt and become more resilient. Nature-based solutions (NBS) are recognized as adaptation measures that increase cities' resilience in the face of global change, given their multiple benefits and co-benefits. Nevertheless, there is a lack of evidence on the expected impacts, benefits and co-benefits of urban NBS in an integrated way. Furthermore, potential negative impacts (such as gentrification) are scarcely assessed and policy instruments to steer urbanization patterns (to reduce negative impacts and enhance benefits) are poorly explored. Hence, the overall objective of this research is to assess the environmental, economic and social impacts of NBS as well as to assess the effectiveness of policy instruments to mitigate negative impacts and potentiate expected benefits of NBS for urban global change adaptation. Overall, by fostering the impact of NBS in urban areas, it contributes to the 11th Sustainable Cities and Communities, 10th Reduced Inequalities and the 13th Climate Action within the Sustainable Development Goals.

Keywords: *Nature-Based Solutions; Simulation Modelling; Urban planning Policy Instruments*

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A hybrid system for the simultaneous bioelectricity-biogas production and treatment of industrial effluents using sustainable carbonaceous structures

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Abstract. AbstractThe idea of innovation of bioelectricity generation technologies using microbial fuel cells (MFCs) has been an effort to address the need for the simultaneous decomposition of organic compounds and bioelectricity generation [1]. The performance of such systems is highly dependent on specific interactions between the microorganisms and anode materials which can govern and density of the generated power. In this regard, efficiency, cost-effectiveness, and ecotoxicological aspects related to such technologies are currently under the spotlight. This can be speculated here that the development of novel and sustainable bio-anodes can especially enhance the electron transfer mechanisms between the microorganisms which is essential for both bioelectricity and biogas production. Novel and precise technologies such as 3-D printing have also been introduced in very recent years for the fabrication of electrode materials with enhanced properties required for such applications. There are also two mechanisms involved in ORRs including two- (O2 + 2H+ + 2e → H2O2) or four- (O2 + 4H+ + 4e → 2H2O) electron pathways. Under the four-electron pathway, H2O2 is generated in the cathodic chamber, which can be converted to hydroxyl radicals (•OH) having a strong oxidizing potential (2.8 eV), mediated for instance by iron-based materials such as iron oxides and zero-valent iron, for the decomposition of complex organic compounds [2]. The development of natural air diffusion cathodes (NADCs) has also been an effort to eliminate the need for external aeration, which can considerably reduce the overall treatment costs but has not been well-investigated in MFCs. Modification of cathodes for the optimum production of active species can also create possibilities for the treatment of recalcitrant organic compounds in a cathodic chamber. In this regard, developing novel photoelectrochemical systems is among the current trends in the literature for the innovation of sustainable (waste)water treatment systems. Modern visible-light active materials such as graphitic carbon nitride (g-C3N4) are currently under investigation for such advanced photocatalytic processes. The quality of the treated effluents is also of extreme importance and is related to the efficiency of the applied treatment as well as the formation of intermediate products. However, coupling the ecotoxicological studies with novel (waste)water treatment technologies, to assess their remediation efficiency, has not been developed deeply in the literature [3].

Keywords: *Wastewater treatment, Microbial fuel cells, Bioabodes, Ecotoxicology*

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Machine Learning Algorithms for Mitigation and Adaptation against Climate Change in Timor-Leste: Analysis of Temperature and Precipitation Extremes

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Abstract. Climate change involves increases in average temperatures, uneven shifts in precipitation patterns, and frequent occurrences of extreme weather events such as floods and droughts. These events have become more frequent and had a significant impact on the environment and human life in different regions of Timor-Leste. Insights into past and future patterns are required, but traditional statistical methods can make this difficult. The use of machine learning can make it possible to effectively analyze and predict the occurrence of floods and droughts in risk-prone areas (Zennaro et al., 2021).The most pressing environmental issues in Timor-Leste are deforestation, soil erosion, extreme weather vulnerability due to climate variability, poor water quality and scarcity, waste treatment, and loss of biodiversity and ecosystem services (Secretary of State, 2010). Timor-Leste's total rainfall is expected to rise, as will the intensity of rainfall and heat wave events (Mycoo et al., 2022). The local impacts are poorly understood. How can machine learning algorithms be applied to climate change and variability in small islands? The aim of this research is to use machine learning models to predict floods and droughts, identify and assess key areas for environmental impact assessments, and propose strategies for climate change mitigation and adaptation in Timor-Leste.A mixed approach is used: quantitative and qualitative analysis. The first part is quantitative and based on observed weather station data in Timor-Leste for the analysis of the historical period. Variables used for analysis are precipitation, temperature, wind direction, and wind intensity (Andrade et al., 2018). Satellite-simulated model data are also used for historical and projected scenarios for comparison. Floods and droughts are identified through ETCCDI extreme climate indices and assessed based on bias, Pearson correlation, MAE, and RMSE between observations and projections. Considering multiple future scenarios is essential to planning for mitigation and adaptation against climate change in Timor-Leste.Based on the climate analysis, the second qualitative part is to develop a strategic plan at the national, regional, and operational levels for mitigation and adaptation against climate change and variability. This research is in line with sustainable development goals 6, 11, and 13, which aim to ensure the availability and sustainable management of water resources, make cities and human settlements resilient, and take action against climate change impacts by 2030. Incorporating this study for a small island country such as Timor-Leste would be beneficial to the development of similar island states to combat climate change.

Keywords: *Machine learning, Timor-Leste, Extreme weather, Climate variability, Adaptation, Mitigation*

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Indoor air quality in a public primary school near an industrial complex in Estarreja, Portugal

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Abstract. The school environment has a relevant importance in the health, learning and psychosocial development of students, since at school age, children spend a considerable part of their time in educational environments [1]. Studies conducted in public schools have identified that children exposed to high levels of total VOCs (TVOs), acetaldehyde, PM2.5, and PM10 are more likely to develop respiratory symptoms, some even at low exposure levels [1,2]. Therefore, this study aims to evaluate the indoor air quality in a primary school located near an important industrial center, made up of 30 companies, which hosts various economic activities, such as industrial, commercial, storage and services [3]. Indoor air samples were collected between November and December 2022. Four classrooms were randomly selected for measurement of air pollutants related to respiratory symptoms [1,2]. PM10, PM2.5, CO2, TVOCs and thermal comfort parameters (temperature and relative humidity) were measured continuously for one week in each classroom (not simultaneously), all rooms depending only on ventilation through doors and windows. From Monday to Friday, for 23 hours and a half, in situ sampling of PM10 was carried out in each classroom. Simultaneous PM10 measurements were rectified against in-situ gravimetric PM10 collected on 150 mm diameter quartz filters using a high volume gravimetric sampler (MCV model CAV-A/mb). Relative humidity (RH), CO2 and TVOCs measurements were performed with an automatic portable indoor air quality probe (IQ-610, GrayWolf® monitor) for 24 hours. The average PM10 levels for the occupancy and vacant periods were 38.9 and 16.9 µg/m3, respectively. However, on some days, classrooms A, B and D exceeded mean concentrations of 50 µg/m3de PM10 during the school period. Average PM2.5 concentrations represented 17% of PM10 concentration during school term compared to 46% during free time. The mean CO2 concentration in the four classrooms ranged from 388 to 1233 ppm during school term, not exceeding the limit of 1250 ppm stipulated by Portuguese law. In general, significant differences were observed during school term and vacant periods for CO2 and temperature in classrooms A and B. The results indicated that no classrooms recorded pollutant concentrations above the WHO air quality guidelines or national limit values. Nevertheless, since there is evidence that even low concentrations of pollutants can be a risk to children's health, the next stage of this study is involves verifying whether there are significant associations between the air pollutants measured here and respiratory symptoms of asthma and rhinitis.

Keywords: *Indoor air quality; school; PM; CO2*

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Eco-hydrological modelling of eucalyptus dominated catchments for climate change adaptation

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Abstract. Forests are of great importance in the regulation of water balance. Nevertheless, forest contribution to hydrological cycle is dependent on soil type, topography, climate, tree species and forest management. Knowledge of forests' ecohydrological response is essential to support management strategies, especially in regions that already register water scarcity. Eco-hydrological models have been used to assess and quantify the induced effects of climate change scenarios on catchment responses as well as to support effective land management and planning forest resources.Shifts in climatological conditions are expected to effect thermopluviometric regimes, plant growth cycle as well as physiological and biological rhythms, atmospheric CO2 concentrations potential evapotranspiration, biomass production, crop yield and land management operations.The main objectives of this study were to evaluate the impacts of climate scenarios on water yield and biomass production on eucalypt-to-eucalypt succession catchment (South Portugal) and assess the effectiveness of bench terraces as a water conservation practice on a eucalypt dominated catchment (Central Portugal).On the South Portugal catchment, the SWAT model was run with bias-corrected regional climate models (RCA, HIRHAM5, RACMO) under RCP 4.5 and 8.5. The results denoted a reduction of water yields in line with the reduction in total annual precipitation. The HIRHAM5 and RACMO projected a two month shift on streamflow, following the trend in precipitation (May to September). The biomass production registered a contrasting trend ranging from a decrease of up to 46% to an increase up to 20%, indicating, respectively negative and positive impacts of climate change.The catchment´s (Central Portugal) hydrological responses were analysed considering the absence of terraces and 59% of terraces occupation on the catchment. Different SWAT models were set-up using four DEMs resolutions (10m, 1m, 0.5m, and 0.25m). SWAT simulations for the scenario without terraces resulted in dynamic hydrological response with streamflow registering increases ranging from 28% to 36% when comparing with the terraces scenario. These findings corroborated the effectiveness of bench terraces as a water conservation practice.

Keywords: *Climate scenarios; Forest ecohydrological modelling; Eucalyptus; Forested catchments; SWAT model*

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Assessing the effects of nature-based solutions on surface water quality and related ecosystem services and values: a cross-Europe comparison

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Abstract. In urban and peri-urban environments, toxic agents from human and industrial activities, as well as traffic and agricultural non-point pollution, destabilize surface water quality, becoming a risk for ecosystems and human health alike (Egodawatta et al., 2007; Schwarzenbach et al., 2010; Khalifa et al., 2018). One way to combat this phenomenon is to use nature-based solutions (NBS), nature-inspired actions designed to mitigate environmental issues while providing additional economic and social benefits to communities (European Comission, 2015). The literature recognizes that NBS can contribute to the improvement of water quality (Fardel et al., 2020); their use in urban water management improves the quality of rainwater and runoff waters (Al Husseini et al., 2013), and also helps create an approximation of the natural water cycle (Wild et al., 2017). Still, studies that model impacts of NBS on water quality, and which also assess the resulting changes to associated ecosystem services and values are very scarce; they only assess a very limited type and number of NBS scenarios, and rarely take climate change into consideration (Matos ; Roebeling, 2022). Furthermore, few studies consistently assess the benefits of continuous changes in surface water quality from a chemical and biological standpoint, resulting in a lack of proper understanding of the links between biodiversity, ecosystem services and their respective values (Polasky ; Segerson, 2009; Teeb, 2010). Hence, the objectives of this study are to assess the multiple impacts, as well as costs and benefits, of NBS on surface water quality in urban and peri-urban landscapes in the face of climate change. To this end, modelling software will be used to simulate the implementation of different types of NBS (e.g.: green roofs, bioswales, rain gardens, etc.) in three case study cities of Europe – Eindhoven (Netherlands), Tampere (Finland) and Barcelona (Spain). The resulting changes to freshwater quality will be estimated under present and future climate conditions, then, these results will be used to estimate economic benefits in two ways: using a benefit transfer approach to calculate the value of water-related cultural ecosystem services, and using a benefit assessment method to calculate avoided decontamination costs. This study, aligned with sustainable development goals (SDG) 6 (Clean Water and Sanitation), 11 (Sustainable Cities and Communities) and 13 (Climate Action), aims to provide evidence to inform European local administration entities on the topic of NBS implementation for climate change resilience-building, water resource management, and ecosystem service enhancement.

Keywords: *Nature-based Solutions; Water Quality; Nutrient Pollution; Hydrological Modelling; Ecosystem Services; Economic Valuation*

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Exposure and deposition of PM10 in the human respiratory tract: a case study of residential microenvironments

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Abstract. Indoor air quality has been the subject of several studies in the last decade, especially due to harmful effects from short and long-term exposure to high concentrations of air pollutants on human health. As people spend most of their time at home [1], exposure in indoor microenvironments can be responsible for serious health outcomes, including cardiorespiratory diseases [2]. Significant efforts have been made to assess the impact on the human respiratory tract (HRT) from inhalation of particulate matter (PM) [3], ranking fifth on the list of global death factors and being classified as a carcinogen pollutant. However, the occupant's exposure is generally evaluated from a single specific microenvironment, Studies on the representativeness of a single microenvironment characterise the entire dwelling are still scarce. Therefore, the aim of this study was to evaluate the concentrations of PM10 in different microenvironments and the contribution to the deposition in the HRT. PM10 monitoring was conducted in three different dwellings, with weekly sampling campaigns, at the same time in the kitchen, living room and bedroom. PM10 24-h concentrations were obtained from low-volume gravimetric samplers (Echo Tecora, Italy and Leckel LVS6, Germany), operated at 2.3 m3 h-1 and equipped with 47 mm pre-weighed PTFE filters (Pall). The Multiple-Path Particle Dosimetry Model (MPPD) was applied to evaluate the occupant's deposition fractions (DF) in total and specific airways regions. The PM10 mean concentrations followed the order: house 3 (Bedroom: 68.2 µg m-3; Living room: 43.1 µg m-3; Kitchen: 42.1 µg m-3) > house 1 (Bedroom: 22.7 µg m-3; Living room: 15.3 µg m-3; Kitchen: 15.9 µg m-3) > house 2 (Bedroom: 19.5 µg m-3; Living room: 6.5 µg m-3; Kitchen: 11.7 µg m-3). House 3 showed the highest concentrations for all microenvironments than other residences due to Saharan dust intrusions and contributions of wildfire smoke from long-range transport. MPPD results showed that PM10 is the main contributor to deposition in the head region (up to 85%). Total PM10 deposition fractions ranged from 73% to 86% for males and 69% to 83% for females. In general, the regional DF of PM10 showed a similar pattern, irrespective of the house: H > P > TB. In general, PM10 concentrations and depositions did not show significant differences between microenvironments, except for house 2, mainly related to indoor activities, ventilation, and infiltration from the outdoor.

Keywords: *Indoor air quality; PM; Dose; MPPD; dwellings.*

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Development of a gas-liquid membrane contactor with encapsulated non-volatile solvents for improvement of indoor air quality.

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Abstract. Almost the entire global population (99%) breathes air that exceeds air quality limits which leads to negative impacts on human health(WHO, 2023). The deterioration of indoor air quality (IQA) is being attributed to several contaminants, such as gases and volatile organic compounds (VOCs). Among the house rooms, the bathroom is that most contribute to IAQ, thus, it becomes crucial to develop and implement effective measures of mitigation to remove such pollutants. Following the successful development of a new hybrid hollow fiber membrane with highly effective nontoxic absorbents and amino acid ILs encapsulated in carbonaceous sub-microcapsules for dehydration, that overperformed current commercial and literature technology(Gebreyohannes et al., 2020), here a gas-liquid membrane contactor (GLMC) is proposed to remove CO2, H2S, SO2, toluene, acetone (and other VOCs that prove to be pertinent for IAQ) from sanitary bowls and bathrooms. Formulation of new no-volatile solvents based on ILs/ILs-mixtures, or DES will be pursuit aiming high affinity towards the target pollutants, high permeation, and high selectivity. Only the best non-volatile solvents mixtures will be encapsulated in carbonaceous microcapsules and extruded in hollow fibers composing mixed matrix membrane (MMM) to build the GLMC for continuous, low maintenance, and compact separation prototype unit separation. The polar nature of the target pollutants, water, envisioned non-volatile solvents and their compatibility with the polymeric matrices tag this proposal as challenging due the achievement of almost-defect-free ultrathin layers, high mass transfer resistance and maximization of permeation. Furthermore, quickened physical aging, easier plasticization, and reduced mechanical robustness are among other problematic issues foreseeable and that will be addressed. An optimization of the variables involved on the production of MMM (quantity of loaded capsules, temperature, and pressure) will be performed through response surface methodology. Quasi-real gaseous mixtures (with water) will be evaluated for a process simulator for realistic scale-up. Mechanistic models capable of relating the separation with the membrane structural-related parameters will be developed based on Equations of State with association term, such as Statistical Associating Fluid Theory (SAFT), Cubic Plus Association (CPA), and Fick and Stefan-Maxwell equations. The developed models will be further implemented in a process simulator to allow a feasible technical and economical evaluation. A contributing for significant advances on the pollutant's absorption/permeation mechanisms in gas-non-volatile-solvent membrane contactors will be achieved, becoming IAQ a reality.

Keywords: *Ionic liquids (ILs); deep eutectic solvents (DESs); gas permeation; volatile organic compounds (VOCs); carbonaceous sub-microcapsules; hollow polymeric fibers.*

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The impacts of biochar application in the soil on runoff and soil erosion by water: A global scale systematic review and meta-analysis

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Abstract. Biochar application to soil has the potential to affect soil and vegetation properties that are key for the processes of runoff and soil erosion which is a process of "desertification, land degradation, and drought", an important topic of Sustainable Development Goal (SDG) 15. Therefore, this study aimed to quantify and interpret the impacts of biochar on runoff and soil erosion through the first systematic meta-analysis on this topic. The developed dataset consists of 184 pairwise observations for runoff and soil erosion from 30 independent studies but 8 of which just focused on soil erosion.
Overall, biochar application to soil significantly reduced runoff by 25% and erosion by 16%. Mitigation of soil erosion in the tropics was approximately three times stronger (30%) than at temperate latitudes (9%); erosion reduction in the subtropical zone was 14%, but not significantly different from either the tropical or temperate zones. Fewer reported field observations for runoff resulted in larger confidence intervals and only the temperate latitudes showed a significant effect (i.e. a 28% reduction). At topsoil gravimetric biochar concentrations between 0.6% and 2.5%, significant reductions occurred in soil erosion, with no effect at lower and higher concentrations. Biochar experiments that included a vegetation cover reduced soil erosion more than twice as much as bare soil experiments, i.e. 27% vs 12%, respectively. This suggests that soil infiltration, canopy interception, and soil cohesion mechanisms may have synergistic effects. Soil amended with biochar pyrolyzed at >500°C was associated with roughly double the erosion reduction than soil amended with biochar produced at 300-500°C, which potentially could be related to the enhancement of hydrophobicity in the latter case.
Our results demonstrate substantial potential for biochar to improve ecosystem services that are affected by increased infiltration and reduced erosion, while mechanistic understanding needs to be improved.

Keywords: *Biochar, Soil hydrology, Soil mechanism, Erosion, Land degradation, Desertification*

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Food Science and Technology and Nutrition

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Valorization of European brown macroalgae for food and agrifood applications

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Abstract. Currently, there has been a growing demand for innovative, sustainable, healthy, and clean-label food products due to the increasing awareness of the relation between diet and health (1). Simultaneously, the agrifood sector is facing the acceleration of climate change episodes, such as drought with consequent reduction of crop yields (2). Therefore, macroalgae are attracting interests as alternative renewable feedstocks due to their large biomass yields and fast growth rates, as well as due to their balanced composition in nutrients and exclusive bioactive compounds. Particularly, brown macroalgae are recognized for its specific target compounds, including phlorotannins and fucoxanthin which are phenolics and carotenoids, respectively, and polysaccharides including fucoidans, laminarans and alginates. These compounds have been claimed for their promising bioactivities, namely antioxidant and immunomodulatory effects, making them attractive for the development of added-value functional foods (1). Likewise, they have been linked to plant stress mitigation, so their application could be a sustainable strategy for high productivity and tolerance to abiotic stressors in crops.

Thus, the present work aimed to obtain economically-affordable extracts rich in specific target compounds from two European brown macroalgae, namely Fucus vesiculosus and Laminaria digitata. The F. vesiculosus-rich extracts will be potentially used as food ingredients in food formulations, whereas those from L. digitata will be tested against drought effects on tomato seeds and plants.

To achieve this, a holistic extraction methodology was developed and optimized for both macroalgae species. Briefly, it was first performed an extraction either with cold water or hydroethanolic mixtures (96% and 70%) to recover phlorotannins and fucoxanthin, followed by hot water extraction with CaCl2 to recover polysaccharides. In F. vesiculosus, cold water allowed to recover soluble phlorotannins (0.2%), mannitol (5%) and branched laminarans (1.1%). Sequential 70% EtOH re-extraction showed that F. vesiculosus can be used as a source of fucoxanthin. Also, it was observed that Fucus-hot water extracts contained mainly fucoidans which presence of laminarans depended mainly on the algae solvent pre-extraction. Still, the application of L. digitata-ethanolic and aqueous extracts on tomato seeds improved root and shoot elongation and increased germination velocity, whereas foliar application on tomato leaves showed capability in modulating photosynthesis and phytohormones. Overall, this work allowed the development of a sustainable extraction strategy to produce macroalgae extracts rich in specific target compounds with bioactive potential to be used in the formulation of new functional foods, as well as presented potential as plant biostimulant and to mitigate drought stress effects.

Keywords: *Brown macroalgae, sequential sustainable extraction, functional foods, plant biostimulants*

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Valorisation of Lycium spp through the production of high-value food products

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Abstract. L. barbarum L. and L. chinense Mill. are two species known as "goji", consisting of berries and leaves that are being used as functional ingredients in foods and beverage products due to their valuable nutrient and phytochemical content, such as polysaccharides, phenolic compounds, carotenoids, vitamins and minerals. Studies also shown that these compounds possess biological properties such antioxidant, immunomodulating, hypoglycemic, hypolipidemic, anti-aging, neuroprotective and cardioprotective. Moreover, numerous studies have been conducted to evaluate the effects of goji-containing products on physical parameters, sensory analysis and oxidation prevention [1,2,3].

Goji is cultivated in several countries around the world, with Portuguese producers particularly committed to organic cultivation of goji berry and the sale of fresh fruit. In this way, they differentiate their products from the Chinese market, which largely relies on conventional cultivation and the sale of dried fruits. Allied to this, there is a need to create innovative applications as value-added Lycium-derived products, to allow profitable business opportunities [4].

This work, supported by Sanaberry (http://www.sanaberry.pt/), is outlined to settle the profile of valuable nutrients and phytochemicals of L. barbarum L. and L. chinense Mill. cultivated under organic regime in Portugal, and to valorize plant products of low commercial value (small caliber berries, leaves and pruning wastes) as new ingredients for functional foods. Such applications will be supported by scientific knowledge regarding the gains on the phytochemical values, as well as on the bioavailability and bio-efficacy of innovative food ingredients.

To establish the profile of valuable nutrients and phytochemicals of berries, leaves and pruning biowaste from the two species mentioned above provided by Sanaberry, several aqueous and organic extractions were performed. Moreover, moisture, yield of extraction, total sugars, carotenoid profile, total phenolic content and antioxidant activity were analysed through extracts.

L. barbarum L. berries will be used as ingredient in new formulations for ice cream and the previous extracts with best nutritional and phytochemical value will also be added in these formulations. The nutritional and phytochemical value of the extracts will be assessed and compared to non-fortified products. Additionally, the content of target compounds, oxidative stability, melting point, pH, texture, colour, and sensory analysis of the new formulated foods will be evaluated through standard methods.

Keywords: *Goji berries, phytochemicals, functional foods, food formulation, ice cream*

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Colonic fermentability of coffee soluble fibers and potential health benefits

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Abstract. Dietary fiber (DF) is an essential component of a healthy diet, supporting gut health and reducing the risk of chronic diseases, such as cardiovascular diseases.1 Coffee is a rich source of DF, which includes the polysaccharides galactomannans and arabinogalactans, and melanoidins,2 which have been shown to affect cholesterol accessibility due to their bile salt sequestration capacity,3 also affecting its bioavailability.4 The fermentation of these fibers can lead to the production of short chain fatty acids (SCFA), whose ratio, namely acetate/propionate, is known to be a useful biomarker for managing cardiovascular diseases development.5 Moreover, by the action of gut bacteria, primary bile salt may also be converted into secondary, which are known to solubilize cholesterol in a higher extent6 and also to be able to partition to membranes more efficiently,7 impacting on cholesterol accessibility and bile salt enterohepatic recirculation. Coffee high molecular weight compounds can carry phenolic compounds either adsorbed or covalently linked to their backbone.8,9 The fermentation of these fibers can enhance the bioavailability of these phenolic compounds, promoting antioxidant activity in the colon.

Coffee arabinogalactans and melanoidins were isolated, chemically characterized and in vitro fermented. Their impact on bacterial growth, degree of fermentation by analysis of ammonium and SCFA; as well as the bioaccessibility of metabolites generated from phenolic compounds and bile salts were also evaluated. The antioxidant potential of the fermentation products was also analysed.

Arabinogalactans yielded a lower acetate:propionate ratio than melanoidins, suggesting that the former may have a greater potential to decrease cholesterol synthesis in an in vivo scenario. Coffee DF showed a positive effect on the growth of probiotic bacteria, such as lactic acid bacteria. Dihydrocaffeic and dihydroferulic acids were the main colonic metabolites derived from caffeoylquinic and ferulic acids, respectively. Accordingly, the fermented samples retained a strong antioxidant capacity, which is of great interest for the reduction of the risk of gut health diseases. Secondary bile salt production was observed in the presence of coffee fibers, being higher in the fermented arabinogalactans.

Overall, this study highlights the potential use of coffee as a novel source of antioxidant DF with potential health promoting properties for reducing the risk to develop chronic diseases related to gut health and lipid metabolism.

Keywords: *Coffee, Fermentation, Fiber, Antioxidant, Microbiota, Health Benefits*

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Raw poultry meat: hyperbaric inactivation to assure microbial food safety and extend shelf-life without colour change

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Abstract. New food preservation and pasteurisation methodologies are being investigated to ensure food safety of highly perishable foods, while minimizing quality changes.
Raw poultry meat is prone to contamination during slaughter or handling because many pathogenic foodborne bacteria present in animal's faeces and respiratory/gastrointestinal tracts easily contaminate the muscle(Santos et al., 2020; van Ba et al., 2019). Additionally, intrinsic meat factors (such as high pH and water activity and rich nutritional composition) and extrinsic factors (such as handling, transport and storage condition–particularly storage time and temperature), create a very good environment for microbial proliferation which results in a very short shelf-life(Cappelletti et al., 2015; Santos et al., 2020; Zhou et al., 2010). The shelf-life of raw meat can be extended by physical and/or chemical preservation methodologies (such as refrigeration/freezing, vacuum/modified atmosphere packaging). However, the aforementioned hurdle technologies only delay microbial development, and the current processing methodologies (either thermal or nonthermal pasteurization by high pressure processing) yield considerable colour changes on fresh meat, making it less appealing for consumers.
Therefore, this research aims studying a new hydrostatic pressure-inspired pasteurisation methodology to induce microbial inactivation, aiming to reduce the colour changes on raw meat typical of the commercial HPP pasteurization, allowing its commercialization as safe(r) raw meat with extended shelf-life (with no colour changes)–a situation presently not possible.
Staphylococcus aureus and Bacillus cereus are two of the most common agents in foodborne outbreaks in the world and, were precisely the targets firstly evaluated in this study. For both gram-positive pathogenic bacteria three levels of pressure were tested, namely 25/50/75MPa at 25°C, up to 14 days, which were inoculated in a nutritious medium (tryptic soy broth, used as a model)–on a load between $10^5-10^6 cfu/mL, capable of promoting food borne diseases. These experiments are important to understand the growth behaviour of the$
$The results demonstrated that both B. cereus and S. aureus are affected differently by pressure, despite of both being gram-positive bac$
$These results demonstrate that this methodology can inactivate these two pathogenic microorganisms at different rates, and thus it is in$

Keywords: *Raw poultry meat, Food safety, Hyperbaric inactivation, Nonthermal food preservation, Shelf-life*

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Hyperbaric storage of raw eggs as a pressure-based preservation methodology to assure safety and extend shelf-life, maintaining functional and quality parameters

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Abstract. Eggs are a commercial important food due to its nutritional value and functional properties, leading to their use in a vast variety of food products. Nevertheless, eggs are highly perishable and responsible for a large number of food-borne illnesses, mainly Salmonella spp. food poisoning outbreaks. Liquid whole egg/yolk/white (LWE/EY/EW) usually go through thermal processing that extends shelf-life under refrigeration (RF) but causes considerable detrimental effects of functional properties.1 Moreover, RF is highly reported to have significant economic and environmental impacts. Thus, more efficient food preservation methodologies are needed for eggs, without compromising their functionality, quality, and safety with extended shelf-life as a plus.

Hyperbaric storage (HS) is a novel pressure-based food preservation methodology that uses mild pressures (25-150 MPa), being a possible alternative to RF when used at room temperature (RT) since no energy is needed to keep the food products under pressure along storage. This allows reducing the carbon-footprint associated with food preservation, in addition to the longer shelf-life achievable with this methodology.2,3 Therefore, the aim of this work is to evaluate HS/RT as a nonthermal preservation methodology for microbial growth inhibition/slowdown on LWE/EY/EW, to assure its microbial safety and shelf-life extension, thus, avoiding thermal pasteurization that causes considerable detrimental effects of functional/quality properties and evaluate at what extent HS/RT can replace RF.

Briefly, HS experiments at different pressure levels (50/75/100 MPa) at RT were carried out up to 60 days, initially in EW. Microbiological evaluation of HS/RT was assessed through counts of inoculated pathogenic microorganisms (6.8 log CFU/mL), namely Salmonella enterica, Listeria monocytogenes and Staphylococcus aureus, for the established pressure/time conditions and compared with RF at atmospheric pressure. EW preserved at the optimal conditions of HS/RT for microbial inhibition was evaluated for functional and physicochemical properties, such us pH, color, soluble solids content, soluble protein, water holding capacity and foaming capacity and stability.

Microbiological results showed that using HS/RT under 75–100 MPa in EW allowed to reduce S. enterica, L. monocytogenes and S. aureus population to counts below 1 log CFU/mL, notably more than 5 log units inactivation, remaining bellow the detection limit up to 60 days. In addition, functional and physicochemical properties measured in EW maintained in most of the cases unchanged, indicating that HS/RT have great potential not just to preserve EW but also to inactivate microbial population to values normally achieved by pasteurization.

Keywords: *Eggs, hyperbaric storage, food safety, shelf-life, functional properties, refrigeration.*

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High-pressure and pullulanase as pre-treatments to tailor starch-based films properties?

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Abstract. Thermoplastics are part of our daily lives and have numerous benefits including low prices and easy industrial processing, but they produce a lot of non-biodegradable waste threatening world sustainability. Several strategies have been used to develop biodegradable packaging, primarily from biodegradable biopolymers such as starch [1]. Starch is an essential biopolymer being renewable, cheap, and widely available. In addition, multiple studies have demonstrated that starch-based films are appropriate because they are odorless, colorless, visually attractive, can act as an antioxidant and antimicrobial carrier, and are edible [2]. However, high hydrophilicity and retrodegradation can hinder these films. Physical, chemical, and enzymatic techniques can be used to modify starch so that its properties better suit food and industrial applications [3]. Some alternative processing techniques, such as high-pressure processing (HPP), can induce substantial changes in the physical, chemical, and functional properties of starches [4].

Considering this, the purpose of this study was to examine the effect of HPP (350 or 500 MPa for 5 or 15 minutes) as a starch pre-treatment, either alone or in combination with pullulanase incubation for 30 or 165 minutes. The developed films were compared with the untreated ones using FTIR, XRD, TGA, DSC, SEM and in terms of mechanical properties (elongation at break, tensile strength, young's modulus), hydrophobicity, color, transparency, moisture, water solubility and water vapor permeability (WVP).

All films were found to be quite transparent, and those subjected to pressure had a smoother surface. However, the combination of pressure and pullulanase enables films to become significantly more transparent and smoother. Films subjected to a 350 MPa - 5-minute treatment exhibited a greater hydrophobicity and a reduction by a half of WVP. On the other hand, higher elongation at break (up to 285% more) and lower tensile strength were observed for 500 and 350 MPa – 15 min HP treatments. When HPP is combined with pullulanase, the elongation at break is diminished but tensile strength increases up to 75% more, when compared to control and up to 170% more when compared to the respective HPP treatment. In addition, this combination increases the crystallinity of the films as well as their WVP and hydrophilicity levels.

It can be concluded that starch pressure and pullulanase pre-treatments are effective for modifying starch-based films and can be used to produce films with enhanced properties and ultimately could enable the tailoring of starch-based films to achieve better properties for food applications.

Keywords: *High-Pressure; Pullulanase; Starch Films; Tailoring*

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Impact of pH on food preservation by hyperbaric storage

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Abstract. Hyperbaric storage (HS - food storage under mild pressures), has been proposed as an alternative to refrigeration that can be used at room temperature (RT), allowing for lower energy costs and greenhouse gas emissions and HS has been demonstrated to preserve foods products similarly to/better than refrigeration (Santos et al., 2021). Moderate pressure pasteurization (MPP) employs moderate hydrostatic pressures for brief periods (a few hours/days) at RT as a novel nonthermal pasteurization technique (Lemos et al., 2022).
Watermelon juice (WJ) has an interesting nutritional composition, which includes vitamins (A, B, C, and E), minerals (K, Mg, Ca, and Fe), functionally important amino acids (citrulline and arginine), and antioxidants such as carotenoids and phenolic compounds. However, WJ is highly perishable, due to its high pH (5.2–6.7) and high water activity (0.97–0.99), being more prone to microbial growth, enzymatic activity, and a shortened shelf-life (Lemos et al., 2017).
This research aims to evaluate, for the first time, the impact of food's pH on storage/preservation using HS at RT, focusing on microbiological behaviour (by inoculating Escherichia coli, Listeria monocytogenes, and Saccharomyces cerevisiae) and physicochemical attributes like colour, total soluble solids, cloudiness, and browning degree. Additionally, the effects of storage following a MPP treatment were also studied. To achieve these objectives, the pH of WJ was adjusted to different levels (4.0-6.5) and stored by HS-RT with varying storage conditions or processed by MPP (3 h at 200 MPa) followed by storage by refrigeration or HS (75 MPa).
The obtained results indicate that the inactivation of inoculated E. coli and L. monocytogenes in WJ is accelerated when the pH is lowered or the pressure level was increased, whereas this was not the case for S. cerevisiae. The results also demonstrate HS's ability in controlling microbial growth and, also, inducing microbial inactivation during storage. Regarding MPP, it was observed that microbial counts remained below the detection limit during storage and the HS-stored WJ samples were comparable to the refrigerated samples for the majority of physicochemical parameters evaluated. This work revealed that MPP has the potential to be successfully used as a nonthermal innovative pasteurization technique, with the main advantages compared to the current commercial and thermal pasteurization being the lower energy costs and greenhouse gas emissions and the possibility of pasteurizing during storage. Deeper insights on this possibility are now being evaluated.

Keywords: *Hyperbaric storage; Moderate pressure pasteurization; Watermelon juice; Microbial inactivation*

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Unraveled purple passion fruit volatile profile: from fresh fruit to thermal and high-pressure pasteurized juice

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Abstract. Passion fruit has an average global production of 1.5 million tons, most of which is consumed fresh or processed into juice (FAO, 2018). Its purple variety (Passiflora edulis f. edulis) is considered more palatable due to its higher sweetness and lower acidity (Pontes et al., 2009). When consumed fresh, the fruit is cut into halves and the pulp is spooned out and eaten directly. Alternatively, the fruit is submitted to a juice extraction procedure and then thermally processed to improve its shelf-life (Fonseca et al., 2022). Aroma perception of fresh fruits and juices is considered among the most relevant factors that influence the consumer's preferences and it is determined by the emitted volatile compounds.

The objective of this work is: a) to identify key markers in whole and halved fruits that potentially impact on consumer aroma perception; and b) to evaluate the impact of juice pasteurization (thermal (TP) and high-pressure (HPP) pasteurization) on passion fruit key aroma compounds. The volatile compounds released from whole (WF), halved fruit (HF) and juice (fresh and thermal and high-pressure pasteurized) were analyzed by headspace solid-phase microextraction (HS-SPME) combined with comprehensive two-dimensional gas chromatography coupled with time-of-flight mass spectrometry (GC×GC-ToFMS). Brix, pH, acidity, total phenolic content, and antioxidant activity were also quantified and chemometric tools were used to combine all domains of information to correlate the volatile compounds profile and physicochemical parameters.

Esters and terpenoids (with higher abundance in HF) were found to be the chemical families that contribute the most to distinguish WF from HF and different key markers were identified for each sample. They have mostly citric, earthy, and fermented notes in the case of WF, and fruity and floral notes in HF. For juice, it was evaluated the effect of each pasteurization method on the key aroma compounds of passion fruit and thus, which one best preserves its aroma.

Keywords: *Purple Passion Fruit; Juice; Volatile Profile; Processing Impact*

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Gerontology and Geriatrics

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Chronic medical conditions and older patients' willingness to have medications deprescribed

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Abstract. Ageing is associated with increased chronic disease prevalence.1 Multimorbidity has increased over time, particularly among older adults, affecting more than 60% of people aged 65 or older. 2 Multimorbidity is also strongly associated with polypharmacy, and polypharmacy and older age increase the risk of potentially inappropriate medication (PIM) and adverse drug events (ADE). Deprescribing is a process to address inappropriate polypharmacy. It is a patient-centred process involving shared doctor-patient decision-making, which has proven to be safe and efficient in reducing inappropriate medicines.3 For deprescribing success, it is important to consider patients' beliefs and attitudes toward their medication. Additionally, some patients´ characteristics have been associated with patients' willingness to have medications deprescribed.4 Available evidence suggests that patients' willingness to have medications deprescribed differs according to the specific class of medication. Thus, one can hypothesise whether the willingness to have a medication deprescribed is influenced differently by specific medical conditions. This study explores whether specific clinical conditions are associated with the patient's willingness to have a medication deprescribed.

We conducted a cross-sectional study with community-dwelling patients aged 65 and taking at least one regular medication. Data collection included patients' demographic and clinical characteristics and the Portuguese revised Patients' Attitudes Towards Deprescribing (rPATD) questionnaire.5 Descriptive statistics were used to present patients' characteristics. In addition, a multiple binary logistic regression analysis was performed to identify which chronic medical conditions were associated with patients' willingness to have medications deprescribed.

One hundred ninety-two participants (median age 72 years; 65.6% female) were included; multimorbidity was greatly present (91.6% of participants). The odds of willingness to have a medication deprescribed increased with the presence of gastric disease (aOR= 4.11; 95 % IC 1.21, 18.85) and decreased with the rPATD appropriateness factor (aOR= 0.474; 95% IC 0.247, 0.91) and the rPATD concerns about stopping factor (aOR= 0.341; 95 % IC 0.170, 0.684).

Older patients' attitudes toward deprescribing are influenced by their perceived medication appropriateness and concerns about stopping it. In this study sample, chronic gastric disease increased the odds of patients' willingness to deprescribe, which suggests that further research should focus on how specific chronic medical conditions influence patients' attitudes towards deprescribing.

Keywords: *Deprescribing, older adults, patient attitudes, chronic conditions*

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Fear of falling in community-dwelling older adults

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Abstract. Fear of falling constitutes an ongoing concern in relation to falling. It is a complex, multifactorial and highly prevalent phenomenon in older adults. Risk factors include sociodemographic, physical, psychological, and environmental conditions, and there seems to be a vicious circle between inactivity, lack of balance, fear of falling and an increased risk of falls and other health problems. This study aims to test the multifactorial causality model of fear of falling following Hadjistavropoulos et al.'s (2011) theoretical framework and further screening suggestions (Rossler et al., 2023) and identify other potential factors (e.g., fear of dependency) that may contribute to a better understanding of the fear of falling construct. For data collection, a protocol was developed that included sociodemographic information, clinical, cognitive, affective, social, and fear of falling assessments. The sample consisted of 509 community-dwelling older adults aged from 65 to 94 years old, without cognitive impairment. Linear regression models will be used to identify the determinants of fear of falling. This study is expected to allow identifying the profile of older adults with fear of falling in the clinical context and provide health professionals with the necessary knowledge to strategically intervene in modifiable factors to improve functionality and quality of life in older adults.

Keywords: *Fear of falling; Older adults; Community, Models*

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Quality indicators in long term care

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Abstract. The provision of health care requires the effective measurement of quality performance as an essential principle for the management of services. Measuring quality is a challenge. Most modern nations are currently developing and improve strategies. The quality of care, considered the priority of any health organization, emerges as an elusive (Kajonius Kazemi, 2016), multidimensional (Frijters et al., 2013), and complex concept. To measure the quality of care, we need complete and accurate measures that allow some degree of quantification (Donabedian, 1988). This study aims to develop a proposal for a standardized performance of quality indicators, based on the Donabedian model, which helps to standardize procedures, and works as a guide for good practices for multidisciplinary teams, in Unidades de Média Duração e Reabilitação (UMDR) e Unidades de Longa Duração e Manutenção (ULDM), of Rede Nacional de Cuidados Continuados Integrados, in Trás-os-Montes. Data collection includes three moments, application of a questionnaire prepared with structure, process, and result indicators, to assess its effectiveness, relevance, and viability, through the Delphi method. Application of the Resource Use Assessment Scale to one professional from each category, per participating institution. Finally, the internal validation of the study is carried out through a database in SPSS V. 28, with all the data of the Individual Process in Continuous Care, through the Gestcare CCI application. The sample is composed of 5 UMDR and 9 ULDM. A longitudinal study will be carried out to identify the structure, process and result quality indicators applied in these institutions. We hope to show that financial, human, equipment, facilities, information, and qualification resources; diagnosis, preventive and therapeutic care, rehabilitation, treatment; health status, preventive care outcomes, correct use of resources, well-being, and resident satisfaction are predictors of quality/adequate multidisciplinary health care. The main contribution of this research is to define a standardized performance instrument, with indicators to measure the quality of care, in long-term institutions, that can improve the phenomenon under study. This study will make it possible to identify the structure, process and result indicators that promote the improvement of the health status of residents and provide the professionals, of the multidisciplinary team, the necessary knowledge for an adequate targeted intervention.
Keywords
Aging, Long-term care, Quality indicators, Resource utilization, Donabedian model.

Keywords: *Quality indicators, Long term care, Resource utilization, Donabedian model.*

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Technology-mediated dance intervention in older adults with mild cognitive impairment: impact on cognitive and physical functioning

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Abstract. This project aims to add to the available knowledge on technology-mediated dance interventions by conducting : i) a systematic review with meta-analysis on the effectiveness of technology-mediated interventions, including dance, for cognitive and physical functioning; ii) a feasibility pilot study followed by iii) a randomized, controlled, single-blind trial to assess the effectiveness of using a dance intervention mediated by a dance mat on the cognitive and physical functioning of older adults with mild cognitive impairment and iv) a secondary analysis of data from this trial to determine factors associated with the response to the intervention. The overall results are expected to inform clinical practice and further research. The baseline systematic review has been divided into two systematic reviews due to the size of the study and the diversity of included variables: the first systematic review focused on healthy older adults and included 19 studies, whereas the second on older adults with clinical conditions (e.g., mild cognitive impairment, Parkinson disease, stroke, frailty and pre-frailty) and included 11 studies. After performing a meta-analysis, our main results suggest no significant differences between interventions mediated by technology and traditional interventions for both groups. The empirical part of the project (feasibility study and RCT) is currently submitted to the ethics committee of the University of Aveiro.

Keywords: *Technology; dance; older adults; cognition; physical activity.*

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Educational intervention on mealtime difficulties for dementia caregivers: a pilot study

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Abstract. Dementia is a chronic/progressive syndrome distinguished by a decline in cognitive function and the capacity to perform activities of daily living, exceeding what is typically expected in the normal process of aging (World Health Organization, 2017). Individuals who are in the later stages of dementia may encounter challenges during mealtimes, like oropharyngeal dysphagia, low food intake, refusal to eat, and aversive behaviors (Cintra et al., 2013), and require assistance from others to be fed.The aim of this pilot study was to assess the feasibility, acceptability, and preliminary effects of an educational intervention designed to address mealtime challenges experienced by people with dementia and their caregivers. Sixteen direct care workers and residents from one nursing home in the central region of Portugal participated in the study. During 5 sessions, direct care workers received information about dementia and mealtime difficulties, as well as training on strategies and techniques to manage such difficulties.Feasibility was assessed through rates of screening, eligibility, consent, retention, completion, and adherence to the intervention, while acceptability was assessed using a satisfaction questionnaire. The evaluation of the direct care workers involved an assessment of burnout levels, job satisfaction, as well as knowledge about dementia and mealtime difficulties. People with dementia were evaluated for eating and feeding difficulties, and their food intake was measured.The primary results indicate that except for the screening rate (89%), all other feasibility measures were exceptional, achieving a rate of 100%. Direct care workers expressed their appreciation for the intervention and recognized the educational and practical advantages it provided. However, they mentioned that they required more time to offer better assistance. Following the intervention, burnout levels remained unchanged with a mean of 58.6 compared to 58.9 before the intervention. However, job satisfaction demonstrated a positive trend with a mean of 74.5 compared to 71 before the intervention. The level of knowledge increased by 37.5% in comparison to the baseline measurement. After the intervention, there was a slight improvement in the Edinburgh Feeding Evaluation in Dementia score and people with dementia showed an increase in oral intake (91.1% versus 98.1%).This pilot study demonstrated that the intervention was found to be feasible and acceptable. Nevertheless, the educational content needs improvement. Further research, employing more robust designs and larger sample sizes, is required to achieve a better understanding of the effects of the intervention on both direct care workers and people with dementia.

Keywords: *Feeding difficulties, Person with dementia, Social ecological model, Intervention, Long-term care, Nursing homes*

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Gerotranscendence and Well-Being in Institutionalized Older Adults

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Abstract. Gerotranscendence is an adaptative theory of aging that postulates a mindset shift in late life about time perception, connection with the universe, ego-integrity, and increased need for solitude. Gerotranscendence has been associated to higher levels of life satisfaction, well-being, and lower levels of depression; how gerotranscendence could be developed and explored, however, remains unclear. The aim of this project is to explore how the gerotranscendence theory can be used as a guiding framework for an intervention program for institutionalized older adults. The first task consisted of performing a conceptual analysis on gerotranscendence and self-transcendence, aiming to differentiate these theories and provide an in-depth understanding of its associated concepts and relation with old age and it was completed in 2022. The second PhD task consisted of a scoping review to identify, characterize, and synthesize interventions based on gerotranscendence targeting older adults. This review provided knowledge about how and if this theory can serve and guide psychosocial group interventions. Findings showed that gerotranscendence can be developed through weekly thematic encounters. The validation of gerotranscendence scales for the Portuguese population is currently undergoing, as well as an additional review of gerotranscendence interventions with staff members and focus groups with older adults to understand their perceptions of gerotranscendence. Once these tasks are completed, the project will proceed with the development and application of the gerotranscendence intervention programs on nursing homes and the randomized trial to assess its impact.

Keywords: *gerotranscendence, interventions, scoping review, transcendence, older adults.*

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Perspectives on Death in Residential Care Facilities (RCFs): Reports from Older People, their Relatives, and Staff

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Abstract. Introduction: Death is a natural, universal, and inevitable process that many people fear to think and talk about. In Portugal, approximately 4.34% of the elderly population is in Residential Care Facilities (RCFs), where, when someone dies, their place is occupied by another resident. Objective: This doctoral project aims to contribute to a better understanding of the perspectives on death in RCFs, considering the key players: residents (older adults), their relatives, and staff. Methodology: The project involves a mixed methods approach (quanti-qualitative) and includes three studies: 1) 'End of Life and Death in RCFs: the perspective of Care Directors' (ongoing); 2) attitudes of staff towards death in RCFs (ongoing); 3) narratives around death and dying of residents, their relatives, and staff (to be started). The study no. 1 is an exploratory qualitative study, aimed to identify and analyze experiences and practices related to end-of-life care and death in RCFs from the perspective of Care Directors. The data were obtained from 17 directors in three focus groups and the analysis was performed using an interpretative phenomenological approach. Results: Care Directors describe three moments in the residents where death and dying are addressed in different stages: Admission and living in - focus on adaptation and quality of life; end-of life, death - focus on caring and managing the dead; post-death and new admission - moving forward. The theme of death and dying is discussed mainly when the end of life becomes evident, but discussing these topics throughout life allows residents to prepare for death by making decisions and expressing wishes. The study highlighted the importance of training and creating opportunities for reflection to normalize discussions about death and dying. Another theme emerged in the study that was analyzed separately: experiences and practices of death before and during the COVID-19 pandemic. Four themes were identified: lack of adequate health care in death; dying alone; inability to say goodbye; burial at a distance. These results support the importance of a good death, and dying with dignity in RCFs, and the need for policies, practices, and training on the death of residents in RCFs in Portugal. Conclusion: End of life and death are inevitable, becoming recurrent events in RCFs. When individuals die in a RCF practices and policies should assure a dignity and a good death
Keywords: End-of-life; Death; Care Director; Residential Care Facilities (RCFs); perspectives

Keywords: *End-of-life; Death; Care Director; Residential Care Facilities (RCFs); perspectives*

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Exploring Peer Teaching in Universities of the Third Age and Beyond: Insights and Implications

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Abstract. As the global population ages, understanding the experiences and perspectives of older adults during their retirement years has become increasingly important. This research study focuses on the role of retired older adult peer educators who choose to teach at universities of the third age (U3As) or other lifelong learning institutions. These institutions provide older adults with opportunities for engagement, learning, and socialization, associated with positive outcomes such as increased civic engagement, life satisfaction, and human capital. However, there is a lack of available research specifically focusing on the role of older adult peer educators in these settings.

The first task involved developing a historical review of lifelong learning institutions and U3As examing the French and British models. This review explored how these models have been adapted to local contexts and the needs of older adults in different regions around the world. The evolution of these institutions across the globe was highlighted, recognizing their significant role in fostering active aging, social inclusion, and productive engagement in later life, while also providing critiques and exploring ways to ensure their continued relevance in modern times.

The second task involved data collection in the USA, where interviews were conducted with 17 peer educators who teach at lifelong learning institutions in Florida, with ages ranging from 61 to 84. A thematic analysis was conducted to identify patterns and themes in the interview data. The preliminary results suggest volunteerism and altruism play a significant role on their decision to become educators. The study identified several emerging themes, including the need for purpose, the value of social connections, enjoyment of their role, and the importance of mutual learning. The interviews also revealed challenges such as the need for environmental modifications and effective marketing strategies.

The third task, currently ongoing, is a scoping review exploring the effects of productive engagement in the lives of older adults. This review examines qualitative and quantitative research on the various activities that older adults choose to engage in after retirement, as well as the effects of such engagement, and identify gaps in existing research. The results of this scoping review will contribute to the overall understanding of productive engagement and the role of peer teaching in this context.

In conclusion, all tasks completed and ongoing are critical components of this study´s methodology and will contribute to understanding the effects of peer teaching on older adults and the institutions they serve.

Keywords: *U3A, productive engagement, active aging, lifelong learning, older adult peer educator*

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History of Sciences and Scientific Education

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Study of archaea - historical perspective and interdisciplinary links

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Abstract. In 1990, Archaea was proposed as a third taxonomic domain, including species that had been formerly described as bacteria (1). This reclassification brought about a review of the prokaryote/eukaryote dichotomy.Studies of lipid markers demonstrate that compounds which are characteristic of archaea were present very early in the history of Earth. The evolution of eukaryotes involved the association between members of bacterial and archaeal lineages. The part played by archaea in this puzzle was not assessed until the second half of the 20th century.An analysis of RNA samples by Carl Woese (1928-2012) and George Fox (1945-) was on the basis of the classification update. Some of the first species of archaea were collected from sites like Yellowstone Park, in the United States, and submarine hydrothermal vents in Italy. Molecular studies in Sulfolobus acidocaldarius, described in 1972, allowed Wolfram Zillig (1925-2005) to confirm Woese and Fox's findings (2).The objective of this work is to investigate the historical context in which studies about archaea were conducted, with a focus on interdisciplinary connections and some of the technical and scientific developments that made these studies possible.For this study, an analysis of publications from the period 1970-2010, obtained through searches in Scopus and Web of Science databases, was performed. Topics, keywords and representative examples were selected to illustrate connections of studies about archaea to different areas of work, especially on the 1970-1990 period. "Archaea" or "archaebacteria" were used as the main terms for search. Metadata exported from Scopus and Web of Science were systematized into a database.An increasing trend was observed in the number of publications after Woese's proposal. Portuguese institutions who took part in these studies were identified. Subjects and methods were not found to be significantly different from 1980 to 2000, apart from technological developments. An interest in the adaptive features of extremophiles was noted in earlier publications, as well as in possible applications, although these had limited success.Environmental connections, especially with Marine Sciences and Geology, were sought. Areas like Biophysics and Multidisciplinary Sciences were frequently assigned to these publications. In the 1970-1990 period, collaboration between American and German researchers delivered particularly good results. A counterpart for the amount of resources invested on different steps of work - choice of locations, collection of samples, laboratory processing, data analysis - was a more detailed view of evolutionary processes, in historical and geographical terms.

Keywords: *Archaea, History of Biology, interdisciplinary work, biodiversity*

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And Galen crossed the Atlantic. The syncretism of Luso-Brazilian medical practices and knowledge (1500-1650)

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Abstract. The Portuguese land in Brazil in April 1500: the first letters sent to King D. Manuel immediately show that new lands, a new fauna, a new flora, a new climate, etc., have been discovered. Likewise, contacts with new peoples, and consequently with new diseases, force the Lusitanians to quickly acquire new knowledge in order to adapt to the local living conditions, very different from the metropolis. Indeed, a problem quickly appears for the Portuguese: what to do when Galen did not describe this disease or plant?By defining the sources different point of view, the issues of theory and practice transmission and the medical and medicinal consequences of bringing two civilizations in contact, this thesis seek firstly to highlight the necessary hybridization of Portuguese medical practices and knowledge, heirs of Galenism, and Indigenous one, centered around the figure of the pajé or shaman. The medical hybridization really developed in the 17th century in Brazil due to a shortage of European doctors and pharmacopoeia, which is perfectly emphasized by municipal and Jesuit registers and inventories. If in the 16th century the Portuguese, and other Europeans, seem to have dedicated themselves to the discovery and description of a «new» medicine, the context of the 17th century rather corresponds to a need to apply this «new» medicine. What we call the "tryptic business-conquest-religion" is the best resume for the Luso-Brazilian medical case. Science and innovation were here at the service of colonization and evangelization during those times of trouble. We think here, for instance, about the Jesuits grabbing the local medical and medicinal knowledge in order to replace the societal pillar that pajés / shamans are and to, ultimately, acculturate indigenous people.Our latest research are currently focused on the diffusion of iatrochemistry and iatromechanical conceptions of medicine and, consequently, on the slow marginalization of the galenical pharmacopoeia on both sides of the Atlantic. Galenism survived indeed until the end of the 18th century in Portugal and Brazil. Many Luso-Brazilian works from the beginning of the century cross humoral theory, miasma theory and chemical therapeutics. While the Farmacopeia Lusitana of D. Caetano is mainly composed in 1704 of remedies heirs of the galenical and medieval tradition, the second edition of 1711 quotes mostly the works of Nicolas Lémery and Moyse Charas. The study of those valuable sources is one of the reasons that pushed us to postpone the timeline of our thesis until 1711.

Keywords: *history of medicine, pharmacopoeias, 16th and 17th centuries, colonial Brazil, Jesuits*

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Industrial Engineering and Management

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Improving business performance through a leagile strategy for layout planning in an automotive industry

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Abstract. The volatility in which the markets currently find themselves has been substantially marked by some events with impact on a global scale, as was the case of the recent pandemic crisis and the largest war ever seen in the XXI century (Russian-Ukrainian war), occurrences which force companies to adapt and be more agile in response to adversities. Additionally, they may face constraints imposed on the market itself, such as the European target of 0% carbon dioxide emissions by passenger cars by 2035.

In this context, companies want to be more able to change, without compromising their organizational performance. That is the case of the target company of the study, which currently operates in the sector of exhaust systems for passenger cars, that operates in a market in a process of change and can only see this challenge as an opportunity for improving.

As a result, there is a need for the company to adapt the new processes to a shorter product life cycle, and to increase its capacity for operational transformation, in terms of material flows, layouts, equipment's and process's reengineering. Due to this paradigm, which is the future of an end-of-life business and the importance of continuing to satisfy the customer on current products, there is a need for the company to be able to create solutions at the level of material flows and manufacturing layout to satisfy market demands, customers and the organization itself.

Therefore, it will be proposed the use of systematic layout planning (SLP) with the support of the leagile management strategy to speed up the decision process and implementation of the proposed layouts and flows, and the maintenance or improvement of the company's operational results. The present research will be based on a case study in a manufacturing environment, a methodology that presents several advantages when applied to the planning of the manufacturing layout, namely it will evidence the true impact of the changes on the results. The objective is to create an adapted SLP structure, supported by the leagile strategy, for the rapid development of a factory layout planning that can respond in an agile manner to the conditions imposed on the business, without compromising its operational performance.

Keywords: *SLP; Leagile; Material Handling Costs Savings; Facility Layout*

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Roadmap 2050 para a descarbonização da Indústria de Vidro

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Abstract.
The Portuguese Energy and Climate Plan establishes the reduction of greenhouse gas (GHG) emissions by 2050. These constraints push the energy-intensive glass industry to enormous challenges, namely energy transition, through the replacement of the sector's main energy, natural gas, which is a relevant topic for the elimination of GHG. Thus, energy transition is at the core of sustainable transformations and involves urgent challenges and opportunities to address climate change.
In this context, the main objective of this research project is to contribute to the sustainable energy transition, proposing a Roadmap that disruptively envisions the main decarbonization options for the Glass Industry in Iberia until 2050. For that it will integrate a strategic analysis of the political, economic, social, technological, environmental, and legislative pillars, prioritizing its implementation over time. It also intends to detect the threats and opportunities of the different decarbonization options and develop an objective view of their implications for the external environment, focusing on all vectors of sustainability and in line with international agreements.
For that, the Design Science Research methodology will be followed. Firstly, a combination of a systematic literature review (SLR) and a set of key questionnaires directed to different interfaces of the sector will be used. The aim of the SLR is to define the maturity level of each alternative. The questionnaires to experts aim to access the future actions with respect to the adoption of different options for the decarbonisation of the glass sector. The panel will be constituted by researchers in the field, technical specialists with expertise in the implementation of different technologies, main stakeholders in the sector, government officials, policy makers, among others. Subsequently, multi-cases studies will be carry on, merging quantitative and qualitative data. The aim is to validate the implementation of sustainable decarbonization options, to envision their viability. Having in mind these milestones, a Roadmap 2050 for the decarbonization of the sector will be proposed, which integrates the socioeconomic profile and the estimated impacts of more sustainable decarbonization options, contributing to the guidance of future academic research, industry, and policy decision.

Keywords: *Descarbonização; Transição Energética; Indústria do Vidro; Sustentabilidade; Roadmap 2050*

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Supply Chain Management in the Healthcare Service Industry: Strategic Performance Indicators for Creating Competitive Advantage

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Abstract. Supply Chain Management in the Healthcare Service Industry: Strategic Performance Indicators for Creating Competitive Advantage
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This research proposal focuses on the critical role of supply chain management (SCM) in the healthcare service industry. The aim is to identify strategic performance indicators (SPIs) that can enhance the competitive advantage of healthcare organizations. By analyzing the existing literature and conducting empirical research, this study aims to contribute to the understanding of SCM practices in healthcare and provide valuable insights for healthcare managers and policymakers. The research will employ a mixed-methods approach, incorporating both quantitative and qualitative data collection techniques. The findings of this study can help healthcare organizations optimize their supply chains and improve overall performance.
In society, effective supply chain management (SCM) in the healthcare service industry plays a crucial role in improving patient outcomes, reducing costs, and enhancing overall healthcare delivery. By optimizing supply chain processes, healthcare organizations can ensure the availability of critical medical supplies, medications, and equipment, thereby enhancing patient safety and quality of care. Moreover, efficient SCM practices contribute to cost containment, enabling healthcare providers to deliver services at affordable prices while maintaining financial stability. The implementation of strategic performance indicators (SPIs) can further create a competitive advantage, fostering innovation, sustainability, and responsiveness within the healthcare supply chain. Ultimately, this benefits society by promoting efficient resource utilization, enhancing patient satisfaction, and improving healthcare accessibility and affordability. A mixed-method (qualitative and quantitative) methodological approach is the basis of the research technique that is being offered for this study. The first step is to conduct a systematic literature review to thoroughly examine the topic and identify the most significant gaps in the associated literature. The following are the stages and methodological approach:
1. SLR regarding the following topics: SCM / Healthcare Service Industry / KPIS / Simulation...
2. Design of a prototype dashboard of KPIs for decision support
3. Validation of the prototype based on semi-structured interviews
4. Case study (healthcare unit)
5. Proposal of a dashboard of KPIs for creating competitive advantage in Healthcare Service Industry SCM.

Keywords: *Supply Chain Management in the Healthcare Service Industry: Strategic Performance Indicators for Creating Competitive Advantage*

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Contributions of digital transformation in the seaport: increasing resilience with impact on EGS dimensions of sustainability

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Abstract. Maritime transportation can be seen as "the backbone of the global supply chain" (Gao et al., 2022), being very relevant in the global economy, since approximately 80% of global trade is transported by sea.With all this responsibility, ports must adjust to sustain competitiveness in the market, making a transition from traditional ports to digital ports (incorporating technology) giving rise to the concept of "Smart Port". So, for ports it is no longer a choice to adopt digital solutions, with this matter increasingly becoming a focus for researchers (Jović et al., 2022; Min, 2022). As Fiorini ; Galloro (2022) suggest, the COVID-19 pandemic has demonstrated that in fact smart ports already exist and understand the benefits of this digital transformation. However, there are also ports that still operate in a traditional way, without yet understanding digitalization and how it can be introduced, or in some cases (Fiorini ; Galloro, 2022; Philipp as cited in Meyer et al., 2021). Therefore, the main objective of the study is to analyse the impacts of digital transformation on the dynamics of ports and consequently on the EGS (Environmental, Governance and Social) dimensions of sustainability, aligned especially with SDG 11. In this work, the DSR (Design Science Research) methodology will be used, since it is intended to build an artifact that supports the improvement of the environment where the work is being developed, also showing the process of its construction.Thus, this study intends to contribute both at the theoretical level (which consists in the identification of good practices and technologies that contribute to the increase in the level of digital maturity of ports), and at the practical level (propose solutions that can help other seaports mitigate environmental and social issues using information technology).

Keywords: *Industry 4.0, Digital Transformation, Smart Cities, Smart Ports, Logistics, Sustainability*

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Inclusive and sustainable industrial development: An assessment of the industrial challenges, causes and policies during COVID-19 in Portugal

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Abstract. Sustainable development is a term adopted to promote the economic growth, environmental protection, and social inclusion for all people worldwide. One of the most intriguing aspects of this approach is the inclusive and sustainable industrial development, a topic that will be explored in detail during this study. The advent and spread of COVID-19 in early 2020 have changed everything, including the progress of inclusive and sustainable industrial development (ISID). Lockdowns, logistics, input shortages, supply and demand disruptions, and business continuity loans, among so many other challenges, had to be addressed in a very short and intense period of time. Therefore, it's essential to study such a phenomenon to be prepared for similar future events. Accordingly, this research will be descriptive and diagnostic, will be conducted in Portugal as a case study, and will take advantage of mixed methods that collects both quantitative and qualitative data within the same study. Firstly, a survey questionnaire will be constructed to gather all the primary and necessary data, then it will be analyzed using the Statistical Package for the Social Sciences (SPSS), content and thematic analysis when applicable. The research objectives intend to show how the Portuguese industry was affected by COVID-19, how significant were the challenges faced during the crisis, what were the causes behind those challenges, and the possibility of building a model based on the most preferred policies that were reported in the several UNIDO studies and the validation of it after the analysis of multiple real case studies. The research will aid in perceiving and comprehending the crisis more, conveying a clearer picture about the various phases undergone, developing a model that can be used as a reference in future similar events, strengthening the research in sustainability, constituting a basis for subsequent studies to be conducted in other countries of interest and providing the opportunity to further improve and optimize the results reached.

Keywords: *COVID-19, sustainable development, Inclusive and sustainable and industrial development (ISID), Industrial challenges, National Policies, Industrial impact, Crisis Modelling, Pandemic Management, Optimal Control, Recovery Plan.*

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Cost Efficiency of Water Supply Systems Through Optimization Methodologies

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Abstract. Global water supply significantly contributes to global energy consumption (Manteigas et al., 2022). Consequently, water management entities need to minimise energy consumption and the costs of water supply systems (WSS) (Manuel, 2017). High energy consumption highlights the importance of energy efficiency for the sustainability of water management entities and encourages the adoption of intelligent solutions that can reduce costs. Furthermore, energy and water management costs are rising faster than inflation, making it increasingly difficult for companies to rely solely on the expertise of their most experienced employees. As a result, even minor improvements in operational efficiency can lead to significant cost savings in the water utility sector (Selek et al., 2012).

Optimization can be applied to three main areas of WSSs but the pump operation area is particularly critical in terms of energy consumption (Mala-Jetmarova et al., 2017). There are several ways to reduce the pump's energy consumption. However, scheduling the pump operation is the most efficient since it requires no additional investment, and the energy cost reduction occurs immediately. This problem is commonly known as the pump scheduling problem, and historically it has been formulated as an implicit or explicit control problem. The explicit control problem can be further divided into two categories: time-position restricted and time-position unrestricted. In all formulations for this optimization problem, the objective is to minimize the cost of energy consumed by pumps during the total time horizon, which is typically 24 hours. Several constraints can be considered, including maintaining minimum and maximum water levels in tanks, limiting the number of pump startings, conservation of the system's mass and energy in terms of water flow, etc.

Although there are several mathematical formulations for this optimization problem, there is a lack of quantitative comparison between them. While the binary formulation, which relates to the on/off state of pumps, is the most commonly used, it is not always the most economical option in every situation. Considering that each WSS has unique physical characteristics, each mathematical model for the optimization of these systems operation may have different performances. The primary objective of this study is to conduct a rigorous quantitative comparison of four mathematical approaches for optimizing pump scheduling in two distinct water WSSs. The mathematical approaches included in this study comprise two explicit formulations with time-position restriction, one explicit formulation with time-position unrestricted, and one implicit formulation.

Keywords: *Cost Reduction, Efficiency, Mathematical Approaches, Optimization Methodologies, Sustainability, Water Supply Systems*

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A smart mobility management solution for a case of a real-word seaport

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Abstract. Seaports, as strategic interfaces for sea and land transportations, have become important players in economic liberalization (Bakar et al., 2021). Their functions have significantly changed through different generations in response to many transformations in the global economy. Globalization, environmental concerns, and intense competition between ports have motivated the evolution towards smart ports (Belmoukari et al., 2023). A smart port "optimizes in-, intra- and out-bound flow of goods and information, lead a sustainable development and guarantee safe, resilient and secure activities through the capabilities of its (extended) port community and enabling technologies" (Boullauazan et al., 2023). Efficient planning and management of operations, taking advantage of information technologies and optimization methods (Kizilay ; Eliiyi, 2021), represent an important feature of smart ports (Belmoukari et al., 2023). Synchromodality, understood as real-time, dynamic, and optimized intermodal transport (Ambra et al., 2019), corresponds to another relevant aspect (Boullauazan et al., 2023).
Each zone of a container port has a specific function (Hsu et al., 2021) and as such different operations (Bakar et al., 2021). The seaside accommodates vessels for loading/unloading containers; the landside connects with the hinterland, enabling the transportation of containers into/out of the terminal; the yard side between the seaside and landside provides temporary storage for containers (Hsu et al., 2021). Although in the literature the decision problems that arise in these areas are often addressed individually, disregarding the relationships between operations in container ports may compromise the synchronization of the interrelated activities resulting in worse solutions to the overall problem due to their conflicting objectives. Accordingly, integrated approaches represent a promising area for future research (Kizilay ; Eliiyi, 2021).
This research project aims to develop optimization algorithms for a smart mobility management solution designed for a real-world seaport. Initially a literature review should be conducted focusing on the optimization problems arising in the planning and management of container ports operations. Simultaneously, the current state of the seaport considered, including logistic operators, railways, road infrastructures and traffic, should be characterized. The resulting description of the problem should allow the development of optimization models for scheduling operations at logistics gates. New algorithms to solve the problem should also be proposed. These approaches are to be validated against data collected at the seaport and incorporated into transport planning and management tools. The solution should be capable of optimizing routes and handling operations, integrating the various modes of transport through an approach based on synchromodality principles.

Keywords: *Logistics, Seaports, Mobility, Digital transition, Optimization*

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Contributions of Industry 4.0 to the Sustainability of supply chain management: an integrated solution in the biomass industry

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Abstract. The paradigm of Industry 4.0 is defined as the integration of digital solutions in the processes to achieve benefits (Leesakul et al., 2022). The benefits can affect the three dimensions of sustainability, however, the majority are related to the economic pillar, which becomes reducer to a society that increasingly gives value to sustainability concerns.
Biomass, which is renewable energy, is projected to have an important role in combatting climate change. The ease of storage, the great accessibility, and the efficacy of conversion processes make this resource "desirable", however, aspects such as the seasonality or the geographic dispersion make the biomass supply chain (SC) challenging (Fernández-Puratich et al., 2021). Furthermore, the possibility of accidents by biomass workers is another problem. Besides this, although many rural activities give leftovers that could be energy sources, however, most of them are burned, which can lead to rural fires (Casau et al., 2022).
An open and connective platform that enables a network through cooperation and collaboration amongst actors in the SC is vital for the achievement of sustainability issues (Kayikci et al., 2022). The information benefits from the lean philosophy and the implementation of this in this context is known as Lean Information Management (LIM) (Hicks, 2007).
In this scenario, this thesis proposal emerges as an attempt to address the problem of avoiding waste burning, achieving sustainability in SC, and utilizing the energy potential in a digital paradigm. Consequently, the major goal is to understand how emerging technologies can help SC sustainability in the biomass industry.
In this context, the main contribution of this work is to create a framework that allows a more flexible SC management and to understand how technologies 4.0, combined with Lean principles, can enable a sustainable SC, valuing all energy sources. Allied to this, in practical terms, it is intended to create a prototype of a technological tool, considering the LIM philosophy, that allows the flow of information connecting the various actors of the SC.
To fulfill the objective, and achieve the expected results, this study will follow the methodology of Design Science Research, which will rely on theoretical (literature review) and practical perspectives, promoting the participation of people from the field. This approach will serve for the perception of micro-objectives and, later, for the validation of the proposed mechanisms.

Keywords: *Digital transition, Information Systems, Supply chain management, Sustainability, Biomass industry*

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Simulation-Based Model for Residual Agroforestry Biomass Supply Chain

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Abstract. Residual biomass has become an appealing renewable and sustainable energy source due to its low negative environmental impact in terms of CO2 emissions, which make up the majority of greenhouse gas emissions. Supply chain management of residual agroforestry biomass requires extensive seasonal, logistical, and uncertainty coordination to collect, process, store and transport the biomass effectively to build and sustain a circular economy. Unfortunately, this seems to be a hard nut to crack without the appropriate enhancer.
The work aims to design and develop a simulation-based model for the supply chain management of residual agroforestry that can effectively forecast and aid intelligent decisions that will ensure a sustainable society.
In order to accomplish the goal, the researchers utilized a case study approach on a forest management company situated in the Figueria da Foz region of Coimbra, Portugal. A quantitative analysis of the data was conducted, and the model was simulated for 365 days utilizing Anylogistix software.
The simulation experiment results show that the annual demand for each product is 1 unit. This implies that the distribution centers need to run at capacity of 10 m3 to maintain the fulfillment order generated by 100 customers for 4 products supplied from two distribution centers.
Based on this analysis, the supply chain is effective as there was no disruption in service, lead time or the revenue. For future work, a comparison experiment is recommended to have a better insight on the what-if scenarios obtainable to have a resilient supply chain.

Keywords: *Agroforestry, Residual biomass, Simulation, Supply chain*

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The importance of AI in the quantification of deadlines for project management in the metalworking industry

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Abstract. The challenges faced by the metalworking industry in the production of intermediate goods, such as project delivery delays. Causes include organisational aspects, optimisation of resources, poor time scheduling (Palange ; Dhatrak, 2021). In the bibliography, no models accept the production system as it is and move towards its management from a realistic perspective. There are approaches to solve planning and resource allocation problems, such as Gantt/Waterfall, PMBOK Guide, Spiral Model, Prince 2, critical path (CPM)/PERT, agile management tools such as Scrum, Prince 2 Agile, Kanban, Lean Project Management, Agile Project Management and DSDM (Pires et al., 2016), (Singh, 2018), (Amran et al., 2019), (Palange ; Dhatrak, 2021), (Sarkar et al., 2021), (Vila Grau ; Capuz Rizo, 2022), (Cizmecioglu et al., 2022), (Weflen et al., 2022).
However, these approaches have limitations in the accuracy of time estimates (Babalola et al., 2019) (Silva et al., 2021), (Sarkar et al., 2021). An AI system is proposed to assist in the management of industrial projects, in determining time and cost, based on neural networks. This system will adapt to the constraints in real time, being more efficient.
To achieve the overall objective, the phases to be developed are: study delays in project management, determine causes, identify how companies minimise the problem, analyse the bibliography of suitable intelligent systems, develop the model, identify factors that cause problems in project duration, identify tools to integrate in the model, define experiment plan, test and validate the model with case studies.
The AI system will be trained with five inputs: project data, cost, time, historical and market. Thus, it will be possible to create an AI system that proposes deadlines more consistent with the company's reality, contributing to more efficient and realistic projects. Companies recognise its potential in the future, and it is expected to be widely used in conjunction with project management in the metalworking area, as AI is expanding in the new era of data (Bengio et al., 2017), (Benedetto et al., 2018), (Kareem Kamoona ; Budayan, 2019), (Czako et al., 2021), (Egwim et al., 2021).

Keywords: *Industrial organizations intelligent, Project Management, Multi-project management, Digitalization I4.0, Smart business in project management, Time estimation for dynamic decision making, Artificial neural network.*

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Human Energy Reinforcement in Industry 5.0: resilient and productive workforce

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Abstract. Human Energy Reinforcement in Industry 5.0: resilient and productive workforce
ABSTRACT
In the context of the fifth Industrial Revolution, industry's emphasis on human centricity extends beyond mere productivity and efficiency, placing a higher value on the well-being of individuals. Gallup's study has shown that 70% of people in industry globally struggle or suffer, particularly aggravated by circumstances like natural disasters, pandemics, automation risks, and economic downturns. These factors contribute to a depletion of the individuals' energy levels, exacerbating feelings of concern, anxiety, and sadness. Therefore, it becomes imperative to prioritize the optimization of human energy and well-being, placing the human capital at the forefront of industry. This shift entails not only focusing on their productivity but also ensuring their ability to thrive.
This research aims to identify advanced human energy reinforcement solutions and create a process model that integrates these solutions into organizational culture. The primary goal is to foster an agile approach to effectively managing human energy within the organization.
The study employs a mixed-method approach, incorporating qualitative and quantitative methods. Data will be gathered through surveys, interviews, and observation. The goal is to create a descriptive agile process model that utilizes a blend of lean solutions, Agile, and Scrum methodologies, ultimately enhancing organizational plasticity.
The desired outcome is to cultivate agility in the implementation of cutting-edge human energy reinforcement strategies within an organizational culture, aiming to enhance workforce camaraderie and productivity. Hence, building a resilient industrial ecosystem in the face of constant uncertainties in a rapidly changing world.
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Keywords: *Human-centric industry, Industry 5.0, Workforce resilience, human energy, mental energy, organizational plasticity*

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2nd year PhD Research: Developing Sustainable Business Models for Residual Agro-Forestry Biomass Supply Chain to Foster Economic Growth in Portugal

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Abstract. This Ph.D. study aims to develop sustainable business models for the residual agroforestry biomass supply chain in Portugal. Residual agroforestry biomass valorization offers a renewable and greener source of raw materials while reducing dependency on non-renewable resources. In Portugal, where approximately 36.15% of the national territory is covered by forests, the valorization of fuel load can reduce fire risk and contribute to economic sectors like biomass energy production. Wildfires release high amounts of carbon dioxide and destroy natural habitats and ecosystems. This study is part of the FCT research project "Sustainable Biomass Supply Chain Management Model Residual Agroforestry Supported on a Web Platform" and began in February 2022. So far, a conceptual framework that identifies factors that can impact valorization efforts has been developed. The framework considers collection, transportation and processing costs, government policies, residual biomass characterization and availability, and knowledge of valorization options among suppliers to convert low-value residues into value-added feedstock and products supporting local communities, businesses, and industries (Rijal et.al, 2023). While a systematic literature review identified key drivers and barriers of residual agroforestry biomass valorization. The drivers and barriers of residual biomass valorization were identified and categorized using institutional and autopoietic theory. Advancements in technology and financial support mechanisms drive its growth. However, barriers such as lack of support for biobased products and bioenergy, inadequate investment in research and development, insufficient training programs, and lack of government policies hinder its growth. The knowledge of drivers and barriers will serve as a guide in the business model development process, helping to create a model that enables stakeholders to navigate around the barriers. The next stages of the study will employ a Delphi methodology for a better understanding of the drivers and barriers considered the most important, the relationships between them, and also their hierarchical position. Interview questionnaires will be prepared and sent to experts and stakeholders in the sector. The drivers and barriers will be used to design the questionnaires in an effort to find solutions that can eliminate or mitigate the barriers faced by producers (farmers and forest owners); loggers and transport companies; and customers (manufacturers, or producers using the residual feedstock to produce value-added products). A comprehensive understanding of these issues will enable the development of a model that minimizes or mitigate the barriers, making the commercialization of residual agroforestry biomass a profitable and sustainable economic activity for all stakeholders involved in the valorization process.

Keywords: *Agroforestry residues, residual biomass valorization, sustainable practices, Sustainable supply chains, sustainable business models, Drivers and Barriers, supply chain management*

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Employee (dis)satisfaction in Sustainable supply chain management, Challenges and Solutions

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Abstract. Sustainable development is a philosophy that seeks to achieve human development goals while protecting the ability of natural systems to provide natural resources and ecosystems for all economies and societies and since today the corporate supply chain has grown larger and more complex than ever before, it is important to achieve sustainability in the supply chain.In previous research, scholars have paid much attention to economic and environmental sustainability in SCM and less attention to the social dimension which significantly impacts it.

In order to achieve social sustainability in supply chain management, having a satisfied and engaged workforce is one of the basic conditions. Employees are a critical part of this chain, and their dissatisfaction can pose challenges to sustainable supply chain management and have a negative impact on all three dimensions of sustainability, social, economic, and environmental.

Dissatisfied employees caused high turnover rates, less productivity, and less innovation which impacts the company's bottom line and also increased absenteeism, higher healthcare costs, and other expenses that can negatively impact the company's profitability. they may be less likely to prioritize environmental initiatives and may not take the necessary steps to reduce the company's carbon footprint also lead to increased energy use, waste production, and other environmental impacts.

Sustainability and employee satisfaction are two interrelated concepts in the modern workplace so here the role of HRM is so important. HRM can identify the root causes of employee dissatisfaction and take appropriate actions (such as Providing career development opportunities, recognition, and rewards, improving work-life balance, and Providing a safe and healthy work environment, ...) to address them.

The study is based on an analysis of bibliometric data published in the Scopus, science direct, and Emerald databases between 2012 and 2023.

In summary, sustainability and employee satisfaction are two interrelated concepts that are essential to creating a positive, productive, and successful workplace. Companies that prioritize both sustainability and employee satisfaction are likely to see benefits in terms of employee retention, productivity, and overall success. thus, organizations should prioritize employee satisfaction in their efforts to achieve sustainable supply chain management

Keywords: *Supply Chain Management, Social Sustainable Development, Job satisfaction, Dissatisfied Employee, HRM*

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Sustainable Decision Support System Tools for Automated Energy Management in Smart Cities

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Abstract. With the increasing global demand for energy, there is a growing need for solutions that promote energy efficiency and sustainability. Home energy management systems (HEMS) and other smart technologies have emerged as potential solutions to help individuals and organizations reduce their energy consumption and lower their carbon footprint. However, the adoption of these technologies by end-users is often hindered by economic, technological, and social barriers. Therefore, there is a need to explore innovative approaches that incentivize end-users to modify their energy consumption patterns, increase their awareness towards energy saving and conservation, and incorporate green and zero-emission building concepts into the operation of buildings.

For this research, the target is to develop a decision support system tool to deal with energy management at the home level. The main questions of this research are:

1. Can insights from behavioral economics be used to better predict and account for consumer behavior?
2. What is the optimal strategy for activating the role of end-users to leverage the Renewable Energy Sources (RES) integration?
3. Can insights from behavioral social lifestyles be used to better predict and account for consumer behavior?

In terms of methodology, this research proposal aims at developing computer-based simulations for optimizing energy consumption using actual data from the public database and energy providers. Then, the main goals targeted for this research proposal will be investigated based on the simulation results.

Keywords: *Support System; Local Energy Communities; Optimal Scheduling; Smart Cities; Sustainable and Renewable Development; Energy Management System*

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Human Factor in the Fourth Industrial Revolution: A framework to foster Operator 4.0 working engagement

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Abstract. While the focus of companies remains on the introduction of technology, there is already an organic force towards people, placing them at the center of innovation, thus constituting the phenomenon of Industry 5.0 (Pathak et al., 2019). Apart from this, the phenomenon of Great Resignation is threatening organizational knowledge (Serenko, 2022), therefore it is essential to create mechanisms that promote employee engagement and happiness and their consequent commitment. An happy and engaged employee leads to greater productivity, greater innovation, and a lower risk of turnover (Salvadorinho ; Teixeira, 2023; Saputra et al., 2018).

This doctoral thesis contributes with an innovative framework consisting of methods and a proof of concept that repositions people in the digital paradigm, through technological tools and through a new organizational culture, promoted by a new leadership style 4.0.

To achieve this, a set of systematic literature reviews and benchmarking approaches were carried out, while at the same time a study with three multi-sector organizations (2 multinationals) was conducted. This study involved 30 interviews of middle managers, 560 responses to a questionnaire to understand the effect of engagement drivers on employees and their influence on their intention to leave the company. Since the Coaching theme was a "hot"topic (in the literature and in the interviews) (Milner et al., 2018), 11 more interviews were conducted with people working in organizational Coaching with international intervention, to determine mechanisms to integrate it in the business routine and to support a new leadership style within the digital paradigm. In addition, a technological platform for promoting and monitoring work engagement was modeled and prototyped in co-creation (with the 3 companies).

The proposals developed focus on: a set of drivers for work engagement that include organizational and new generation perspectives (Y and Z), an extension to the Self-Determination Theory, a new leadership style 4.0 (considering the drivers of work engagement), a predictive model (using machine learning techniques and the survey's data) of the intention to leave, and a technological tool named BoosToRaise that promotes a protean career attitude, voice behavior, and a cockpit to monitor the organizational emotional state.

Keywords: *Human factor, Industry 4.0, Workforce Engagement, Coaching Leadership, Turnover, Data Visualization*

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Proposal of a Framework for the implementation of Quality 4.0 in Small and Medium-sized Enterprises

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Abstract. Quality 4.0 is being presented as the new stage of quality development, emerging within the Industry 4.0 paradigm. However, its overlying concept and rationale are still hard to define, with research on the topic being essentially focused on theoretical discussions on what Quality 4.0 may signify. The number of studies reporting how Quality 4.0 is actually being implemented in organisations is rather limited, calling for further empirical research.

This research project main goal is to develop a framework to support the transition to Quality 4.0 in small and medium-sized enterprises (SME). The work comprises three stages: a systematic literature review on the topic of Quality 4.0, aiming at understanding what different studies advocate Quality 4.0 is becoming and how companies and professionals are evolving to work within this new approach to quality management; a case study of Quality 4.0 implementation in a ceramics industry operating in the Industry 4.0 paradigm; a survey to be conducted at a set of companies to identify their Quality 4.0 maturity level, the driving factors for implementing Quality 4.0 and the challenges it entails.

Regarding the systematic literature review, 73 documents have been identified in the Scopus database, from 2016 to 2022. Their analysis allowed to conclude that Quality 4.0 emerges as an evolution of quality management, combining traditional quality concepts and tools with the connectivity, intelligence and automation that characterise Industry 4.0. The main objective is to improve performance through decision-making based on large, real-time datasets.

The case study was conducted between March and July 2022 and allowed to understand how a ceramics company operating in the Industry 4.0 paradigm is approaching quality management. The company is developing a number of new quality projects aimed at implementing real-time quality control. The goal is to obtain quality gains, in terms of number of rejections and overall process effectiveness. However, the need for investment and the lack of specific solutions for the ceramics industry emerged as major challenges for using this approach in the company.

Based on the results of the previous two phases, a questionnaire will be applied to a set of companies in the centre region of Portugal, in order to make a diagnosis of Quality 4.0 implementation, and to understand what are the driving factors and the challenges companies face when moving into this new quality management paradigm. Finally, a framework will be developed to assist SME in implementing Quality 4.0

Keywords: *Industry 4.0; Quality 4.0; Small and Medium Size Companies; Survey*

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Overview of financial, energy, and environmental performance indicators to evaluate the overall companies' performance.

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Abstract. As the overall performance of companies is highly influenced by, among others, financial, energy and environmental interactions, a series of indicators should be implemented in order to evaluate the efficiency of different divisions which can be used for improving the internal and/or external stakeholders' functionality.This work identifies and describe the essential indicators, and their influence, relevant for precise assessment of companies' performances from financial, energy, and environment perspective. For that a systematic literature review (SLR) is followed for selection process of manuscripts in period of 2002-2023, with especial emphasis on the past 5 years.

For that, based on input of expert and relevant congress, a table of keywords were constructed which is used for bibliographic screening. The obtained results were organized following a ranking system were criteria such as publication year, author, journal relevant, etc is considered and scored. Consequently, for each perspective number of manuscript is selected, from which the relevant, important, and essential indicators, for evaluation of the company, were extracted, explained, and mathematically formulated.

Therefore, a comprehensive list of financial, energy, and environmental indicators, essential to analysing the performance of companies in financial, energy, and environmental areas will be established, providing a tool for stakeholders to analysis and consequently improve companies performance through compare and adopt the appropriate indicators regarding their specific concerns.

Keywords: *Financial performance indicators, energy performance indicators, environmental performance indicators, Exergy*

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Accelerating Towards the Circular Economy: The consumer role.

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Abstract. The transition from the linear economy to the circular economy (CE) is already an unavoidable reality, which has been integrated with different origins and triggers. Legal imperatives, imposition of the industry itself, or what is conciseness to be the most sustained and lasting, a customer requirement.
In this investigation, we intend to assess whether CE is a customer requirement, and whether it corresponds to one of the quality parameters identified by the consumer.
In the first phase of this investigation, a state of the art was carried out, to assess what has been published about CE, and in a second phase of the investigation, it is intended to inquire companies to understand how they feel that CE is or is not a consumer requirement.
To carry out this task, it was decided to conduct interviews with Portuguese SMEs, from different sectors of activity, and carried out a qualitative analysis of the results interviewed in these interviews. Thus, 32 companies were selected, and interviews were carried out with their entrepreneurs, in which, in addition to the visit, an on-site observation of the circularity practices that each business operation was carried out. Subsequently, it was pretended to understand what had triggered the companies to initiate such practices, and what was the consumer's behaviour in demanding such practices.
The information collected through semi-structured interviews is synthesized using descriptive statistics. Its content will be analysed using NVivo, with which a qualitative analysis will be carried out on the collected data, we may have more clues as to whether the CE is a consumer requirement and a way to implement the CE.

Keywords: *Circular economy; Consumer; Customer requirements; Quality.*

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Deepeia: optimization of SME internationalization strategy via innovation engineering, 3rd update

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Abstract. The research study is set to conceptualize a deep learning model designed to suggest the best foreign market for exporting products or services, based on 180 variables that scholars have found to determine SME Internationalization success. The Artificial Intelligence solution will be modeled using SYSML, and later built using Keras or similar, and trained on a product dataset from various countries, using ASIN product classification, via a combination of neural networks to process inputs and make predictions. The concept is being developed based on an initial theoretical foundation (SUPWAVE), created by the authors, and expanded by a systematic literature review (SLR) of determinants of export performance, which provided a framework for understanding the key factors that impact SME success, and the most important variables for predicting the best foreign market for a given product or service. Ten Interviews with experts were also conducted and transcribed to refine the solution. The theoretical foundation has been published in ICIEMC 2021 proceedings, and a systematic review of SME internationalization and export performance based also on a bibliometric analysis was performed. Findings reveal export performance measures and internationalization gaps, such as disruptive technologies and discourse variables, and the interviews demonstrate that there is a propensity for acquisition of such a solution. Limitations arise from a mandatory focus on SME, due to the amount and size of the body of literature. The contribution is linked to the revelation that there has been a rise of relevance regarding theories related to social narratives and corporate activism, but authors also show that there is still much to do in SME internationalization, namely on what makes a small firm, well established in their native market, have success in other countries. Several trends and gaps were identified, such as a focus on services, theory integration, longitudinal studies between antecedents and performance, strategic fit versus opportunism, network theory on niche marketing, born-"glocal" strategies, disruptive technologies and discourse variables, for the future of SME export success.

Keywords: *SME Internationalization, Determinants of Export Performance, Systematic Literature Review, Bibliometric Analysis, VOSviewer, Interviews*

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Information systems for the development of tourism in the digital era: A framework for Accessible Tourism

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Abstract. With the fourth industrial revolution, changing the tourism sector, it is essential to study what impacts the latest emerging technologies will have in this sector. Tourism is an activity that enriches people in many dimensions. However, it is difficult for disabled tourists to travel without any constraints. Accessible tourism is a crucial topic for the development of a more inclusive society, enhancing tourism among people with special needs (PwSN). Since technology needs to be at the service of society, then the promotion of accessibility in various tourist activities, through various technologies is necessary. This project can be seen as a bridge that connects the technologies of the fourth industrial revolution and accessible tourism. The new digitalization era primarily focuses on improving connectivity, thus making information a critical factor. There are new technologies, developing connectivity with the ability to carry the concept of Smart Tourism even further and at the same time, contribute to more accessible tourism, as one of the main problems, preventing PwSN from traveling is mainly related to the shortage of information. Web applications are a great example, to illustrate how digitalization is revolutionizing accessible tourism, improving accessibility through information and connectivity. Therefore, the main goal is to design, develop and implement a concept of a Web-based Intelligent System (WBIS) - access@tour by action - to support information management and knowledge sharing, in the accessible tourism context, promoting the co-creation of tourism experiences. The conceptualization and validation of the concept followed a 6-stage process: (i) analyzing the research area (accessible tourism market); (ii) assessment of the main functional and non-functional users' requirements; (iii) designing the system based on Unified Modelling Language (UML) and the creation of Personas; (iv) develop the vertical prototype in Adobe XD; (v) perform usability and accessibility testing; and (vi) Implementation study within Tourism 4.0 components. The main results are a fully tested accessible tourism information system solution and a validated research framework. It is expected that this academic work will be capable of supporting future researchers/developers, in understanding and answering the particular requirements of PwSN, when developing accessible information systems. Linking technological development, tourism, and social inclusion components, this project presents itself as an interdisciplinary and important study. In the future, this project could be of high importance for engineering information systems for tourism and also have a big social impact, especially for PwSN.

Keywords: *Accessible Tourism; Tourism 4.0; Information Systems; Web application; Tourism management*

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Language Sciences

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The Clinical Practice of Speech and Language Therapists with preschool-age children with language disorder – syntactic assessment and intervention

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Abstract. Title: The clinical practice of speech and language therapists with preschool-age children with language disorder – syntactic assessment and intervention
Abstract: The total population prevalence of language disorder is estimated to be 9.92%. (Norbury et al., 2016). Children with language disorder benefit from speech and language therapy intervention (Goldstein ; Prelock, 2016). Few studies focus on the clinical practice of the speech therapist. The aim of this study was to explore and analyze the clinical practice of speech and language therapists (SLT) with preschool-age children with language disorder, more specifically, in the syntactic domain.
A cross-sectional survey was conducted in Portugal, using a web-based questionnaire designed specifically for this study. The survey is composed of 109 questions divided into several different sections. The questionnaire was previously validated by a panel of experts. All SLTs working in Portugal as the target population and a final sample of 357 participants was obtained, representing 10% of the total population. The data collected were analyzed using descriptive statistics.
Considering the academic background, 52% of SLTs did not attend a master's degree and 80% did not attend any complementary training in language. Regarding professional experience, 89% of SLTs work with preschool children with syntactic disorders from Autism Spectrum Disorder (ASD) and Developmental Language Disorder (DLD). In both cases, the majority of the SLTs (87%) report that they have never used any program, method or approach specific for syntactic intervention. When they report using them, INsyntax was the most frequently mentioned. 33.6% of SLTs report not feeling confident in assessing syntactic skills with preschool children with (syntactic) language disorders while 29.3% report not feeling confident in intervening with this population. Between 80 and 90% of SLTs report the need to obtain more academic knowledge and practical training and knowledge in the areas of prevention, assessment and intervention.
In Portugal, it seems to lack scientific evidence regarding the procedures used in both assessment and intervention in the clinical practice of SLTs with preschool children with (syntactic) language disorders. This fact may be related to the need felt by SLTs for more academic and practical training. The current findings highlight the need to address training in (syntactic) language disorder within graduate and post-graduate programs for SLTs.
Keywords: clinical practice; speech and language therapy; syntactic domain

Keywords: *clinical practice; speech and language therapy; syntactic domain*

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Scientific Popularisation in Life and Health Sciences: a Comparable Corpus Study in Chinese and Portuguese

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Abstract. Scientific popularisation has been playing an important role in disseminating scientific and technological knowledge across individuals and eras. In the information age, science popularisation is of great significance and can promote the public's understanding and acceptance of specialized or domain-specific knowledge. Furthermore, it can enable the public to become disseminators of scientific knowledge, rather than being merely passive recipients. In our research work, we aim to collect and subsequently analyse a comparable corpus of popular science texts from the field of Life and Health Sciences in the Chinese-Portuguese language pair. Comparable corpora represent useful and efficient resources for constrastive language studies, in that they are compiled "on the same principles (size of the collections, size of the samples, topics covered, chronological period, etc.) in different languages, or different variants of the same language" (Mikhailov ; Cooper, 2016, p. 217). The corpus analysis will be carried out by using the corpus manager and text analysis tool Sketch Engine (Kilgariff et al., 2014). With this research work, we aim to explore and describe inherent characteristics of popular science texts and come up with suggestions for improving popular science texts, enhancing readers' understanding of scientific concepts, and illustrating the importance of cultivating scientific literacy. Furthermore, this study explores the strategies and methods employed in science communication in both Chinese and Portuguese, highlighting effective ways to promote scientific literacy in these language communities.

Keywords: *Scientific Popularization, Science Communication, Life and Health Sciences, Comparable Corpora, Chinese-Portuguese Language Pair*

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Effects of Pragmatic Intervention Programme in language impairment: a state of the art analysis

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Abstract. Effects of Pragmatic Intervention Programme in language impairment: a state of the art analysisChildren with Autism Spectrum Disorder (ASD) and Developmental Language Disorder (DLD) frequently face pragmatic impairments which may result in learning, socialization, and mental health difficulties, therefore early intervention is crucial (Sansavini et al., 2021). The international literature reports several programs that can be used to improve these skills (Law et al., 2012) but research findings on the effects of pragmatic interventions attending preschool-age children, especially with DLD, are scarce. In Portugal, the Pragmatic Intervention Programme (PICP) (Pereira et al., 2019, 2021) was recently developed, and content validated but its effects are unknown. This study aims to determine the effects of the PICP on preschool-age children with ASD or DLD with pragmatic impairment.

A non-randomized controlled trial has been conducted. Until now, 20 children participated in the study. The children were assigned to the intervention (n = 11) or the control group (waiting list) (n = 9). Each child attended 24 PICP-based intervention sessions provided by a Speech and Language Therapist in kindergarten. The sessions were freely given biweekly, for one hour, by one Speech and Language Therapist with deep-in knowledge about the programme content, implementation, and previous clinical practice providing intervention to children with pragmatic impairments in educational settings. The primary outcome measure was a Goal Attainment Scale (GAS) rated by parents and kindergarten teachers. Secondary outcomes include parent/teacher-reported communication skills (Escala de Avaliação de Competências Comunicativas) and an assessment of the child's general language ability (Teste de Linguagem – Avaliação da Linguagem Pré-Escolar). GAS results show that all the children in the intervention group made progress. Statistically significant differences between pre- and post-intervention assessments were found for all secondary outcomes. Conclusions: The main findings suggest that the PICP improves language in preschool-age children with ASD and DLD with pragmatic difficulties. Further research is needed to analyse the effects of the PICP for each neurodevelopmental disorder individually (Pereira et al., 2022).

Keywords: *neurodevelopmental disorders; autism spectrum disorder; developmental language disorder; pragmatic language intervention; preschool-age children; pragmatic intervention programme*

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Literary Studies

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Women's rights, the law and literature

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Abstract. Since the 1970s, law and literature studies have argued that literature can partake in the struggle for women's human rights. Feminist discourse argues that gender constructions for men and women and sexism are the reasons why women continue to comprise two-thirds of the world's illiterate people and two-thirds of the world's poor. Statistics also show that violence against women is a worldwide phenomenon.

In Botswana, Unity Dow argues that her novels tell stories of women she met while working as a human rights lawyer, adding that these stories claim rights and legal change more adequately than reports. Botswana has a plural legal system of customary law and common law of English and Roman-Dutch descent. Dow's novels portray mostly young women who have achieved financial independence and empowerment mainly through education. Dow's protagonists are young, agentic and above reproach. The novels suggest that the younger generation is more prepared and more committed to dealing with present day human rights issues than the older generation, but Dow's young women do not always achieve the degree of success they wish for women and girls.

Dow's novels imply that the common law serves women's rights better than the customary law, but that some legal provisions are still punitive to women. Therefore, readers are expected to empathise with the women's predicaments as portrayed in the novels and participate in legal reform that will more adequately protect women's rights.

Keywords: *Feminist legal studies, women's rights, Unity Dow.*

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Breakdowns and dead ends: the Portuguese counter-road novel

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Abstract. Road novel, the literary manifestation of a narrative and transmedial genre called road narrative, can be defined as any novel that (i) narrates a journey taking place on a road, in a time when automobility is widespread and considered to be the norm, (ii) thematizes mobility as a practice during which an individual undergoes a process of identification with his community, and (iii) has a specific lexicography, mainly consisting in the naming of several places connected with contemporary road travel. On the other hand, the counter-road novel – a concept not yet established in literary studies, but which I propose to be the literary homologue of what Nadia Lie (2017) calls the counter-road movie – can be seen as the road novel's counterstatement (Fowler, 1982, p. 174). Both road and counter-road novel share the same lexicography and roughly the same thematic concern (mobility), but they address the latter in different ways: while a road novel generally represents the practice of mobility, a counter-road novel tends to depict stillness or, more broadly, the difficulties and inequalities regarding the ability to move.
During the research I have been conducting on the Portuguese road novel for the past three years, I have come to observe that such a counterversion has a relevant presence in Portuguese literature. I therefore propose to shortly consider four Portuguese counter-road novels: Lídia Jorge's O vale da paixão (1998), Dulce Maria Cardoso's Os meus sentimentos (2005), Maria Velho da Costa's Myra (2008), and David Machado's Índice médio de felicidade (2013). I will be highlighting each work's particular take on the subject and representation of mobility (even if through its counterpart: immobility or stasis), while also showing the hermeneutical advantages of applying a genre-informed framework to their analysis, for, if it is true that a countergenre (or an antigenre) «has a life of its own that continues collaterally with the contrasting genre» (Fowler, 1982, p. 175), the exploration of common themes and narrative spaces allows for a reading of the counter-road novel guided by the same critical methodology that governs the study of road novels.

Keywords: *Road novel, Counter-road novel, Portuguese contemporary literature, Genre literary theory, Mobility, Motility*

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The Portuguese multimodal novel: new trails to be blazed

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Abstract. We propose to investigate the presence and diversity of the multimodal novel in Portuguese 21st century literary narrative, a sub-genre that, while not new or specifically contemporary, has, in recent decades, acquired undeniable relevance. In multimodal novels, different modes and/or media interact in a semantically integrated way with the printed word and their synergistic relationship is essential for the construction of literary meaning.
Though contemporary novels have often been integrating multimodal resources, they have to date received very little critical attention in Portuguese criticism, a neglect we intend to remedy. This thesis aims to assess the relevance and examine the diversity of the Portuguese multimodal novel, identifying some of its fictional precedents in Portuguese literature. Moreover, it intends to assess the narrative function of convergent semiotic codes in the novel and their contribution to its overall signification, while also positing the new interpretative challenges multimodal fiction presents to readers.

Keywords: *Multimodal novel; Novel; Portuguese literature; Multimodal studies; Intermediality.*

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Nem tudo o vento levou - Os percursos da crónica na literatura portuguesa contemporânea

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Abstract. Género tendencialmente difícil de definir, pela sua volatilidade e contaminação por outros géneros literários e não literários, a crónica é um tipo de texto em crescimento, cuja proliferação nos jornais, revistas, livros e no mundo cibernético não tem sido acompanhada de um ajuizamento crítico correspondente, vindo da Academia. Neste sentido, os cronistas têm apostado fortemente em procurar legitimação e voz crítica nos prefácios das suas publicações e nos seus próprios textos – as metacrónicas. Escape para quando o cronista é atingido pela falta de assunto ou para quando a dúvida sobre como escrever o toma de assalto, a metacrónica tem-se revelado de suma importância para ajudar a balizar um género cujas possibilidades se têm afigurado ilimitadas. Será, por isso, a metacrónica, o escopo da nossa comunicação, na presente edição do Research Summit.

Keywords: *Crónica contemporânea; prefácio; falta de assunto; metacrónica*

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Notebooks, deviations and places in transformation: hybridism and multimodality in Ana Pessoa's young adults' narrative (second year)

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Abstract. This thesis, orientated by Professor Ana Margarida Ramos, is based on the young adults' novels written by Ana Pessoa, a new voice in young adults' literature (Silva, 2020, p. 185) broadly awarded and recognized not only within the Portuguese context but also abroad, catching the eye of academics, critics and juries. This study aims to look closely to these young adults' narratives, published in Two Steps and a Leap Collection, created by Planeta Tangerina, also a highly prestigious publishing house.

Some of the main points of this study relate to the analyses of the various literary procedures used in these narratives, which are built using different artistic languages, with written text in close dialogue with design and illustration language, and also exploring elements like photographs, typography, among others. This investigation aims to show that these kind of hybrid and multimodal novels are highly sophisticated works of literature and art, ones that challenge reading processes (Ramos ; Navas, 2016, pp.148-149 and 169). Consequently, this study will include the latest theorical reflections on these fields, in close relation to the analyses of the young adults' books written by Ana Pessoa.

This project, presented and defended last year, will contain reflections on the contemporary scenario regarding critic discourse on young adults' literature in general and specifically on Ana Pessoa. It will also map Portuguese young adults' books related with hybridism and multimodality contemporary tendences and present the author relating biographic aspects and her literary work. Other important issues are the problematization of young adults' literature, adolescence and hybridism and multimodality concepts. Besides that, and after having examined some of the narratives from the point of view of the flânerie and other urban wanderings, and of diaristic discourse and peritextuality, other analyses, exploring the archive discourse or the music references, are being considered. A status report on publications, congresses and submissions will also be made.

So far, the readings, reflections and analyses of these young adults' books are in sync with contemporary children and young adults' studies that underline the richness and complexity of this kind of narratives constructed in less conventional ways, mixing different literary and artistic procedures.

Keywords: *Young adults' literature, Two Steps and a Leap collection, Ana Pessoa, hybridism and multimodality.*

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Marine Science, Technology and Management

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Microbe-enhanced phytoremediation using the halophyte Salicornia europaea in aquaponics conditions

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Abstract. Marine aquaculture is a growing industry that faces significant challenges such as nutrient management, waste reduction, and disease control. In this context, bioremediation with halophyte plants has shown successful results in the mitigation of the environmental impact associated with effluent discharge, especially in integrated multitrophic aquaculture (IMTA) systems (Cole et al. 2009; Rice 2001).

Plant growth-promoting bacteria (PGPB) have shown promising results as biofertilizers (Ferreira et al. 2023), but their application as biostimulants for enhanced phytoremediation of aquaculture wastewater is still poorly explored. To fill this gap, an experimental approach was implemented to test the hypothesis that the inoculation of halophytes with selected plant-growth promoting bacteria would improve plant growth, in aquaponic conditions and accelerate the removal of excess inorganic nutrients.

For this, the extraction capacity of the halophyte Salicornia europaea (syn. Salicornia ramosissima) inoculated with selected plant growth-promoting bacteria was compared to that of non-inoculated control plants. Two bacterial strains were tested as inoculants: Brevibacterium casei EB3 and Pseudomonas oryzihabitans RL18, both isolated from the rhizosphere of wild S. europaea. Bioremediation was studied under two different conditions: a microcosm experiment in 300 mL pots, in growth-chamber conditions, and an indoor pilot-scale experiment, in 100 L tanks. Plants in the microcosm experiment were inoculated with each of the strains or a mixture of the two. In the tank experiment only the combination EB3+RL18 was tested. In both experiments, non-inoculated plants served as negative controls.

The results showed that the inoculated plants produced 2.6 more biomass than non-inoculated controls. Furthermore, the inoculated plants extracted significantly more nitrogen and phosphorus from the water.

Additionally, we compared the structure of the microbial communities associated with the plants' roots, by PCR-DGGE. According to the analysis, the structure of the microbial communities was affected by the type and by the operational conditions, with significant differences between microcosms and tanks. The metabolite profile of the plants is currently being analyzed, in order to infer the effect of inoculation and cultivation conditions on the chemical composition of plant biomass.

Overall, the results suggest that the combination of halophyte plants and plant growth-promoting bacteria can be a promising strategy for bioremediation in marine aquaculture systems. This study has significant implications in terms of sustainability of aquaculture plants, since the association of halophytes with plant-growth promoting bacteria can increase productivity while reducing its environmental impacts. There is, however, a need for optimization for different aquaculture systems and environments.

Keywords: *halophytes, bioremediation; aquaponics; biostimulants, metabolic profile*

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The use of endogenous insects to promote a more sustainable shrimp aquaculture

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Abstract. Aquaculture is a growing and efficient food production system in line with the Blue Growth strategy. However, the industry relies on wild fisheries as a source of fishmeal and fish oil to meet nutritional requirements of several marine species (mainly in protein and long-chain n-3 polyunsaturated fatty acids), contributing to the growing collapse of fisheries stocks. Alternative sources of protein are being developed. However, current alternatives either have anti-nutritional factors or have a relatively high cost of production. Insects have high protein content and are rich in other beneficial nutrients such as amino acids, lipids, vitamins, and minerals, and are considered good candidates to serve as feed ingredients. Yet, terrestrial insect species lack n- 3 polyunsaturated fatty acids essential for fish and shrimp growth. In contrast, evidence suggests that costal insects present a nutritional composition richer in n-3, being potentially good candidates to feed marine species.This project is investigating this by testing endemic costal insect species regarding their nutritional composition and rearing capabilities. By making samplings of native insects using a sweep net, the study selected three endogenous species that can be reared in captivity, two seaweed flies, Fucellia maritima and Malacomyia sciomyzina and the bush cricket Conocephalus fuscus. Fucellia maritima was selected as the most promising one, due to the capacity of rearing year-round. Lipid extraction was done using an adapted Blight ; Dyer protocol, as well as protein analysis using the Kjeldahl digestion. The seaweed fly F. maritima presents 8.8% to 11.4% fat and 60.5% to 74.7% of protein (all in Dry Weight), with a n-3/n-6 ratio from 0.5 to 4.3, depending on the substrate used, showing a capacity to manipulate its nutritional profile. With the presence of n-3 fatty acids and capacity to be reared in captivity these three species are good candidates to produce adequate aquafeeds and contribute to ensure food security through native insect biodiversity.

Keywords: *Biodiversity, Insect rearing, Sustainable aquaculture, PUFA, Insect meal, Aquafeeds*

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Bioconversion and performance of Black Soldier Fly (Hermetia illucens) in the recovery of nutrients from expired fish feeds

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Abstract. Alternative raw materials such as insect meals have been successfully tested as aquafeed ingredients (Nogales-Mérida et al., 2018), having these the advantage of being able to be fed with by-products and wastes (Surendra et al., 2020). In modern aquaculture systems, feeds are a source of the waste, including expired aquafeeds, mostly due to, lipid oxidation with consequences for palatability, which can lead to feed rejection (Phung et al., 2020). Herein, we study the ability of Black Soldier Fly (BSF) larvae to use as substrate an expired fish aquafeed, enabling the recovery of valuable n-3 fatty acids and adding value to insect meals which traditionally lack these important nutrients. After hatching BSF larvae were maintained under a control diet consisting of chick feed and tap water (1:1, v/v) and kept under controlled conditions (16L: 8D, at 40±5% RH and 30±3 °C). Post-hatching larvae with 7-, 10-, and 15-days (trials A, B and C, respectively) were selected for the trials. On each trial, five different replacement levels were tested: a) chicken feed (CF) at 100%; b)25% of expired fish feed (EFF) and 75% of CF; c)50% of EFF and 50% of CF; d)75% of EFF and 25% of CF; and e)100% of EFF. Each trial (A, B and, C) employed 125 specimens divided into 5 groups (replicates), for each replacement level (a, b, c, d and, e). On the 17th day post-hatching, all specimens were harvested to access larval growth and performance (weight gain, feed conversion rate, bioconversion rate) and for further chemical analysis: proximal composition, fatty acid and amino acid content (both retrieved by GC-MS).
The results showed that by using different fish feed incorporation levels of diet we unravelled the amount of n-3 fatty acids which could be added to larval tissues of BSF larvae after 2, 7, and 10 days of feeding. Also, that short trials and high levels of diet replacement had a negative impact on larval final weight. Furthermore, amino acid and fatty acid larval contents were shaped by the supplied diet, with results supporting the inclusion of BSF meal in aquafeeds, due to the levels of lysine (5.6-8.9%), methionine (1.9-3.2%) and omega-3 fatty acids (14.5%: 7.29% -linolenic acid, 3.01% eicosapentaenoic acid and 3.81% docosahexaenoic acid) recorded. These results demonstrate that BSF can successfully recover important nutrients for aquafeeds targeting marine species and foster the production of a value-added insect under a circular bioeconomy framework.

Keywords: *Insects, insect meal, aquafeed, circular bioeconomy, waste management*

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Marketing and Strategy

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Breaking down barriers: The role of digital-driven leadership for manufacturing businesses.

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Abstract. Background: The existence of resource limitations is one of the most significant concerns. Managers endeavour to optimize resource efficiency. Technologies can boost human resources' motivation to carry out organizational missions. Thus, companies are trying to use digital transformation talents and new technologies such as databases, cloud planning, web Internet, smart systems, and supplies on a considerable scale (Kempegowda, and Chaczko, 2016). The latest technologies have influenced additional characteristics of the community and have also altered industries. Associations demand to maintain these modifications to support and enhance their competitiveness (Tolboom, 2016). Generally, the primary objective of leadership is to encourage the support of the employees to execute the organizational policy, and also leadership has changed with recent advances in technology. In this investigation, we are trying to access Portuguese and Iranian organizations' data.
Objectives: Our purposes are to comprehend the implementation and efficiency of digital transformation to enhance the activities of organizational managing. Could operating technology help in strengthening leadership skills to promote work teams? Would it assist to enhance business activities to expand the market? What is the effect of implementing IT solutions in the organization?
Methodology: Our approach for this investigation will combine the use of scientific articles, library resources, statistical data, and fieldwork. The questionnaire will be operating in the target communities, and other field research techniques include examining and analysing the current situation through interactions with primary data sources. We will also implement fuzzy analysis methods. Statistical techniques will also be applied (calculation of the mean, standard deviation, Cronbach's Alpha, chi-square tests, correlations, regression analysis, among others) using IBM statistical software package SPSS (version 28).
Originality: Cross-cultural studies are hard to do. This study will take place in an industrial country (Portugal) and a developing country (Iran). The data will be collected through local companies. Data and findings should be compared for purposes of establishing best practice.
Primary Results and Conclusion: Primary investigations indicate a significant connection between leadership and technology and organizational objectives. Using technology can generate some conflicts and challenges. It can improve the efficiency and agility of processes and organizations.

Keywords: *Leadership, Technologies, Digital Transformation, Enhance accomplishment, IT Solution.*

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Fatores que influenciam o compromisso na adoção de práticas de conservação da água pelas empresas de enoturismo em Portugal

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Abstract. A sociedade atual vive uma crise ambiental sem precedentes. Um dos problemas ecológicos é a perda substancial de recursos naturais como a água. Existem várias causas para esta situação entre elas a utilização excessiva deste recurso pelas atividades económicas como a agricultura e o turismo (Antonova, Ruiz-Rosa, ; Mendoza-Jiménez, 2021; Miglietta ; Morrone, 2018). O enoturismo, que interliga o setor do turismo com o setor do vinho, pode também ter impactos negativos neste domínio. Estes efeitos estão relacionados não só com as atividades e serviços oferecidos aos enoturistas mas também, com a conduta pouco ecológica dos responsáveis e decisores das empresas. Ponderar sobre os seus comportamentos em contexto empresarial é essencial pois são os principais instigadores da mudança ambiental numa empresa (Ayuso, 2006). Assim, esta pesquisa tem como objetivo central refletir sobre os momentos de desperdício de água, identificar as práticas de conservação que têm sido utilizadas para mitigar este problema bem como, analisar os potenciais determinantes (motivações, barreiras, benefícios) incluindo os preditores psicológicos e situacionais que podem influenciar o comportamento a nível da adoção destas práticas. Para tal, o estudo tem como público-alvo os proprietários-gestores de empresas vitícolas que oferecem experiências de enoturismo em Portugal. Utiliza numa primeira fase a recolha de dados qualitativos (entrevista) e numa segunda fase a recolha de dados quantitativos (questionários). Os resultados preliminares, referentes à primeira fase, sugerem que são as provas de vinho nas adegas (associadas sobretudo à lavagem de utensílios utilizados) e as infraestrutura de apoio (limpeza e utilização) os locais onde se consomem mais água. As principais práticas de conservação deste recurso estão localizadas também nestas duas áreas: adega (exemplo: temporizadores e redutores de caudal) e infraestruturas de apoio (exemplo: técnicas de redução do caudal como meias descargas/garrafas). O estudo inicial aponta também que, apesar dos benefícios financeiros (redução de custos) terem sido mencionados como uma força motriz para a adoção de práticas de conservação da água, as motivações internas (ética/atitude/valores) ganham destaque. Observa-se ainda que nem todos os entrevistados se comportam da mesma forma face à problemática ambiental relacionada com a água num contexto idêntico. Esta constatação aponta para a potencial influência dos fatores psicológicos na adoção de práticas sustentáveis. Estes determinantes são alvo de análise na segunda fase do estudo empírico. Esta informação mais holística permitirá traçar caminhos para futuras intervenções de marketing social em prol de comportamentos mais sustentáveis destes importantes atores turísticos.

Keywords: *"water conservation practices", "wine tourism", barriers, drivers, benefits, "social marketing"*

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The role of user-generated photography in cities' tourism promotion strategy: a study based on the UNESCO Creative Cities Network

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Abstract. Globalization has compelled cities to seek innovative ways to stand out and become unique to attract visitors (Nursanty et al., 2017). Moreover, the advent of the Internet, especially the massification of social networks, has changed how tourists acquire destination information, with photography assuming a decisive role (Fatanti ; Suyadnya, 2015; Stepchenkova ; Zhan, 2013). Photography is a type of user-generated content. During the destination selection process, many tourists rely mainly on this type of content, which reflects the experience of tourists, and which has become an important source for information dissemination (Tugores-Ques ; Bonilla-Quijada, 2022).

Currently, the tourist is just a click away from a social network to publish information about a particular destination (Yu ; Sun, 2019). On the other hand, destination marketing organizations constantly try to project images of a particular place.

The objective of this study is to explore how images and photographs shared on social media, particularly Instagram, can be harnessed to enhance a city's brand image and promote its overall destination appeal (Iglesias-Sánchez et al., 2020).

A mixed methodology will be employed to achieve this objective, combining qualitative techniques such as semi-structured interviews with eye-tracking technology and surveys.

Given the scarcity of scientific output on social networks in tourism (Hanan ; Putit, 2013; Iglesias-Sánchez et al., 2020), this investigation is expected to make significant theoretical contributions to studies on user-generated photography, Instagram, the city brand, and the destination image. The study will also fill gaps in the literature by examining the factors that motivate tourists to share content on Instagram, what characteristics generate the desire to visit a destination and the extent to which photographs influence the overall brand image of the destination.

In addition to its theoretical contributions, this study is expected to generate practical impacts for cities and their promotion strategies. The results will help cities to identify the relevant aspects for improving the image of destinations and the city's brand, ultimately attracting more tourists. Therefore, this study has the potential to contribute to sustainable tourism development in cities and enhance their competitiveness in the global market.

Keywords: *tourism marketing; destination image; place branding; user-generated content and photography; social media networks; Instagram*

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The Role of Virtual Reality in Sustainable Tourism – a systematic literature review and research agenda

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Abstract. The role of virtual reality in sustainable tourism – a systematic literature review and research agenda
Abstract
Tourism is an important industry for global economies, contributing to a significant proportion of jobs worldwide and moving millions of people each year. At the same time, tourism is also one of the most polluting industries and generates negative externalities in destinations. For this reason, the scientific debate on sustainable tourism is so important since it can contribute to solving this problem by suggesting more sustainable practices.
The pandemic crisis resulted in an abrupt and huge decrease in tourism worldwide. The restrictions on people's mobility made it impossible for them to enjoy face-to-face tourism services during some periods, and the importance of virtual tours has thus increased. Virtual Reality was one of the technologies used to conduct the virtual tours. This technology has also been demonstrated to satisfy tourists and influence their future intentions towards the destination. Therefore, previous literature suggests that, in the post-pandemic period, virtual reality can be used to contribute to the sustainability of the tourism industry. The present research aims to better understand how Virtual reality can contribute to sustainable tourism. To accomplish this objective, a systematic literature review was conducted using the PRISMA procedure. The data collection process was performed while using two databases, namely Scopus and Web of Science.
Virtual reality is a technology included in a broader concept, that is virtual tourism. However, this technology has several advantages compared with other technologies, as it provides a more immersive and authentic experience. This technology may contribute to sustainability by replacing some face-to-face physical tourist experiences. The literature on this topic is mostly composed of very specific case studies, which makes generalization of the results difficult. This study also proposes a research agenda composed of three main research lines for future studies. The first line is related to the concepts that may influence tourist's intention to use this technology to substitute touristic activities that can be more negative to the environment or to the destination. The second research line is related to the determinants of virtual reality adoption by tourism organizations. Lastly, the third research line is related to the features that virtual reality experiences should have to increase tourists' perceptions and intentions towards the destination.

Keywords: *Virtual Reality, tourism, sustainability*

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Materials Science and Engineering

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Exploration of Alternative Sintering Techniques for the sustainable process of lead-free electroceramics

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Abstract. Advanced ceramics such as smart response non-linear dielectrics, piezomaterials for sensors and actuators, and microwave-tunable devices are now essential in today's digital society and Industry 5.0. The most well-known and widely used composition is based on Lead Zirconate Titanate [Pb(Zr1-xTix)O3, PZT] due to its excellent electrical properties [1]. However, restriction of certain hazardous substances has drastically limited the use of lead. Among several possible lead-free candidates, in this work we address the investigation of Barium Strontium Titanate (BaxSr1-x)TiO3 (BST) as a microwave tunable device. It is well known that to obtain an adequate densification by the Conventional Sintering (CS), BST-based materials should be processed at high temperatures (>1300ºC) and long sintering times (>hours) [2] which prevents its integration with other materials such as polymers and metals for specific applications, e.g., metal-insulator-metal (MIM) structures. Therefore, a major advance bringing up a low sintering temperature is needed to overcome these technological limitations. In this context, this doctoral work aims to explore the use of alternative sintering techniques, namely, Cold Sintering Process (CSP), Flash Sintering (FS), Spark Plasma Sintering (SPS) and among other derivatives thereof, to produce high-performance BST electroceramics at lower temperatures. For all sintering methods, the effects on structure, microstructure and electrical properties have been evaluated. The expected benefits also include contributing to develop suitable and sustainable processing routes for lead-free materials.

Keywords: *BST; Sustainable Process; Alternative Sintering Techniques; Electroceramics; Lead-free Materials.*

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Electromechanical behaviour of chitosan-chitin-based films

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Abstract. The field of electromechanical properties in chitosan-based composites is rapidly growing with potential applications in electronics, sensing, and biomedicine[1]. However, identifying the source of their electromechanical performance has been challenging due to varying fabrication factors and measurement methodologies. Based on the systematic characterization of chitosan pristine films, it has been concluded that the primary contribution to their electromechanical performance comes from non-piezoelectric effects, which raises questions about the electrostrictive component in dielectrics[2]. This study aims to compare the electromechanical performance of chitosan-based films with chitin nanostructures and using various characterization techniques such as X-Ray Diffraction (XRD), Fourier Transform InfraRed spectroscopy (FTIR), tension until rupture tests, Piezoelectric Force Microscopy (PFM) through the second harmonic generation analysis[3], and piezoelectric sensitivity measurements. The goal is to gain a better understanding of how polysaccharide-based films perform for potential use in flexible electronic applications.

Keywords: *Electromechanical; chitosan; chitin; cast films; materials characterization*

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Enhancing the CO2 adsorption capacity of seafood waste

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Abstract. Approximately 8 million tons of seafood waste is produced and dumped each year in landfills or the ocean without further treatment.[1] However, given their relevant chemical and physical characteristics (e.g., the presence of chitin, proteins, and natural porosity), these residues may be reused for environmental applications, such as gas capture and separation. In the previous work, we demonstrated the capabilities of crab shell residues for CO2 adsorption. Now, we applied the same principles to other seafood waste, such as bone cuttlefish, shrimp, and clam shells, which, given their components, have the potential to render sorbents with a large surface area capable to adsorb CO2. As we made in crab shells, we implemented mild acid and alkali aqueous treatments to optimize the proportion of chitin, calcium carbonate, and proteins, increasing its natural porosity towards optimal CO2 adsorption. The textural properties of the prepared materials and their CO2 adsorption capacity were evaluated through several characterization techniques, including gas adsorption isotherms, thermogravimetry, X-ray diffraction, and solid-state NMR. Our results show that the untreated cuttlefish bone, shrimp, and clams have a low surface area. After being subjected to acid/alkali treatments, we expect an enhancement in porosity analogous to what happened in crab. The success of this project will allow the reusing of large quantities of seafood waste to produce an inexpensive and environmental-friendly material for CO2 adsorption.

Keywords: *Sustainable, CO2 adsorption, Climate changes*

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Development of cork-polymer composites by thermoplastic resin transfer moulding

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Abstract. Greenhouse gas (GHG) emissions are a current environmental concern due to its effects on ecosystems and climate change. In 2019, the transportation sector emitted 16 % of GHG global emissions, while the landfill and waste sector emitted 4% of GHG [1].

Cork, the bark of the cork oak tree (Quercus suber L.), is a natural, renewable, and recycling material. It presents unique characteristics, due to its alveolar-like structure and chemical composition. It represents itself an environmental concern, because around 50,000 tons/year of cork waste are generated by the cork industry and almost all of this amount is landfilled or incinerated. The development of Cork-polymer composites (CPC) has been studied for cork recovery, using conventional thermoplastic processing technologies, such as injection moulding (IM) or extrusion. Although, the high injection pressure used in IM technology compresses the cork alveolar structure compromising the effect of the unique characteristics of cork in CPC. Also, the high viscosity of conventional thermoplastics prevents the processing of continuous fiber-reinforced composites by classical thermoplastic processing technologies [2].

Thermoplastic Resin Transfer Molding (T-RTM) is an emergent technology able to process continuous fiber-reinforced composites with low injection pressure, due to the use of low-viscosity precursors. In the last years, polyamide 6 (PA6) has been a thermoplastic matrix investigated for the manufacturing of thermoplastic composites by T-RTM due to the good mechanical performance and market availability of PA6 precursors. In this technology, PA6 is polymerized inside a mould by anionic ring-opening polymerization (AROP) of caprolactam (-CL), its monomer, combined with a catalyst and an activator, in nitrogen atmosphere [3].

The goal of this work is the development of CPC by T-RTM technology. AP-NYLON® Caprolactam (monomer), BRUGGOLEN® C10 (catalyst), and BRUGGOLEN® C20P (activator) were tested as matrix phase, while different cork granulometries MF5, MF8, BD0.5/1, MD0.5/1 and AD0.5/1, from Amorim Cork, were used as filler phase until 20% (v/v). The CPC were polymerized inside a mould at 170 °C and 3 bar injection pressure. The obtained CPC were characterized by thermal, chemical, and mechanical analyses.The results showed a better dispersion of MF8 in the matrix. Overall, the addition of cork decreased the resistance, stiffness, density, and conversion degree of CPCs in relation to PA6. However, the elastic properties of cork had an effect on impact strength and elongation at break of CPC. As future work, compatibilizer agents and continuous fibers should be added to optimize the performance of the CPC.

Keywords: *Thermoplastic Resin Transfer Molding, cork powder, cork-polymer composites*

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The influence of a new dynamic mixing system in the Thermoplastic Resin Transfer Moulding technology

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Abstract. Over the last decades, global greenhouse gases (GHGs) emissions have been increasingly affecting biodiversity and the planet's natural resources. Aware of this problem, the automotive industry has been promoting new solutions to reduce GHGs emissions, some of which are based on a lightweight design of automotive components. Polymer-based materials have been increasingly used in road vehicles due to their low density, high fatigue and corrosion resistance. The manufacture of structural composite materials is a good opportunity for lightweight design in the automotive industry. Nowadays, this is done using thermosetting-based polymers, leading to end-of-life problems: landfilling of these materials is not a sustainable solution.[1]Thermoplastic Resin Transfer Moulding (T-RTM) is a liquid moulding technology with the potential to produce lightweight thermoplastic composites with continuous reinforcement fibres. One of the distinctive features of T-RTM is the injection and polymerization of a thermoplastic monomer inside a mould. To produce polyamide 6 (PA6), an exotherm reaction occurs via anionic ring-opening polymerization of the -caprolactam monomer. Compared to traditional composites, the potential of T-RTM technology is enhanced by the higher recyclability of the thermoplastic matrix and the lower viscosity of the resin, which can aid fibre impregnation.[2]Although promising, this technology is still not reliable at an industrial level. In addition to the common problems of liquid moulding technologies, such as the presence of voids, the instability of the resin in the presence of moisture or oxygen and the thermal gradients of the process can cause a lack of parts homogeneity and process reproducibility. Even partial polymerization occurring outside the mould can lead to clogging issues and therefore high maintenance and repair costs in complex technological systems as mixing heads.[3]To achieve a better homogeneity of the parts, a new dynamic mixing system has been developed, based on reciprocal and linear movement of the resin inside the mould.
This work assesses the effect of resin flow rate and mixing time in the parts homogeneity. AP-Nylon® -caprolactam monomer (CL), Brüggolen® C1 catalyst (C1) and Brüggolen® C20P activator (C20P) were used to produce PA6 parts, in an 85:10:5 wt% ratio.
The effect of the dynamic mixing system on the production of PA6 parts by T-RTM was evaluated through physical, thermal and mechanical analyses.
The results indicate that the mixing process had a positive influence on PA6 density, tensile properties homogeneity and process reproducibility, thus contributing to the development and application of the technology at the industrial level.

Keywords: *T-RTM; thermoplastic matrix; dynamic mixing system.*

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FDM Capacitive Sensors

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Abstract. The area of User eXperience (UX) and Human Machine Interface (HMI) is changing rapidly, and users have high expectations in terms of experience. Requirements for new features, such as sensors, actuators, and communication functions, to be incorporated in daily life objects, are growing. These demands will require new capacities to design and produce innovative devices and systems, leading to the development of new ideas combining mechanical and electronic functions [1]. An additive manufacturing (AM) approach for the fabrication of electrical circuits and embedded electronic components provides numerous advantages compared to the conventional approaches [2].
Capacitive sensors, acquiring the gestures of the user, are a fundamental component in the development of new forms of interaction. Capacitive sensors were printed on plastic injected parts by an additive manufacturing technology as Fused Deposition Modelling (FDM). Chemical and superficial characterization of the substrates was done. Conductive metal filled filament and conductive carbon filled filament were characterized regarding chemical (FTIR and XRD) and thermogravimetric properties (TG and DSC). SEM and electrical studies were performed to analyze adhesion, thickness, and electrical properties of the capacitive sensors. Electrical properties of the capacitive sensors were also measured presenting similar capacitance responses independently of the capacitor electrode material.

Keywords: *HMI; FDM; printed electronics; capacitive sensors*

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Optimization of Robocasting Process for Additive Manufacturing of WC-9Ni Cemented Carbide: Rheological Behaviour and Performance Evaluation

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Abstract. Additive manufacturing, or 3D printing, has attracted considerable attention in the field of powder metallurgy to produce complex shaped parts offering potential advantages such as reduced manufacturing time and increased geometric complexity and direct production without need of mould. The problem addressed in this study is the need for an efficient additive manufacturing process to produce complex shaped hardmetal parts with desirable properties such as wear resistance, impact resistance and low porosity for prototyping or small batch production. Traditional powder metallurgy methods involve multiple operations such as uniaxial or isostatic die pressing, and then shaping by CNC multiaxis or lathe machines which increases production time and cost. The proposed solution is to use robocasting, a near-net process that offers advantages such as shorter manufacturing time, higher geometric complexity and better sustainability. In this study, a novel near-net shape robocasting process was investigated for the additive manufacturing of WC-9Ni cemented carbide using an aqueous and non-aqueous slurry. The rheological behaviour of the slurries was investigated by varying the processing parameters, including the binder type and amount, dispersant type and concentration, and solids loading. The aim was to obtain a printable paste with a high solid loading above 90wt%. The properties of the green and sintered bodies were evaluated and provided information on the performance of the robocasting process to produce WC-9Ni cemented carbide parts. The study showed the potential of an additive manufacturing process for producing complex-shaped hardmetal parts with desirable properties from a slurry with a high solid loading of 90wt%. After sintering the parts had linear retraction of 20%, a relative density of 95% without HIP and a hardness up to 13.5 GPa Vickers.In conclusion, the rheological behaviour of the slurries of WC-9Ni cemented carbide was optimized by varying processing parameters, leading to the fabrication of complex-shaped samples with properties close to those obtained in conventional powder metallurgy production. The results of this study contribute to the advancement of additive manufacturing extrusion techniques for hardmetal materials, and further research can be conducted to explore the potential applications of robocasting in other fields of powder metallurgy.

Keywords: *Robocasting, additive manufacturing, hardmetal, WC-9Ni cemented carbide, Rheology, Printability*

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Tailoring the rigidity of bioplastics using green carbon feedstocks

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Abstract. Plastics are commonly used due to several features, namely their low cost, lightweight, durability, chemical resistance, electrical, and thermal insulating properties [1]. In particular, thermoplastics can also be easily molded through a variety of polymer processing technologies. However, most thermoplastics products are traditionally made from non-biodegradable polymers derived from petroleum [2]. The use of natural feedstocks with comparable performance and processability to fossil plastics can be a viable strategy for meeting current environmental demands. Herein, starch-based blends are being developed due to starch's availability, low cost, non-toxicity, and biocompatibility [3]. Nevertheless, their limited mechanical performance and moisture uptake compromises their processability by injection molding, one of the most widely used technologies in the production of semi-rigid and rigid polymeric materials. In this PhD thesis,different approaches are being studied to overcome such issues, including the preparation of enhanced starch-based blends using aliphatic polyesters, such as polycaprolactone (PCL), poly(butylene adipate-co_x0002_terephthalate) (PBAT), and polybutylene succinate (PBS). The feasibility of using graphene nanoparticles and natural materials (e. g. cork, pine resins) as reinforcing agents will also be studied. Each developed biocomposites will be characterized by thermal (Differential Scanning Calorimetry (DSC), Thermogravimetric Analysis (TGA)), rheological (Melt Flow Index (MFI), double capillary), chemical (Fourier Transform Infra-Red (FTIR)) and mechanical (tensile, flexural, compression, impact, Heat Deflection Temperature (HDT)) analyses. To validate their environmental sustainability, a life cycle assessment (LCA) of the most promising formulation(s) will be carried out. So far, preliminary experiments showed that PBS, pine resins, and graphene nanoplatelets increased the stiffness (Young's modulus increased from 66 MPa up to 97 MPa) and thermal stability up to 300 ºC of starch-based materials. Moreover, all the developed biocomposites presented a non-Newtonian pseudoplastic behavior, suggesting adequate behavior for processing by injection molding and potential for semi-rigid and rigid applications.

Keywords: *Biobased, Biocomposites, Starch-based blends, Sustainability.*

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3D printing of advanced silicon nitride cutting tools for high-tech applications

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Abstract. Silicon nitride (Si3N4) is a non-oxide ceramic material that showcases outstanding chemical stability as well as thermal and mechanical (e.g. toughness, strength and hardness) properties, thus making them highly suitable to be applied in a plethora of industrial challenging environments as gas turbine engines, automotive turbochargers, bearings, thermocouple tube sleeves and cutting tools, among others[1]. Despite highly promising for different end-use industries, conventional shaping techniques (e.g. pressing and molding/casting)[2] have hindered the Si3N4 market growth towards emerging opportunities and new products. From an industrial perspective, additive manufacturing (AM) technologies have represented a significant promise for the fabrication of disruptive silicon nitride structures with on-demand functionality[3], overcoming time-consuming and costly conventional processes.

This PhD project envisions a breakthrough in the way that cutting-tools are produced, by engineering advanced Si3N4 ceramic structures through stereolithography, aiming at obtaining near-net shape cutting tools with unprecedented structural complexity, efficiency and lifetime, while saving hard metal materials (tungsten carbide, cobalt, and titanium carbide) commonly employed in traditional carbide cutting tools. Therefore, highly loaded Si3N4 suspensions with suitable rheological properties and crosslinking kinetics have been developed to be further applied in the 3D-printing of complex green Si3N4-based structures. Preliminary results have shown the production of filigree 3D cutting tools with precise cooling microchannels and proper interlayer adhesion. Now, sintering conditions (temperature, dwell time and heating/cooling rate) have been optimized to achieve highly dense tools' structures.

Overall, it's expected that PhD outcomes will bring AM technologies closer to the cutting tool industry, accelerating the Si3N4 market growth as a raw and sustainable ceramic material.

Keywords: *Silicon nitride ceramics, structurally complex cutting tools, additive manufacturing technologies, stereolithography, sustainable industrial development*

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Surface Modification of Boron-Doped Diamond Electrodes for Water Treatment using Plasma Etching: Experimental Evaluation of the Impacts on Electrochemical Activity

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Abstract. Surface modification of boron-doped diamond (BDD) electrodes is a promising approach for enhancing their electrochemical performance in water treatment applications. BDD surfaces grown by Chemical Vapor Deposition (CVD) methods are typically terminated with hydrogen atoms because they are cooled down in a hydrogen atmosphere. In this study, we used radiofrequency (RF) plasma treatments with different gases (O, Ar, and CF4) to functionalize BDD surfaces. The modified BDD surfaces were characterized using Raman spectroscopy, sessile drop contact angle measurements, cyclic voltammetry (CV), electrochemical impedance spectroscopy (EIS), and Mott-Schottky analysis. We also compared the capacity of the plasma-treated BDD electrodes with that of as-grown BDD films for the electrochemical oxidation of phenol as a model pollutant. Our results indicate that RF plasma treatments significantly affect several characteristics of BDD films, such as electrochemical potential window, kinetics towards the Fe(CN)6 3/4 and Ru(NH3)62+/3+ redox couples, surface wettability, and flat-band potential. However, the diamond quality and the capacitance of the films were not significantly affected. Our electrooxidation tests show that the as-grown BDD film without plasma treatment exhibits the best performance in terms of electrochemical oxidation of phenol, indicating that the plasma treatments may not improve the electrochemical activity of the BDD electrodes for water treatment. Overall, our findings suggest that RF plasma treatments can modify the surface characteristics of BDD films, but their use in water remediation may not be optimal. However, plasma treatments may be valuable for other applications of BDD electrodes, such as sensing. These results have important implications for developing more effective strategies for functionalizing BDD electrodes for several applications.

Keywords: *boron-doped diamond; plasma treatment; electrochemical oxidation; water remediation; surface modification; electrode functionalization*

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Blown-extruded starch-based materials using rice and potato industry by-products

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Abstract. Blown extrusion is a polymer technology widely used for producing plastic films for packaging, that requires polymers with high fluidity, tensile resistance, and flexibility. Due to environmental concerns, nowadays, the development of renewable and biodegradable feedstocks that fulfil these requirements are being studied. Herein, thermoplastic starch (TPS)-based formulations have been considered. Nevertheless, their low melt tenacity and thermal stability, brittleness, and water-sensitivity still compromise their trading.

To overcome these drawbacks, blending TPS with plasticizers and/or fillers is being considered. In this PhD work, the feasibility of using non-purified starch-rich rice and potato industry by-products to develop blown extrudable TPS-based materials with enhanced performance is being explored. Furthermore, rice husks and potato peels have also been used to develop nanostructured fillers for TPS-based materials. Rejected colored rice (RC) and rice dust allowed to develop TPS-based films by solvent casting and hot-pressing, similar to starch recovered from potato washing slurries. In both production techniques, flexible films were obtained, with RC-based films presenting the highest flexibility and hydrophobicity, as well as active properties such as antioxidant and UV-protective capacity. The incorporation of rice husk- and potato peels-derived cellulose nanostructures, led to an increase in the hydrophobicity and tensile resistance of the TPS-based films without losing their stretchability. Until now, RC-based materials were tested for blown extrusion and showed a promising profile due to high melt fluidity and stretchability, although some processing parameters and material properties still require investigation. Overall, this PhD work is on track to achieve the final objective of developing a competitive formulation processable by blown extrusion and based on agrifood by-products, and the next steps will involve the chemical modification of the starch rich by-products through the use of oil extracted from rice bran, which could lead to further improvements in processability and hydrophobicity.

Keywords: *nan*

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Naturally coloured, flexible, and water tolerant bioplastic coatings for paper using potato, onion, and garlic industry byproducts

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Abstract. Non-biodegradable plastics have been used on paper coating due to their high-water vapor/gas barrier properties. To minimize the ecological footprint from the paper sector, biodegradable coatings are in demand. In this PhD thesis, it is hypothesized that potato, onion, and garlic industry byproducts can be used as source of biomolecules suitable to develop naturally coloured, flexible, and water tolerant bioplastic coatings for paper.
After the biochemical and thermal characterization of each agrifood byproduct, starch recovered from potato washing slurries was thermoplasticized and the influence of onion peel (OP) and garlic peel (GP) on physicochemical, rheological, antioxidant and mechanical properties of thermoplastic starch-based materials is now being studied.
Chemical analysis on starch included determination of total starch content, ashes and humidity percentages in line with the ones found in literature. Biochemical analysis on OP and GP included the determination of carbohydrates, proteins, lipids, phenolics, ashes and moisture content. Thermal analysis of all byproducts included thermal gravity analysis and differential scanning calorimetry. None of the byproducts degraded until 210 °C. After the blending OP/GP with starch, it was observed that the resulting OP/GP conferred an orange/beige colour to starch-based materials, whose intensity increased linearly with the byproduct amount. Moreover, OP/GP decreased the melt flow index and flexibility of starch-based materials.
Further experiments will focus on the characterization water vapor/gas permeability, wettability, and extrudability of starch/OP- and starch/GP-based films, as well as their suitability to be used on paper coating.

Keywords: *nan*

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Investigating Safe Rare Earth Doping Levels for Improved CO2 Flux in Composite Membrane

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Abstract. Ceramic-carbonate composite membranes have shown promising results for separation of hot CO2. However, the carbonates used in these membranes attack the ceramic backbone through acid-base reaction. Rare earth doped oxides have been most referred ceramics to accelerate gas separation kinetic, but their vulnerable to coexisting molten carbonate (MC) and CO2 are not documented well. Particularly, the study of detailing required safe doping in above concern is scarce. The present work focused on determining the safe doping limit in Ce1-XGdXO2-LiNaCO3 (80:20 vol%) composite membrane, where X = 0.10, 0.15, and 0.20. The ceramic powders were synthesized using Pechini route and coarsened for larger grains at 1500 C. The matrices were prepared from those powders at 1500 C and then impregnated with LiNaCO3 at 700 C. The impedance measurement at 250ºC illustrated the highest bulk and total composite conductivity respectively in 10 and 15 mol% of Gd doping. CO2-separation followed the total conductivity trend, with highest flux of 0.14 cm3.min-1.cm-2 observed at 650 C for 15 mol% Gd. Post-mortem analysis on membrane of 20 mol% Gd doping showed Gd-precipitation and evaporation of melt with retention of carbon allotropes on the sweep face. This work provides insight into optimizing rare earth doping level for improved performance in composite CO2-separation membrane.

Keywords: *CO2-separation membrane; composites; Impedance; Microstructure; Molten carbonate; carbon allotropes*

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Optimizing the Performance of Barium Titanate-based Ceramic Thermoelectric Materials: A Comparison of Solid State Technique and Spark Plasma Sintering

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Abstract. Ceramic Thermoelectric materials have gained significant attention due to their potential application in energy conversion and waste heat recovery. The selecting of synthesis and sintering methods plays a crucial role in determining the properties and performance of these materials. This study focuses on the comparative studies of electrical properties of barium titanate-based TE prepared by two different techniques, solid state method and spark plasma sintering (SPS).The conventional solid-state technique involved uniaxial pressing followed by cold isostatic pressing (CIP) and afterward sintering, while the SPS technique does not require pre-pressed samples and powders are directly placed in the graphite die for pressing and sintering simultaneously. After sintering, the phase identification was performed through powder X-Ray Diffraction (XRD) analysis. Morphological and microstructural characterization was conducted using scanning electron microscopy (SEM) complemented by energy-dispersive spectrometry (EDX) for elemental analysis. Archimedes densities were measured for several sintered samples from each composition to minimize measurement errors. Electrical conductivity and Seebeck coefficient values were simultaneously measured using the four-point probe DC method. Results showed that the prepared materials are n-type semiconductors, as indicated by the negative sign of the Seebeck coefficient in all temperature ranges. It was found that sintering the sample through SPS, even at the lower sintering temperature, increased the electrical conductivity up to 3 times at high temperature (800°C) and around 6 times at lower temperature (400°C) in comparison to that of solid-state sintering. As expected from the data of electrical conductivity and Seebeck coefficient, the power factor increased almost 10 times at lower temperature (400°C) and around 3 times at higher temperature (800°C) when the sample was sintered through SPS.

Keywords: *Solid-state method, Spark plasma sintering, Thermoelectric, Barium titanate-based*

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Screen printable bio-based ink for smart food packaging

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Abstract. About a third of global food production is wasted every year. To address this issue, the advancement of active and intelligent food packaging is crucial since it not only allows the shelf-life extension of perishable food, such as meat and fish, but also provides information to consumers about their quality.[1]
In particular, volatile amines found in meat and fish have been used as a sign of food spoilage. These amines, resulting from microbial enzyme activity, make up the majority of the total volatile basic nitrogen compounds (TVB-N). Moreover, as the pH level of meat and fish typically hovers around 6.0, TVB-N's alkaline nature can increase it to 7.0, indicating spoilage.[2] Colorimetric freshness indicators have emerged to monitor food quality through color changes. Natural pigments like anthocyanins can act as real-time freshness indicator dyes due to their varying color at pH 6 and 7, making them a safer alternative to traditional dyes, while also presenting antioxidant and antimicrobial activity. Therefore, it may be possible to assess the exact moment the food starts to get spoiled, just by looking at the packaging, without the need to use any additional device.[3]To use these pigments, their incorporation into a suitable matrix must be well done. Biopolymers such as chitosan and starch are very popular due to their low cost and availability. Their biodegradability and possibility to extract them from natural sources, make them a more sustainable alternative to the conventional fossil-based polymers. Even though incorporating anthocyanins into these biopolymeric matrixes to form films that act as intelligent food packaging has proved successful, scalability remains an obstacle.[4] Instead, developing inks to be directly printed onto the packaging using techniques such as screen-printing seems to be more efficient due to its simplicity, affordability, and adaptability to the fabrication process.
Therefore, the formulation of ink for screen-printing with anthocyanins enclosed in a biopolymeric matrix is promising. The formulation is expected to increase meat and fish shelf-life due to the antimicrobial and antioxidant properties of anthocyanins and their ability to monitor fresh food quality as a colorimetric indicator, not requiring any electronics for the output and expectedly at a low cost.

Keywords: *Food packaging, active, intelligent, TVB-N, anthocyanins, screen-printing*

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Mathematics

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Optical Sensors Algorithms for Data Acquisition in Recirculating Aquaculture Systems

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Abstract. According to FAO, aquaculture is defined as: "The farming of aquatic organisms including fish, molluscs, crustaceans and aquatic plants". This industry has been playing an increasingly role in the world's food supply and is now the producer of more than half of the fish consumed worldwide.
In opposition to traditional systems, Recirculating Aquaculture Systems (RAS) have proven to be the most profitable ones. By using different types of filtration and environmental control agents, RAS are able to minimize the injection of fresh water in the tanks, while maintaining a considerable production of fish.
However, a large production of fish raises other concerns, as the health and quality of life of the individuals, the amount of resources needed to maintain it and the economics of the entire production process. These concerns may be addressed by applying Industry 4.0 approaches to the Aquaculture Industry, e.g., installing IoT devices to collect data and big data analytics to optimize and enhance the complete system in a sustainable way.
In the context of a bigger project, this specific work aims to develop algorithms to support the building of new optical sensors, installed near the fish tanks, capable of measuring concentrations of bacteria and hormones, such as E. Coli and cortisol, respectively.
Techniques from image processing, statistics and machine learning will be combined to transform the sensor digital signs into concentration values. Currently, the optical data has been processed and the stage of algorithm development and benchmarking has started.

Keywords: *Aquaculture Sensors, Recirculating Aquaculture Systems, Machine Learning, Industry 4.0, Sustainability.*

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Pré-Cálculo: mathematics learning application

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Abstract. With the ever-growing development in technologies and its adoption by the masses in the most diverse fields, it is imperative that teaching methods evolve alongside these changes. With this in mind, the Department of Mathematics is developing a multitude of projects, being the website SIACUA one of its most successful. These projects are made possible with the support of CIDMA, the University Rectory through the Aveiro Education and Social Alliance and POCH.
In this website, students from all backgrounds can find a wide range of introductory videos of mathematical subjects and exercises with their respective solution. It's believed that these elements synergise well with the widest range of students, which is backed by the positive feedback received from students.
Even though we can consider this website to be vastly resourceful, it is our mission to expand it as much as we can. Therefore, a whole new application was developed to address SIACUA's missing topic: the previous knowledge that a student must be proficient at, before enrolling in University.
Thus, the journey of building a new application that would host those topics has started. This construction did not start from scratch since it uses some features that were already implemented in SIACUA.
This application is divided in modules, each one approaching subjects like: logic, mathematical sequences, functions, geometry, and algebra. A certificate must be assigned to the user once he/she completes each module. Every module is always accompanied with an introductory video and a sequence of steps explaining the subject through interactive texts, videos, and exercises.
The team assigned to develop this app thinks that these resources will affirm themselves as essential to warrant the best learning experience not only for new students but students which are attending higher math courses as well, since one of the biggest obstacles preventing students from achieving their objectives is the lack of proficiency on previous knowledge. Moreover, these deficiencies are very common in the years after the pandemic due to online teaching.
Given what has been said, we think that it is reasonable to say that the work held by our team is of extreme importance not only to increase the admission rates of the math courses but also to contribute for the education of a more knowledgeable work force.

Keywords: *nan*

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Asymptotic results for certain diophantine equations

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Abstract. In order to solve some Diophantine equations, the general approach is to associate a geometric object to a putative solution. In our cases, these objects will be Q-curves over an imaginary quadratic extension. A result of Ribet implies that these particular curves have (after a twist by a Hecke character) a Galois representation defined over the rationals, and hence, by Serre's conjectures and some Taylor-Wiles' results on modularity, it has associated a modular form f. Using a Ribet result this modular form will be congruent module a prime to a modular form g in a smaller space.The idea is to try to discard, via some methods, these latter modular forms. By Eichler-Shimura, they have associated an abelian variety and a field of coefficients. However, the newforms g of this smaller space whose coefficient field matches the one of f in general pass this elimination procedure. There is a plausible situation that might appear (because the curve is defined in an imaginary quadratic field) which is that the building block of the abelian variety associated to g might have dimension two. On the other hand, the abelian variety associated to f has a 1-dimensional building block, the Q-curve we started with. Then a reasonable question might be: Is it true that the newform g also has a building block of dimension 1? If so, what is the minimum field of definition of the elliptic curve? One of the main contributions of this work ([1]) is to provide a positive answer to this latter question, as well as to answer some other relations between the algebra of endomorphisms of their abelian varieties.A non-trivial application of our results is solving the Diophantine equations the authors studied at [2] and,[3], but this time asymptotically for the parameter d.

Keywords: *Endomorphisms of GL_2-type abelian varieties, Diophantine equations, Elliptic curves, Modular forms*

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Mean-Value-Property in the Heisenberg Group

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Abstract. The Mean-Value-Property is a very useful property of harmonic functions. These are functions that satisfy the Laplace operator which is widely known within the field of partial differential equations. In sub-Riemannian geometry this operator is not the euclidean one since at each point we have a linear subspace of the tangent space. During this project we studied the simplest sub-Riemannian structure and derived a necessary condition for functions that satisfy the Mean-Value-Property by doing an asymptotic expansion up to order 4.

Keywords: *sub-Riemannian geometry; Heisenberg Group; Mean-value-property*

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A Numerical Approach for the Aircraft Deconfliction Problem with Speed Regulation (Abstract)

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Abstract. Based in previous work done by project ERASMUS and using a known formulation for the problem of aircraft deconfliction and crash prevention we will obtain a series of numerical results using SIP (Semi-Infinite Programming) and NLP (Non-Linear Programming) algorithms. A comparison between algorithms results will be made in order to obtain the optimal value for the objective function of our problem, that measures the total speed changes of the aircraft based on the safety distance legislation for the european airspace. The work also involves a reformulation of the original problem by using NLP theorems and properties that allows us to transform the SIP problem into a more simple NLP problem.

Keywords: *Deconfliction, Aircrafts, Safe Distance, Semi Infinite Programming*

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Mechanical Engineering

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Development of semantic reconstruction algorithms of 3D models for damage detection and recognition

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Abstract. Additive manufacturing has been widely used for reconstructing and repairing metal parts. However, thisprocess has significant limitations since it is often developed to specific parts or damage types, making itdifficult to repair arbitrary parts or variable defects (Hascoët et al., 2018). Several researchers haveproposed automation methods for the metal parts repair process to overcome this limitation, includingdefect detection and recognition (Hascoët et al., 2018; Biegler et al., 2020; Li et al., 2017; Liu et al., 2016;Ueda et al., 2020). This study presents a Python algorithm that uses the Open3D library to automate thedetection and recognition of different types of damage in 3D mesh models. The algorithm is based on planesegmentation and the RANSAC algorithm and was tested on damaged parts with surface, edges and cornerdefects. The developed algorithm accurately detects and extracts the defect's geometry, volume, andposition, which enables automatic damage characterization and the definition of new automatic repairstrategies. The proposed method's accuracy and ability to integrate into automated repair systems throughadditive manufacturing were demonstrated by comparing the regions of interest, between the extracteddamage zone and the real damage zone. The results showed that the developed algorithm can detect andcharacterize defects, providing a reliable and automated method for repairing metal parts. In summary, thiswork presents a novel approach to automating detecting and recognizing defects in 3D mesh models. Themethod's accuracy and potential for integration into automated repair systems make it a promising solutionfor repairing metal parts through additive manufacturing

Keywords: *Automated repair systems; 3D model semantic reconstruction; Damage detection; Point cloud plane extraction; 3D point clustering;*

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Continuous manufacturing of bio-based and biodegradable density-graded plastic foams

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Abstract. The development of density-graded foams (DGF) has been a subject of increased interest due to beneficial property gradients that they provide. Conceptually, DGFs hinge on spatially varying the local density along the foam's thickness to achieve lightweight structures with optimal strength and energy-absorbing capacity for different applications, including innovative packaging solutions (e.g., foam-in-box packaging) . Nonetheless, common manufacturing processes to promote density gradation in thermoplastic foams (TF) rely on temperature- or pressure-induced batch foaming, thus hindering their industrialization. Therefore, the possibility of achieving a continuous process to manufacture DGF provides an opportunity to combine multifunctionality with a cost-effective production. In continuous foam extrusion, density gradients arise from the effect of polymer properties and processing conditions. Particularly, shear is an enabler of uneven nucleation, thereby providing a path to create DGF. However, the nucleation behavior of a polymer/gas system in extrusion conditions is challenging. In this context, advanced polymer processing technologies, such as multilayer co-extrusion, provide a continuous and flexible process to manufacture DGF that combines the physical and mechanical behavior of both solid and foamed polymers.
Furthermore, the use of synthetic polymers to produce TF has been targeted as a main source of plastic pollution due to their high persistence in the environment. Although these materials are recyclable, their high volume-to-weight ratio hinders their recycling rate. In this context, legislators have been phasing out the use of synthetic TF in single-use applications, including expanded polystyrene (EPS) products for single-use packaging. Thus, a demand for alternative materials that fulfill the market for short-to-medium lifecycle TF creates an opportunity to implement bio-based thermoplastics. Within these, thermoplastic starch (TPS)-based materials have been highlighted, due to the starch abundance, biodegradability, and possibility to be retrieved from non-edible agri-food industry by-products. Notwithstanding, neat TPS-based materials show high viscosity, brittleness, and water sensitivity, thus limiting their extrudability. In this PhD thesis, the feasibility of developing an in situ chemically modified TPS via citric acid is being studied to enhance TPS rigidity and decrease its water binding ability, thereby rendering it suitable for continuous multilayer coextrusion of DGF. Overall, a balance between the processability and mechanical performance of TPS is expected, thus unveiling the possibility to implement a sustainable material in the development of a new generation of performance-oriented foam-in-box packaging. Until now, the PhD workplan was developed and chronologically distributed. Further experiments will be focused on achieving stable foam extrusion and the evaluation of the structure/property/process interrelationships.

Keywords: *multilayer co-extrusion; density-graded foams; lightweight materials; bio-based thermoplastics; biodegradable thermoplastics; starch;*

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Recovering of recycled expanded polystyrene via extrusion

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Abstract. Expanded polystyrene (EPS) is a polymer consisting of 98% air and 2% polystyrene (PS) (Eaves, 2004). EPS parts are made up of PS beads that contain a blowing agent, typically pentane, entrapped into their interior, which allows them to expand to form a cellular structure similar to a honeycomb (Raps et al., 2015). The unfoamed expandable beads permit efficient storage and transportation, as well as their density control in separate steps (pre-expansion and molding) (Raps et al., 2015). The low density and excellent mechanical and thermal properties of EPS make it widely used in insulation and packaging applications (Eaves, 2004). However, many applications of EPS have a short service life, emphasizing the need for efficient recycling methods (Capricho et al., 2022). Furthermore, the European targets Green Deal aims to achieve carbon neutrality, requiring the circularity of raw materials and strategies to minimize the use of virgin feedstocks (European Commission, 2019). The most used EPS recycling method involves shredding and extrusion into recycled PS granules for use in other applications. Yet, this process, which is known as downcycling, destroys the cellular structure of EPS, while releasing the blowing agent, compromising their further reprocessability (Capricho et al., 2022). This work aims to recover the value of recycled (shredded) EPS through the extrusion process by adding a blowing agent to produce granules similar to those produced in the more conventional process (suspension polymerization) (Raps et al., 2015). This approach has the potential to create a closed EPS recycling loop. Herein, a mechanical prototype that allow to introduce an expanding agent during the recycled EPS extrusion was developed.

Keywords: *Expanded polystyrene (EPS), Mechanical recycling, Extrusion, Expandable beads, Blowing agent*

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Reprocessed PLA degradation assessment and mitigation for closed-loop FFF filament extrusion

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Abstract. Enabling closed-loop manufacturing in the plastics industry is of the utmost importance to create more sustainable production models. However, there are barriers that need to be overcome. Plastics suffer degradation throughout their lifecycles, which often renders them unsuitable for the original or similar applications. Employing degradation assessment methods to allow verifying these plastics' quality is, therefore, critical, especially if it can be done in-process and non-destructively. Multiple techniques are currently available that can do just that, even more so, when paired with suitable prediction algorithms. Such is the case with in-line spectroscopy and rheology (Mulrennan et al., 2022). Within the scope of small-scale closed-loop additive manufacturing (AM) with reprocessed poly(lactic acid) (PLA), this work was aimed at evaluating the potential of rheology, near-infrared (NIR), and Fourier-transform infrared (FTIR) spectroscopy to generate data for degradation classification.

During reprocessing, particularly in melt-processing stages, such as extrusion and material extrusion-based AM technologies PLA is subjected to degradation-inducing factors ranging from temperature and mechanical stresses to exposure to moisture and oxidation agents. This leads to, among other effects, chain scission of PLA molecules, leading to a decrease in molecular weight, and, from the macroscopic point of view, it affects melt behavior and mechanical properties (Badia, Strömberg, Karlsson, ; Ribes-Greus, 2012). A chain extender is an additive used to rejoin the polymeric chains, counteracting some degradation effects (Ramírez-Herrera, Flores-Vela, Torres-Huerta, Domínguez-Crespo, ; Palma-Ramírez, 2018). This work was, therefore, also aimed at characterizing the capability of 1,3-bis(4,5-dihydro-2-oxazolyl)benzene (PBO), a chain extender still understudied in PLA, to recover reprocessed PLA's properties. To achieve this, PLA was subjected to one or two consecutive cycles of extrusion, printing recurring to Fused Filament Fabrication technique , and grinding, after which, formulations were developed with varying PBO concentrations. The formulations were granulated, extruded, and 3D printed. Capillary rheology, NIR, FTIR spectroscopy, differential scanning calorimetry (DSC), tensile tests, and print quality assessment were performed.

The data collected in this study will be used to develop algorithms that can predict properties of reprocessed PLA and allow the strictly necessary amount of PBO to be mixed into the polymer, thus recovering its mechanical and rheological properties to the required level. This way, the basis for a system integrating in-process, non-destructive, degradation assessment, and mitigation for small-scale closed-loop AM, is created. This, in turn, will lead to an extension of the number of reprocessing cycles PLA can go through while minimizing quality loss after each cycle.

Keywords: *Closed-loop manufacturing; Fused filament fabrication; Chain extender; In-process monitoring; Degradation classification*

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Enhancing the Functionality and Customization of Artificial Lawns with Photoluminescent Additives and Backlight Systems

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Abstract. Enhancing the functionality and customization of artificial lawns with photoluminescent additives and backlight systems

Keywords: *Artificial grass, Photoluminescence, Backlight system, Customization*

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Smart Predictive Digital Twins and Multiservice Orchestration for Real-time Streamlining of Water Supply Systems

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Abstract. Water supply systems (WSS) are responsible for the reliable delivery of safe water to every community in society. These systems implement pump scheduling operations to meet water demands, while respecting hydraulic limitations (such as maintaining adequate pressure throughout the WSS, and feasible water levels in tanks). Costs of pumping operations are affected by a multitude of factors, such as aging infrastructure, climate change, and energy cost uncertainty. This work proposes a digital transformation of the WSS to achieve cost-effective pump scheduling operations.Digital twins have recently emerged as powerful tools for creating virtual representations of complex real-world systems in the digital space. This technology is promising for emulating and predicting WSS's hydraulic states and has already been applied to water leakage control (Ramos et al., 2022), and prediction of the system's performance (Pesantez et al., 2021). Hydraulic simulators, such as EPANET, have been used to model WSS. However, their calibration is still time-consuming. Alternatively, data-driven models do not require calibration and, therefore, can be easily used instead.This work focuses on the implementation of a Smart Predictive Digital Twin (SPDT) to reduce the cost of pump scheduling operations. The proposed system operates in real-time and is structured as a multiservice architecture. Each service is responsible for a specific aspect of the overall system (e.g., forecasting of water demands, tariffs forecasting). The services work independently, but collaboratively to achieve a common goal. Each service encompasses machine learning techniques, resulting in different data outputs, such as energy costs, water demand forecasts, and WSS hydraulic state predictions. The SPDT's operation is improved by incorporating this data in the decision-making process.The use of multiple non-exact data sources alongside machine learning methodologies creates error/uncertainty that is spread throughout the developed system. To address this issue a global orchestration module is introduced. This module monitors and manages all streams of data, ensuring the reliability of each service and overall system. The main contributions of this work are the development of a SPDT capable of efficient pump scheduling operations, and the implementation of a novel real-time orchestrator to correct module uncertainties/errors, consequently improving system decisions. This work also evaluates how the performance of each service affects the overall system.

Keywords: *Digital Twins; Dynamic Orchestration; Forecasting; Machine Learning; Water Supply Systems; Model Predictive Control; Multiservice Frameworks.*

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Coupling tool to assist mould design and engineering during hybrid fabrication

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Abstract. The injection moulding (IM) process is one of the most widespread and economical methods used to produce high-quality plastic parts. In recent years the growing demand on geometric/functional, and even aesthetics part constrains have introduced additive manufacturing (AM) as a solution to produce new and enhanced temperature control strategies in injection moulds (Sachs et al. 2000; Armillotta, Baraggi, and Fasoli 2014; Feng, Kamat, and Pei 2021). Nevertheless, the design of an effective TCS is challenging, and project rules to comply with part specifications, without compromising the tool durability are required (Torres-Alba et al. 2020; Kanbur, Suping, and Duan 2020). This PhD work program has been designed to tackle the above highlighted issues through the development of an automated tool to assist the design of enhanced temperature control strategies. To accomplish this goal, first a parametric analysis was envisaged to understand the relative influence of parameters such as channel location and geometry, and flow conditions, on the heat extraction rate, which will enable to establish the proper foundations towards the development of an automatic strategy for TCS design. For this purpose, a HDPE food container was selected to be produced by IM and, to assess part quality and determine the impact of the parameters under analysis on the dimensional tolerances imposed. The IM HDPE part study was carried out using Autodesk Moldflow Insight software via a Finite Element Method (FEM) transient in cycle analysis, where different channel parameters, namely, channel position (pitch, distance between channel centreline and mould wall) and channel cross section, were evaluated. The results have shown that both channel position and channel cross section affect the heat extraction rate, which inevitably influences the temperature distribution on the plastic part, therefore affecting the final quality of the part. Moreover, it was concluded that lower pitch values, when compared to the distance between channel centreline and mould wall, result on a more uniform heat flux, therefore, reaching more uniform temperature distribution, and consequently, better part quality. Concerning channel cross section it was concluded that rectangular geometries render better part quality and lower cycle times, due to a constant distance between channel and core/cavity. With this parametric study, and with the conclusions withdrawn, it became necessary to ascertain the validity of this scenario concerning the tool structural integrity prediction. The latter will be accomplished by resorting to Ansys Mechanical, with experimentally calibrated data.

Keywords: *Injection moulding; Temperature Control System; Channel Parameters; Parametric Analysis*

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Failure analysis of thin-wall structure fabricated via Laser Metal Deposition

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Abstract. Laser metal deposition (LMD) is one of the most widely used additive manufacturing techniques, which uses a laser beam to fuse and melt powder onto the substrate(Filippov et al., 2021). In this process, the laser beam is directed to powdered material which is deposited on the surface and create solid layer(Gibson et al., 2015). The process is repeated layer by layer to build the structure(Era, Liu, 2021). LMD is a useful technique to modify existing parts or repairing them, producing large scale parts, creating prototype and fabricating Functionally-graded structure. The process provides several advantages such as fabricating complex geometries(Fortuna et al., 2018) with internal features due to having design flexibility, reduced material waste, faster production compared to the traditional manufacturing process. Given these advantages, this method has motivated the industries such as aerospace, automotive, medical devices fabrication(Liu et al., 2022). Similar to other manufacturing process, LMD can have failure caused by different factors. In the current research, the factors contributing to the failure are given and elaborated. Poor adhesion occurs when the surface is not well-prepared or powder is not melting sufficiently which can be prevented by proper cleaning of substrate, adjusting laser setting and processing parameters (Wu et al., 2017). Warping or waviness occurs when the heat or nozzles are not controlled during the process particularly on the last layers which can be addressed setting proper working distance between the nozzle and surface(Demir, 2018). Porosity is one of the most frequently occurring phenomena in powder-based LMD due to insufficient powder fusion on the melt pool or shielding gas. Another problem that occurs with LMD parts is cracking when the part is subjected to thermal stress, which can be caused by a huge thermal gradient between the layers and substrates.

Keywords: *Additive Manufacturing, Laser Metal Deposition, failure analysis,*

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Investigation of mechanical properties through Finite Element Method analysis of laser welding 3rd generation Dual Phase steels

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Abstract. Laser welding is a widely used joining process mainly in applications regarding medical and aerospace. Currently this process is being studied to be used in automotive industry as a substitute of Resistance Spot Welding, since laser welding is more versatile and is a non-contact process, among other advantages. Still regarding automotive industry, Advanced High Strength Steels have been proved to be a great asset introducing the weight of the vehicle without having impact in mechanical properties. The aim of this work is to present a review about the main types of AHSS and types of lasers that were studied by FEM analysis, which mechanical properties are more relevant, and future approaches by integrating data in machine learning algorithms.Keywords: Laser welding, AHSS, FEM analysis, Mechanical properties

Keywords: *Laser welding, Dual Phase Steels 3rd Generation, FEM analysis, Abaqus, Nd:YAG*

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PCM 3D printing encapsulation – Development and optimization of PCM macroencapsulation processes and systems

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Abstract. During recent years, the research and studies focusing on Phase Change Materials (PCM) have been increased significantly due to their impact on the energy efficiency of multiple thermal systems (Nicotra et al., 2018). However, analysing recent and previous research studies about the use and application of PCM, a lack of solutions to incorporate these materials into real world applications is identifiable (Silva et al., 2016). Most of the studies that use pure PCM incorporate them into macrocapsules constructed with manual methods, culminating in unreliable and defective systems. These methods are not ergonomic or adaptative, and also have limitations on the filling process being repetitive and troublesome, which is worsened in large-scale scenarios (Moreira et al., 2023). In addition, this makes not only the scientific data gathered unreliable, but also makes consumer market penetration low, as producing these macrocapsules is not economically viable.

Recent advancements in the additive manufacturing industry show promise in creating possible solutions to overcome PCM encapsulation problems. There have been already developments in this field where researchers tried to make 3D printed capsules viable to hold PCM, as in Pandis et al. (Pandis et al., 2019) and even 3D printing PCM directly, regarding the work of Yang et al. (Yang et al., 2021).

This work presents the development of a novel framework for the macroencapsulation of PCM with the assistance of additive manufacturing. The aim of this work is to develop both systems and processes that allow users to repeatably and efficiently produce a certain design of macroencapsulated PCM, according to the required specifications.

The development and optimization of the PCM macroencapsulation processes and systems are supported by an experimental campaign and numerical approaches. Exploratory results about the use and reliability of the PCM macroencapsulation was attended from experimental trials, in this case using an organic PCM (Chrodatherm53) in PETG capsules.

Keywords: *PCM; 3D Printing; Macroencapsulation;*

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Smart tags based on polylactic acid/ lanthanide-based metal-organic framework composites

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Abstract. In recent years, the open-sourced nature of the 3D printing process and reduced costs when compared to traditional manufacturing, contributed to a significant rise of additive manufacturing at the industrial scale. However, this freedom to create new products or recreate others gave rise to an increased demand for producers and users to verify the authenticity and quality of purchased parts. This is even more important in the case of polymeric products since nowadays a 3D printer is readily accessible for all segments of population. To this end, we purpose an anti-counterfeiting method based on a quick-response (QR) code, using luminescent lanthanide metal-organic framework (LnMOF) composites. The goal is for the smart tag to be embedded in the product, and to only be traceable by a very specific sequence previously programmed accordingly on the production process. For that purpose, three different composites were prepared with the incorporation of LnMOFs of europium (EuMOF), terbium (TbMOF) and codoped (Eu,TbMOF), on a biodegradable polymer matrix of polylactic acid (PLA). The samples were fully characterized, with their chemical, structural, and morphological properties assessed by different techniques, such as Fourier Transform Infrared Spectroscopy (FTIR); X-ray diffraction (XRD); and Scanning Electron Microscopy (SEM). Additionally, the optical properties were assessed by room temperature photoluminescence (RT-PL) and photoluminescence excitation (PLE), to determine the effect of the filler's concentration in the PLAmatrix . The results revealed that a homogeneous mixture of all the components was obtained, with no relevant structural modifications of the polymer and an excellent response to selective excitation, with well-defined intraionic lines for TbMOF @ 542nm (5D4→7F5) and for EuMOF @ 615nm (5D0→7F2). Hybrid composites of both fillers were also explored to create an additional encryption, obtaining different colored emissions by variation of the excitation stimuli (ranging from 280 nm to 394 nm). (Simões et al., 2023) Hence, these new luminescent composite materials can be used as optical smart tags for a wide variety of polymeric products able to be traceable by smartphone with near-impossible replication.

Keywords: *Polylactic acid; Lanthanide metal-organic frameworks hybrids; Luminescent polymeric composites; 3D printing; Anti-counterfeiting*

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Degradation models and edge computing for predictive maintenance

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Abstract. Industrial parts and tools undergo continuous degradation processes that inevitably lead to their replacement or repair. Predicting the failure of these parts is of utmost importance for companies, since replacing a worn part before it fails critically can mitigate the degradation of other components whose performance depends on these parts. Proactive actions are often taken in equally spaced intervals of time, which may be a good practice when parts always work under the same conditions, since in these cases, the wear depends mainly on working time. However, in several scenarios, tools work under different conditions. One of these cases is the degradation process of injection molds. These tools may have multiple cavities, allowing them to produce plastic parts with different geometries, and with different materials, which means that setting parameters such as pressures, temperatures and cycle time are usually different for producing distinct parts, meaning that the working of these tools until critical failure has a wide variation. Furthermore, each injection mold may be mounted in different injection molding machines, making degradation monitoring more challenging.Exploiting built-in sensor data to assess the health condition of tools through analytics techniques has been a common approach since the emergence of predictive maintenance (PdM). However, the adoption of these techniques in an industrial environment is not as exploited as would be expected. The main reasons are the fact that often PdM models are machine/deep learning based, which are seen as "black boxes"by maintenance practitioners, hindering their adoption (Lee et al., 2020). Additionally, PdM needs end-to-end architectures to allow monitoring and analytics to be adopted effectively. Furthermore, in a constantly adapting industry, the architectures to deploy these features must be highly flexible and customizable (Cerquitelli et al., 2019). This work presents an industrial use case at OLI, which is a Portuguese company that produces parts by the injection molding process and reports a modular architecture for PdM on injection molds, that exploits the computational capabilities of smart edge devices to deploy containerized services near the shop floor. The results show that the predictive model exploited, the generalized fault trees, contribute to the acceptance of PdM by the maintenance teams, since it has an easily interpretable graphical representation. Furthermore, the network burden is reduced by 97% when using data preprocessing and sensor selection distributed on edge devices.

Keywords: *degradation models; edge computing; predictive maintenance; injection molding process*

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Current summary air to water 2nd year DBI

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Abstract. Around 2 billion people worldwide do not have access to clean water. Although more than two-thirds of the earth is covered with water (Grönwall et. al 2020). In China, up to 80 % of groundwater is heavily contaminated and can no longer be used as direct drinking water (Zhou et. al., 2014). The earth's water reserves consist of over 96 % salt water, with only less than 0.4 % being directly usable as drinking water (Gorjian et. al.,2015). One square kilometer of air contains between 10.000 m³ and 30.000 m³ of water, depending on local conditions (Bar, 2004). This includes a large potential to extract water from the air even in areas with low rainfall. The status report provides an overview of the steps taken and shows the challenges and innovations in the technology development process. At the beginning of the thesis in 2021, the technologies for water extraction were analyzed and divided into three main groups the direct water harvesting, humidity harvesting and byproduct water harvesting. A created technology analysis led to a focus on one of the most suitable principals to extract water from the air. To obtain a clear target, the search radius for companies and technologies was also greatly reduced within 2022 and 2023. This leads to change from a quantity of 30 technologies to a qualitative perspective. The water extraction by using air humidity and the comparison to five available marketable products will now since 2023 be considered in more detail. One of the next big steps is to build a test installation and evaluate the results starting by July 2023. Historical weather data from 2021 till now, ground analysis and technical developments were carried out to implement test setup. For the test setup, the approach of the simplest and most cost-optimized solution was again implemented. Within the development steps in 2022 the complexity and the costs of the system were reduced. In a first cost estimate, the material costs could be halved by reducing and simplifying 4 main system parts with the same output of drinking water extracted by condensation from the air. Defined within the working process in 2023 for the complete system of water production was a maximum cost block of about 500 € at a production rate of 10 liter drinking water per day under optimal climatic conditions. The climate zones in Southern Europe and North Africa and South America are considered more closely.

Keywords: *water extraction; sorbent material; coolant circuit; simple innovation; air humidity; fog; drinking water; dew water*

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Characterization and functional properties of carbon nanotube reinforced thermoplastic via fused filament fabrication

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Abstract. The surging field of polymer bonded carbon nanotubes (CNTs) has provided promising opportunities for transferring inherent properties of CNTs into macroscopic applications in composite materials [1], electric drive technology [2], and thermal insulator [3], etc.

The aim of the present work was to study physical properties including mechanical, thermal and morphological properties of multiwall carbon nanotube reinforced polylactic acid composites (MWCNT/PLA) manufactured by fused filament fabrication with varying process conditions and CNT concentration. CNTs were first compounded with PLA and extruded into feedstock filaments at different CNT loadings. The properties of the home-made MWCNT/PLA filaments were first evaluated by means of morphological, thermal and mechanical investigations. Then, the effects of CNT concentration (0.5 wt.%, 0.75 wt.%, and 1.0 wt.%) as well as infill density (60 %, 80 %, and 100 %) on mechanical properties including tensile strength, elastic modulus and elongation at break of 3D printed composites were carefully analyzed by tensile testing. Besides, in order to further improve mechanical properties, especially plastic properties of MWCNT/PLA composites, Polyethylene glycol (PEG) at 5 wt% was used as a plasticizer mixing with MWCNT/PLA. The deformation processes and failure mechanisms of laminated composites were analyzed in association with morphological evolution. Besides, a FEM model was developed considering the percentage of infill to predict the modulus of elasticity of FFF parts with low computation time but promising accurate results.

The results showed that the rigidity of 3D printed PLA/CNT composites were significantly reinforced without losing ductility with limited introduction of CNT. Compared to PLA specimens (100% infill density), 3D printed CNT/PLA composites presented an increase in tensile strength, elastic modulus and elongation at break up to 27 %, 53 % and 8 % in the corresponding optimal condition, respectively. In addition, it was found that lower infill density induced lower tensile properties of 3D printed specimens. Composites with infill density of 60 % presented the lowest tensile strength and elastic modulus. Furthermore, with the introduction of plasticizer, elongation at break of MWCNT/PLA composites were significantly improved. Finally, the simplified FEM model presented in this work allows to predict 3D printed parts using some practical assumptions, but keeping accurate results.

Keywords: *Thermoplastic; Additive manufacturing; Mechanical properties; Carbon nanotube; Microstructure; simulation*

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Ranking heterogeneous mechanical tests for the characterization of sheet metal behavior

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Abstract. Sheet metal forming processes are widely used for the manufacturing of critical parts in several industries. With the development of new forming techniques and materials, the cost, material, and time wasted on trial-and-error experiments have increased significantly. The solution lies in reproducing virtually the forming process to replace the need for experimental tests. This requires accurate finite element models that are able to reproduce complex material behaviors.The characterization of sheet metal behavior requires the calibration of material models, which uses information on material behavior provided by mechanical experiments. The most recent mechanical testing approaches propose the use of optimized test geometries that are designed to improve the accuracy and cost-effectiveness of model calibration procedures. These are known for presenting complex boundary conditions or geometries and, as a result, providing a wide range of mechanical phenomena in a single experiment (Souto et al., 2015).Several test configurations have been proposed. Each one was created using a different strategy, such as intuition or an optimization approach, and addressing a different need. As a result, selecting the most suitable test design to characterize a given material's behavior remains challenging (Oliveira et al., 2021).This work addresses this gap and suggests the use of Key Performance Indicators for ranking mechanical tests based on their potential to improve the material behavior characterization task. The diversity of mechanical phenomena presented by each test as well as the potential to characterize the plastic anisotropic behavior have been evaluated quantitatively. Three heterogeneous mechanical tests, obtained from distinct design approaches (Rossi et al., 2016; Jones et al., 2018; Gonçalves et al., 2022), were chosen to be analyzed and compared using the KPIs, leading to an overall performance ranking.

Keywords: *Heterogeneous test, Material behavior, Test ranking, Material testing 2.0*

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Designing for Sustainability and Safety in Urban Micro-mobility: A Novel Helmet Concept

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Abstract. Urban mobility has experienced significant growth in recent years, driven by the proliferation of e-scooters and e-bikes as well as the emergence of sharing services for micromobility. However, this rapid expansion has also resulted in a concerning rise of severe accidents, which can be explained by the failure of governments to keep pace with evolving mobility trends, as well as the incompatibility of traditional bicycle helmets with the spontaneous nature of these new modes of transport (Serra et al., 2021) . Moreover, in times of resource scarcity and global warming aggravation, where sustainable development is a crucial factor in today's economy, helmets perform very low in terms of sustainability. Not only because they are mainly made of petrol derived materials, – but also because the protective foam and the outer shell assembly results from a bonding process that hinders their recycling or repurposing when discarded.

Literature suggests that cork has significant potential to replace synthetic foams for crashworthiness applications (Fernandes et al., 2015; Varela et al., 2020). Therefore, in this study, various dynamic impact tests have been carried out on hybrid composites containing cork and other novel materials capable of absorbing energy, such as polyvinyl chloride (PVC) and polyurethane (PU) containing shear thickening fluid (STF) in their composition, fabric impregnated with STF, and the fluid itself in bulk used in between layers. The aim is to establish the most effective combinations of materials that can replace the conventional ones used by the helmet industry. Additionally, the materials have been numerically modelled and validated, making it possible to simulate the shock absorption tests by the European standard for bicycle helmets. These finite element analyses (FEA) made determining important features, such as the necessary materials' thickness possible. Afterwards, a design concept was developed and a physical prototype manufactured, which was tested for impacts in a certified lab, having it passed all criteria.

The resulting helmet is aesthetically and functionally innovative and also sustainable, with a 42% lower carbon footprint than standard helmets. It can be compressed to the size of a 15"laptop and stored conveniently in a backpack or bag. It is also characterized by an excellent performance in multiple impact scenarios. Moreover, its multi-layered structure allows it to be disassembled and have its parts recycled when discarded, therefore representing a significant step forward in helmet design and manufacturing toward achieving the sustainable development goals set forth by the United Nations for 2030.

Keywords: *Micromobility; Sustainability; Cork; Helmet; Head safety; Crashworthiness; Numerical Simulation*

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Inverse identification of plastic constitutive models using the Arcan test and a virtual experiment

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Abstract. Computer-aided engineering systems are a powerful tool used in modern industry to optimize costs and time consumption in the design of new products. Nowadays, in metal forming technology, the development of sheet metal parts tends to be more virtual through the use of numerical simulation. Sheet metal forming processes typically involve large deformations and complex phenomena. As a result, modelling the behaviour of the materials during forming requires complex constitutive models and high accuracy in their calibration to produce a realistic simulation of the forming processes. During the last decades, a huge effort was made by the scientific community to develop precise constitutive model formulations in elastoplasticity, including complex yield functions (Barlat et al., 2005), and isotropic and kinematic hardening models (Vegter et al., 2011). However, due to the increased flexibility of the mathematical formulation and the consequent increase in the number of constitutive parameters that must be calibrated, the identification of the parameters of such models involves a complex calibration procedure. Classically, the calibration was done using standard homogeneous tests, where each test represents a single stress/strain state. As a result, an extensive experimental campaign is usually required to fully characterise the material behaviour. Nowadays, with the use of heterogeneous test configurations and full-field measurements, it is possible to measure a combination of multiple stress/strain states. This rich kinematic data can be used in inverse identification techniques, such as the virtual fields method (Pierron ; Grédiac, 2012), to identify multiple parameters from a single test with reduced cost and time (Henriques et al., 2022). Moreover, the richness of the measured kinematic data is highly dependent on the test configuration used, and while the Arcan test has been used in sheet metal plasticity by some authors, it is rarely used in heterogeneous test design for plastic constitutive model calibration. Nonetheless, the Arcan test is an interesting test configuration since it allows the loading direction to be varied in a standard uniaxial tensile testing machine. This study presents a numerical evaluation of the Arcan mechanical test to identify plasticity constitutive parameters of a dual-phase steel (DP600). The numerical model used considers the anisotropy and hardening of the material. Several Arcan test configurations are simulated and further evaluated regarding their mechanical state heterogeneity using a set of indicators. This approach presents a methodology for selecting the most suitable configuration.

Keywords: *Sheet metal forming, Inverse identification, Arcan test, Heterogeneous test, Virtual experiment*

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Implicit constitutive modelling using RNNs and the Virtual Fields Method

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Abstract. Constitutive models describe the relationship between stress and strain for a given material. Under plasticity, the material behaviour is highly non-linear and depends on the loading history. It is critical to accurately model this path-dependency in order to predict the material response under different loading conditions. Artificial Neural Networks (ANNs) can implicitly learn constitutive relations directly from data, without assuming a mathematical formulation. Particularly, Recurrent Neural Networks (RNNs) can model temporal data by maintaining an internal memory of past inputs. As such, RNNs have been shown to be effective in capturing the effects of loading history for materials that exhibit path-dependent behaviour.
Implicit constitutive modelling approaches in the literature rely on training ANNs with paired data, usually stress-strain, from numerically generated datasets. Nevertheless, in a real experiment, variables such as stresses are not measurable and the training should be carried out indirectly, using experimentally measurable variables only. Although, in theory, any ANN could be able to learn the constitutive behaviour of a material, given enough data, it usually works as a black-box model, because its structure is not easily interpretable. Moreover, there is no guarantee that its predictions are usable, as they can violate fundamental laws of mechanics and thermodynamics. Thus, it is necessary to enforce physics-based constraints when using ANNs for implicit constitutive modelling. Physics-based constraints act as a regularization agent for ANNs, reducing the space of admissible solutions and allowing the network to learn with smaller datasets, as it already does not have to learn those relationships from data. These constraints can be enforced using custom ANN architectures, model constraints (e.g., weight constraints) or penalty/regularization terms.
In the present work, an RNN-based material model is trained using a novel indirect approach, where the local and global equilibrium conditions are ensured employing the Virtual Fields Method (VFM). Physical constraints are analysed and applied during the training process.

Keywords: *constitutive model, elastoplasticity, recurrent neural networks, indirect training, constrained optimization*

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Material model selection strategy for forming processes

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Abstract. Nowadays, industries rely heavily on digitalisation and virtualisation to ensure their products meet high standards of quality and have efficient production and economic success. The use of numerical simulation tools has become crucial in product development and manufacturing. However, in order to achieve a realistic simulation, it is necessary to choose an appropriate constitutive model and accurately identify the underlying material parameters. Concerning constitutive models, in the last decades, there have been proposed several models to describe different mechanical phenomena. Nevertheless, the selection of an appropriate material constitutive model is a complex task that demands expertise. In the absence of proper knowledge, the numerical predictions may be inaccurate, leading to costly and time-consuming manufacturing delays. These days, the main approach by the scientific community and industry to select material models is brute force. This methodology starts with several mechanical experiments for the identification of different models' parameters, goes through the accurate calibration of the latter and finishes with the simulation and validation of the mechanical process investigated. To mitigate these issues, an automatic tool that recommends material constitutive models is essential.
In this study, the aim is to develop a systematic and rational tool for model selection comprising three steps: the analysis of variance (ANOVA) (Conde, 2023), the identifiability study and the identification quality analysis. The first step establishes a type of constitutive model ranking based on a statistical analysis of the forming process simulation. The second step uses the strain derivatives with respect to the material parameters to exclude some constitutive models that are expected to be complicated to calibrate. The third step uses the final cost-function value of an inverse identification scheme to find a comparison between the different models and select or recommend them.

Keywords: *Constitutive model selection, Analysis of variance (ANOVA), Identifiability, Parameter identification, Metal forming processes*

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Advances in integrated driving safety-volatility-emissions indicator for highways

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Abstract. Abstract
Proper characterization and understanding of driving behavior can contribute to improved road safety and thus decrease the risk of crashes and associated environmental issues. Drivers need to be aware of how much they are contributing to road traffic emissions through an assessment of their driving style. Driving behavior can be characterized through volatility which studies in more detail the acceleration/braking components, vehicular jerk (first derivative of acceleration), lane changing, and also unusually high speeds for the road conditions (Wang et al., 2015). There are several studies that analyze volatility, moreover, some focus on analyzing driver volatility incorporating emissions (Ferreira et al., 2022). However, no study has an integrated indicator of safety, volatility, and driving with emissions. Therefore, in this work, the construction of an integrated indicator that assesses highway driving behavior is presented.
The indicator evaluates safety through time-headway and stopping distance variables, volatility through acceleration and vehicular jerk variables, and emissions through Vehicle Specific Power (VSP) mode. To do this, the proposed indicator was built through a linear optimization problem with linear constraints and also lower bounds and then solved in MATLAB software. To validate the developed application the microscopic traffic model VISSIM with a COM API interface was used. The model was calibrated from test vehicles in experimental campaigns on three highways: A25, A29, and A1 collecting essential information: traffic data, tailpipe emissions, and also the dynamics of each vehicle. For each variable used to define safety and volatility, and also for the VSP mode, the percentage failure was calculated for each trip. The failures were defined using thresholds from the literature review (Choi ; Kim, 2017; Deligianni et al., 2017; Kilinç ; Baybura, 2012; Kovaceva et al., 2020; Reinmueller et al., 2020; Rolim et al., 2014). After that, the score for each trip was computed and the driving behavior was rated.
The results indicated that 29%, 19%, 13%, and 39% of the drivers were classified as calm, normal, aggressive, and very aggressive, respectively.
Keywords: Integrated driving indicator; Safety; Volatility; VSP mode; highways

Keywords: *Integrated driving indicator; Safety; Volatility; VSP mode; highways*

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Reuse of residues from the SLS process using the use of alternative production technologies

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Abstract. One of the most used materials in Selective Laser Sintering (SLS) is Polyamide 12 (PA12). In the SLS process, 80 to 90% of the powder present in the construction chamber is not being sintered (Alo et al., 2022). However, during the heating process, this polymer suffers from thermal degradation, which restrains the number of times that the used material but not sintered can be reused again. The laser sintering market value is growing, exhibiting a CAGR (Compound Annual Growth Rate) of 22.13% (TheExpressWire, 2022) and with this growth, more PA12 waste goes to the landfill.
This study aims to evaluate an alternative production technology to reuse the PA12 after its use in SLS process (the PA12 which cannot be reprocessed again). The evaluation included the use of PA12 in the Fused Deposition Modeling (FDM) process and Thermoplastic Injection Moulding (TIM).
In order to achieve this objective a state-of-the-art analysis was made on polymers, PA12, the processes used in its recycling, its mechanical and thermal properties and the FDM and TIM processes. With this review it was possible to reach conclusions such as the reuse of the powder the melting temperature increases and the fluidity index decreases (Stiller et al., 2022), a correlation between the fluidity index and the superficial quality of the pieces(Duddleston, n.d.) and while achieving good superficial quality may not be feasible, it is anticipated that the mechanical properties will not experience a significant decline(Feng et al., 2019).
The experimental process will start soon with a differential scanning calorimetry (DSC) and a flow index test (MFI) to obtain the thermal and rheological properties of the PA12 waste supplied by CENTIMFE. Once all the properties are known, the processing conditions for FDM and TIM can be determined.
With the specimens formed, it is possible to start to perform mechanical tests, such as tensile tests, with which it will be possible to measure properties such as maximum stress, yield stress and tensile strength.
In future works, and if the results allow, it would be interesting to study the properties when reprocessed for the same FDM and TIM processes.

Keywords: *nan*

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Comparative study of heterogeneous tests for material parameter identification of copper alloy sheet

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Abstract. In order to decrease associated delays and costs, mechanical design of parts tends to be nowadays more virtual, by using numerical simulation. Therefore, the characterization of materials has received increased attention due to the need of precise input data to computational analysis software. The material mechanical behavior is numerically described through constitutive equations and material parameters. The identification of material parameters can be classically achieved using homogeneous strain field data obtained from standard mechanical tests (Souto et al. 2015). This approach assumes that the strain field is homogeneous along the gauge part of the samples, which is quite restrictive. Moreover, from a single classical test it is difficult to extract a considerable number of parameters, requiring that several tests are performed in order to identify a great number of parameters of a single constitutive model.
More recently, research has focused on alternative identification methods based on heterogeneous strain fields, measured using full-field experimental techniques (Prates et al. 2016). The accuracy of this alternative method depends on three main issues: (i) shape of the specimen to be used, (ii) choice of an appropriate technique of measurement of the strain field and (iii) definition of an identification strategy. These techniques allow the extraction of more information on from the strain fields developed in the sample, where ideally the use of a single test might be able to characterize the material behavior. However, the selection of a sample that demonstrates a rich strain field – both in kind and amount of information – is still a topic under research. Additionally, the use of full-field measurement techniques requires the use of inverse methodologies in order to determine the material properties of a specific constitutive model. Depending on the inverse methodology used, the identification procedure consists on minimising the gap between the experimental and numerical data by means of an objective function (e.g. FEMU).
Regarding the heterogeneous tests, these can be, for example, biaxial, shear or tensile tests. The shape of the specimen can include thickness-reduced zones, slots, perforated zones or even complex shapes, such as s-shaped or butterfly-shape specimens. For this purpose, the main focus of this work consists on discussing the most relevant heterogeneous tests previously used and to numerically compare their application for copper alloy sheet samples.

Keywords: *Material parameter identification, Heterogeneous test, Numerical simulation, Copper alloy sheet.*

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Multimedia in Education

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A digital game-based intervention model proposal for mental health promotion in young adults.

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Abstract. This Research Project integrates the convergence between three areas – Multimedia, Psychology, and Education – and proposes conceptualizing, developing, implementing, and evaluating an intervention based on a digital game to promote mental health in young adults. It is intended to achieve an Intervention Model – a set of recommendations for designing, developing, implementing, and assessing digital game-based interventions to promote mental health – that enable to answer the research question: "What features should a digital game-based intervention have to promote mental health in young adults?".

The digital game-based intervention is a psycho-educative entertainment resource that seeks to promote mental health, enabling the exploration of internal processes and mechanisms, supported by the empirically validated strategies of cognitive-behavioral therapy (CBT) [1,2]. CBT is the basis for the most effective digital game-based interventions in mental health [3,4].

The Research Project focuses on three Sustainable Development Goals (SDG) from the United Nations: health and well-being (SDG-3), quality education (SDG-4), and reducing inequalities (SDG-10). It addresses the concerns of the Portuguese National Health Council [5], the opinion of Portuguese young adults [6], and their clinical needs [7,8], attending to the recommendations of the World Health Organization [9,10].

Based on the socio-critical paradigm, mixed nature and methodology, and systemic data integration [11], the Research Project encompasses three phases (F) and two studies (S) supported by Educational Design Research [12,13].

In the Conceptualization Phase (F1), the theoretical and practical framework of the Research Project is developed, and the Digital Game is conceptualized.

In the Development Phase (F2), the Digital Game (DG) is created, improved, and tested through progressive prototypes with different levels of fidelity (P1, P2, and P3) until the final product (DG) is obtained. An iterative process is developed through a case study (S1) with mixed methodology integrated into a linear model, interweaving qualitative data – collected by three focus group sessions with expert consultants – with quantitative data – two testing phases with young adults.

In the Evaluation Phase (F3), the Digital Game is implemented in the population through a quasi-experimental, cross-sectional, longitudinal study (S2) to validate the effectiveness of the psychological intervention and the product's (DG) usability.

The Intervention Model – a set of recommendations for designing, developing, implementing, and evaluating digital games to promote mental health in young adults – is the main expected result from the proposed Research Project. The Intervention Model is expected to contribute to several fields in scientific research, digital game development, and clinical and educative practices.

Keywords: *Mental health; Intervention model; Digital game; Young adults*

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Laboratórios de Aprendizagem Ativa: Espaços que contribuem para a motivação dos alunos

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Abstract. Laboratórios de Aprendizagem Ativa: Espaços que contribuem para a motivação dos alunos Palavras-Chave: Espaços Ativos de Aprendizagem, Laboratórios de Aprendizagem Ativa, Motivação, Autorregulação Os espaços de aprendizagem estão em constante alteração. Com a pandemia e, consequentemente, o pós-pandemia, dá-se um impulso na utilização e proliferação dos espaços de aprendizagem ativa (ALS). Através do Plano de Recuperação e Resiliência (PRR) surgem, agora, em contexto do Ensino Básico e Secundário, os Laboratórios Educativos Digitais (LED), face à necessidade de reconfiguração do espaço educativo, facilitando diferentes dinâmicas de relacionamento entre professores e alunos, motivando e estimulando a aprendizagem. Com a difusão destes espaços, torna-se essencial perceber se os mesmos contribuem, efetivamente, para a motivação e envolvimento dos alunos na sua própria aprendizagem, procurando-se, assim, respostas para as questões investigativas: - De que forma estes espaços influenciam a motivação e o envolvimento dos alunos no processo de aprendizagem? E que tipo de estratégias e atividades de aprendizagem ativa são mais eficazes para motivar e envolver os alunos na aprendizagem? O estudo tem por base a criação e dinamização de uma sala, a qual se vai denominar Laboratório de Aprendizagens Ativas (LAA). Esta sala faz o aproveitamento dos recursos existentes numa escola Básica da região de Aveiro, conjuntamente com os provenientes do programa LED e é feita a análise de doze turmas do terceiro ciclo do ensino básico. Para a concretização dos objetivos propostos, desenvolve-se uma investigação enquadrada no paradigma sociocrítico, com duas fases de intervenção, envolvendo todos (investigadores e investigados). Adota-se uma abordagem metodológica de investigação/ação. A natureza do estudo é mista, os dados qualitativos e quantitativos são recolhidos e analisados em paralelo, de modo a permitir uma compreensão generalizada do problema. Perspetiva-se que este estudo permita verificar que tanto o layout da sala como a tecnologia (software e hardware) a utilizar, têm uma influência direta na motivação dos alunos em torno da aprendizagem. Parte-se, pois, do pressuposto que é essencial uma aposta clara na frequência e dinamização deste tipo de espaços, bem como a alteração do método de ensino, procurando associar, a estes espaços, metodologias de ensino ativas e dinâmicas.

Keywords: *Espaços Ativos de Aprendizagem, Laboratórios de Aprendizagem Ativa, Motivação, Autorregulação*

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Active Methodologies in Flexible Learning Spaces: Proposal of a Model for Teacher Training at the University of Aveiro

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Abstract. This research aims to promote the innovation of pedagogical practices of professors at the University of Aveiro, by encouraging the implementation of active methodologies in the Flexible Learning Space "SALT: Space for Active Learning and Teaching", at the Department of Education and Psychology of this University. In this sense, the study's general objective is to develop, implement, and evaluate a training model for Higher Education faculty that promotes the critical and reflective adoption of active methodologies in technology-enriched spaces, such as SALT. For this, in the first stage of the investigation, we sought to identify and systematize the formative principles that should guide this model, based on a study using the Delphi method (Landeta, 2006). Thirteen experts from different Universities in Portugal participated in this study, specialists in the themes of teacher training, innovative learning environments, and active learning methodologies. Through three successive rounds of online surveys, participants were asked to identify the assumptions, themes, training strategies, and technology integration principles that should guide higher education professors' training to work in Flexible Learning Spaces. The collected data was analyzed qualitatively (Content Analysis) and quantitatively (Descriptive Statistics), with support from the MAXQDA Software. The preliminary results provide evidence that such training should dialogue with the structuring characteristics of the Active Teacher Education model (Rodrigues, 2020) and prioritize training focused on active learning and development of 21st-century skills, pedagogical differentiation for inclusion and accessibility, evidence-based pedagogical innovation, training based on Digital-Enhancement for Teaching and Learning (Gaebel et al., 2021), institutional support and validation, peer-to-peer in-service learning, curriculum alignment with an assessment of/as/for learning, experimentation of the space and simulation of active methodologies, and the design and implementation of learning scenarios in Flexible Learning Spaces (Carlos, Reses and Soares, 2023). The second phase of this research is currently in progress and involves raising the perception of the teachers of the University of Aveiro about active learning methodologies, through a questionnaire survey. The results generated through these exploratory studies implemented during phases 1 and 2 will bring subsidies for the development of the third phase of the research, which will result in the planning, implementation and evaluation of the training model in focus, through three cycles of action research (Coutinho et al., 2009).

Keywords: *Teacher Training, Flexible Learning Spaces, Active Learning Methodologies, Higher Education.*

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Curadoria Digital em Comunidades de Práticas enriquecidas digitalmente: construção e validação de modelo

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Abstract. No ensino verifica-se uma crescente aceitação dos Recursos Educativos Abertos (REA). Mas, encontrar o REA mais adequado a um contexto consome tempo e é desafiante, porque muitos repositórios não apresentam mecanismos de monitorização da qualidade. Alavancar os recursos da nuvem exige um curador experiente, exigente e crítico (Sawyer et al., 2020), pelo que urge desenvolver ações que ajudem os professores a assumir esta responsabilidade (Silva et al., 2021).
De acordo com Lave e Wenger (1991) a participação em comunidades de prática permite uma compreensão profunda e significativa dos conceitos e práticas, pelo que apoiar redes profissionais onde se recorre às dinâmicas do grupo para a procura de soluções pode contribuir para uma curadoria bem-sucedida. Assim, a projeção duma comunidade de práticas enriquecida digitalmente (DECoP) (Donaldson, 2020) suportada por uma plataforma especificamente desenvolvida poderá constituir-se como uma mais-valia para a aplicação, validação e eventual adaptação dum modelo de ciclo de vida de curadoria digital. Os modelos DCC (Higgins, 2008), DCC;U (Constantopoulos et al., 2009), d-Kisti (Rhee, 2022) e Rocha (2022) fornecem estruturas para planeamento das atividades de curadoria, bem como listas de verificação para o desenvolvimento e implementação de estratégias de curadoria digital.
Nesta investigação pretende-se responder às questões: "Quais as características de uma intervenção que apoie a curadoria digital numa DECoP de professores de Biologia e Geologia?" e "Qual o impacte dos mecanismos de curadoria digital na construção de uma DECoP de professores de Biologia e Geologia?".
O estudo enquadra-se num paradigma sociocrítico e a metodologia a adotar será a Educational Design Research que decorre em ciclos interativos e iterativos de análise, prototipagem e avaliação. Os principais objetivos são: concetualizar e especificar as características de uma plataforma para suportar o trabalho curatorial da DECoP; desenvolver e aplicar um programa de formação de moderadores em curadoria digital; aplicar, avaliar e validar um modelo de curadoria digital tendo em conta as necessidades contextuais da comunidade; avaliar o impacte das estratégias de curadoria digital no desenvolvimento e construção da DECoP e avaliar o impacte dos princípios de design de DECoP no desenvolvimento e construção da comunidade. Investigadores e professores constituirão uma comunidade de investigação responsável pela especificação e acompanhamento do desenvolvimento da solução tecnológica e pela definição de instrumentos de monitorização. Pretende-se, assim, desenvolver um modelo que permita a construção de uma DECoP, na qual se desenvolvam mecanismos eficazes de curadoria digital e se construa um repositório adaptado a uma comunidade de professores.

Keywords: *Comunidades de práticas; Curadoria digital; Modelo de ciclo de vida; Recursos Educativos Abertos*

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Inteligência Artificial em Educação: Um caminho a percorrer

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Abstract. A Inteligência Artificial está presente na vida quotidiana. Os assistentes pessoais (e.g. Siri), despertam pela manhã e informam sobre as atividades do dia. O telemóvel informa sobre o tempo estimado de viagem e o sistema de navegação do carro, sobre a previsão de trânsito. Ou falando, ou escrevendo, ou simplesmente através de uma imagem recolhida pelos dispositivos tecnológicos, tem-se um conjunto vasto de aplicações digitais que em segundos, dão o feedback pretendido. Atualmente, a utilização de aplicações com inteligência artificial, levanta discussões sobre ética e privacidade, fruto de reflexões em torno das implicações que podem ter na humanidade, levando a UNESCO a publicar "Recomendação sobre a Ética da Inteligência Artificial" (2021), e enfatizando, em março de 2023, a urgência dos países encontrarem uma estrutura de ética global. A UNESCO aconselha, entre outros aspetos, que haja formação de professores e estudantes para uma utilização conscienciosa, critica e criativa de aplicações com inteligência artificial. Uma grande parte das aplicações são de acesso livre, logo, disponíveis para utilização por qualquer cidadão, incluindo alunos (e.g. Walfram Alpha, Photomath, ChatGPT). Coloca-se, então, o professor no seio de um dilema: limitar ou incorporar aplicações com IA no desenvolvimento do ensino e da aprendizagem? Quais os benefícios? Quais os riscos?

No âmbito do estudo a desenvolver, pretendemos organizar e dinamizar uma formação que leve os professores do ensino básico e secundário, a encontrar estratégias de introdução de aplicações com Inteligência Artificial em atividades de ensino e aprendizagem, de forma segura, informada e vantajosa. Assim, na base estará a reflexão sobre questões éticas e de privacidade subjacentes à utilização de aplicações com Inteligência Artificial, levando os professores a adotarem uma postura ética e responsável na adoção das aplicações e a desenvolverem nos alunos competências que os capacitem para um futuro no qual a inteligência artificial e a humana poderão estar ainda mais próximas. Ao longo da investigação, adotando um paradigma sociocrítico e uma metodologia de investigação-ação, será feito um estudo sobre os impactos que a adoção dessas aplicações têm no desenvolvimento do pensamento crítico e criativo dos alunos, bem como no desenvolvimento de uma consciência cívica na relação que se estabelece com o digital. Espera-se que, no final da formação, as conclusões permitam recolher evidências que ajudem os professores a encontrar caminhos para o desenvolvimento de processos de ensino e aprendizagem com aplicações com IA, bem como, estratégias para o fazerem de forma segura e ética.

Keywords: *Inteligência artificial, Formação de professores, Ética, Privacidade, Ensino, Aprendizagem*

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Comunidades de prática online e a formação para a docência do ensino superior focada no pensamento crítico

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Abstract. Resumo: Este trabalho apresenta a proposta de investigação de tese, relacionando-se ao contexto atual de expansão das Tecnologias da Informação e Comunicação (TIC) na sociedade, que vem trazendo grandes possibilidades para a formação de professores e aprendizagem colaborativa, por meio das comunidades de prática online (Maliza, 2012; Meirinhos, 2006; Vieira, 2018). Atualmente são exigidas diversas competências dos professores, tais como: ser crítico e criativo, gerir situações de aprendizagem, inovar a prática, utilizar novas tecnologias, bem como estar apto para transpor os vários desafios que a sociedade contemporânea impõe (Nóvoa, 2017; Perrenoud, 2000, 2002). A legislação brasileira e as pesquisas internacionais, também, vêm explicitando a relevância e necessidade de se inovar e repensar os modelos e práticas de formação docente de modo a romper com um modelo de formação pautado na transmissão de conteúdo e da racionalidade técnica, bem como, implementar a infusão de capacidades de pensamento crítico por meio das potencialidades das TIC. Além disso, nas experiências acadêmicas em um curso de mestrado, observou-se que algumas práticas de formação pedagógica docente ainda eram incipientes e pautadas em itinerários formativos de caráter linear, sem uma reflexão crítica das possibilidades que as TIC podem proporcionar para viabilizar e potencializar os processos de formação e aprendizagem dos alunos. Diante disso, propõe-se a implementação de atividades/estratégias didáticas, associadas a recursos digitais, em uma comunidade de prática online para a formação docente e promoção do pensamento crítico. Busca-se avaliar a contribuição das atividades/estratégias didáticas, associadas a recursos digitais, desenvolvidas na comunidade de prática online para a formação docente e promoção do pensamento crítico de alunos de um curso de mestrado. Para isso, será utilizada a metodologia de pesquisa do tipo estudo de caso, em uma abordagem qualitativa e estruturada a partir de um paradigma interpretativo. Será utilizada uma plataforma que se considere adequada e ajustada ao contexto em estudo, onde será acoplada a comunidade online e as atividades/estratégias didáticas, associadas a recursos digitais, implementadas para a promoção das capacidades de pensamento crítico dos alunos. Espera-se que essa investigação possa contribuir para uma (re)significação das práticas de formação docente desenvolvidas no âmbito do Programa de mestrado em estudo, bem como, potencializar experiências formativas para o desenvolvimento das capacidades de pensamento crítico dos alunos e auxiliar na formação crítica e reflexiva para o exercício da docência, que responda às necessidades atuais e futuras da sociedade

Keywords: *Comunidade de prática online, Ensino superior, Formação docente, Pensamento crítico, Tecnologias da Informação e Comunicação*

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O contributo de cursos massivos abertos online para o desenvolvimento profissional contínuo de professores do ensino básico e secundário

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Abstract. No sentido de enfrentar os desafios da crescente digitalização na educação, as ações legislativas mais recentes destacam, entre outras, a necessidade de melhorar as competências digitais dos professores, por forma a incorporarem na sua prática profissional e pedagógica tecnologias digitais que contribuam para a melhoria das aprendizagens dos alunos.
Neste contexto, e apesar de maior disponibilização de formação em capacitação digital por parte dos Centros de Formação de Associação de Escolas e de outras entidades formadoras nos últimos dois anos, a oferta formativa continua desfasada das necessidades dos professores e dos contextos em que atuam, nomeadamente no que às modalidades de formação ofertadas diz respeito. Perante a premência em adequar a oferta formativa às novas exigências, sugere-se a abertura a modalidades não tradicionais de formação contínua de professores, em particular, de cursos massivos abertos online. Estes cursos têm recolhido a preferência de um número considerável de professores, embora não esteja devidamente explorado o seu potencial para o desenvolvimento profissional contínuo docente, nem os mesmos sejam reconhecidos, em Portugal Continental, para efeitos de progressão na carreira. Face ao exposto, propõe-se uma investigação de cariz maioritariamente qualitativo, baseada num estudo de caso, em que se acompanha a implementação de um curso massivo aberto online, com o propósito de avaliar o contributo desta modalidade de formação para o desenvolvimento profissional contínuo dos professores e das suas competências digitais. Recorre-se ao inquérito por questionário (inicial e final) e por focus group para a recolha de dados.
Espera-se que os resultados possam contribuir para a clarificação do potencial dos cursos massivos abertos online para o desenvolvimento profissional contínuo dos professores, acrescentando valor à investigação nesta matéria e permitindo definir caminhos de atualização e inovação no que concerne as modalidades de formação contínua de professores.

Keywords: *cursos massivos abertos online, MOOC, desenvolvimento profissional docente, competências digitais, formação contínua de professores*

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A gamificação para o desenvolvimento sustentável - o caso de estudo da app OH!BUG

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Abstract. Nos últimos anos têm surgido ferramentas digitais e interativas que procuram dar resposta às problemáticas climáticas e ambientais que enfrentamos atualmente (Torres-Toukoumidis et al., 2022). As aplicações móveis e jogos têm-se revelado um recurso importante e alternativo no que diz respeito ao desenvolvimento sustentável, promovendo o pensamento crítico sobre o mundo em que vivemos e a participação do cidadão comum na construção de comportamentos e valores pró-ambientais (Ouariachi et al, 2020). Estas aplicações móveis recorrem muitas vezes a métodos e mecanismos de gamificação para motivar e informar o utilizador sobre a temática ambiental (Boncu et al., 2022). O estudo aqui apresentado, pretende analisar e identificar fatores de sucesso e insucesso na implementação de metodologias de gamificação e sistemas de interação em aplicações móveis destinadas ao desenvolvimento sustentável. Este estudo utiliza como objeto de trabalho a aplicação móvel OH!BUG, desenvolvida com o objetivo de promover a literacia ambiental sobre as plantas que nos rodeiam, colocando o utilizador no papel de observador. A aplicação OH!BUG destaca-se pelo seu carácter didático no método de identificação de espécies vegetais e pela adoção de técnicas de jogo. É partindo dos mecanismos e sistemas de interação e gamificação presentes na aplicação OH!BUG que a investigação aqui proposta procura avaliar padrões de utilização num contexto educativo formal e não-formal, com a participação de estudantes do 6º ano do 2º CEB num estudo-piloto. A investigação segue o modelo da metodologia qualitativa designada de grounded theory, prevendo a construção de uma teoria a partir da análise sistemática dos dados obtidos (Fernandes ; Almeida, 2001). O estudo-piloto permitirá a recolha e comparação desses mesmo dados partindo do registo de logs de utilização da aplicação, questionários e o resumo de observação. Este estudo pretende contribuir para o desenvolvimento do conhecimento científico ao nível do impacto que os sistemas de interação e de gamificação podem ter quando integrados em aplicações multimédia que procuram promover o sentido de desenvolvimento sustentável junto de públicos jovens.

Keywords: *Aplicação móvel; Gamificação; Educação; Desenvolvimento Sustentável; Literacia ambiental*

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A criação de jogos digitais como estratégia pedagógica para a melhoria da aprendizagem dos alunos do 1º ciclo

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Abstract. AbstactOne of the emergent challenges in Education is to provide learning environments that are motivating and in which the students find opportunities to build their knowledge and to develop their creativity.Since its appearing in the 70s of the 20st century, video games have been raising continuous interest due to the advances in the new technologies and the digital world. Nowadays, games have a constant and assiduous presence in the life of children and young people, either in computers or mobile devices (Bulut et al., 2022). Due to the intrinsic aspects that video games induce, namely the motivation, engagement, and entertainment, they have been integrated in the educational field.
The potential of video games and digital games has been widely investigated and its benefits in the development of learning skills have been pointed out by several authors (Gee, 2003; Burke ; Kafai, 2014). The Game Design-based Learning approach emerges as a new paradigm in education, by combining the constructivist view of learning, in which the student, instead of being a simple consumer, is placed in the place of creator and producer of their own games, to the integration of curricular contents.
This project intends to investigate the contribution of an active learning strategy on the teaching-learning process of the students. This is projected through an exploratory approach based on the creation of digital games. Additionally, it is intended to understand the perception of the teachers on the entire process. The proposed strategy will be based on a toolkit that supports the process of digital game development and design by students in an autonomous and collaborative way. The final product, i.e., the game, will be designed in the program Scratch. The learning strategy will be applied in classes of the 3rd or 4th grade.
It is expected that this project evidences improvement in learning, the increase on motivation, engagement, curricular and transversal skills of the students, and 21st century skills, linked to new literacies such as digital and media literacy.

Keywords: *game design-based learning, learning, construcionism, educational digital games*

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Criação de podcast para a promoção do engajamento estudantil em instituições de ensino técnico-profissionalizante

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Abstract. Estudantes engajados possuem maiores chances de alcançar sucesso acadêmico e pessoal (Kuh, 2009). As escolas têm como desafio promover o engajamento estudantil, e para isso fazem uso de várias ferramentas pedagógicas. O podcast se apresenta como potencial ferramenta de promoção do engajamento estudantil. Ouvir podcast é uma forma inovadora de consumo de conteúdo didático, mas desenvolver seu próprio podcast transforma o estudante de ouvinte passivo à construtor do seu próprio conhecimento (Kendall, 2014).Criar um podcast apresenta desafios organizacionais e técnicos. Professores e estudantes não são preparados para utilizar esta mídia como ferramenta didática. Para superar este desafio, a presente investigação propõe a construção de um framework de criação de podcasts, focado em seu uso pedagógico como atividade didática em sala de aula de escolas de ensino técnico e profissionalizante, utilizando as teorias de engajamento estudantil e aprendizagem construtivista como pilares pedagógicos.

Design-Based Research (DBR) é a abordagem metodológica escolhida para esta investigação, pois sua estrutura propõe passos cíclicos e iterativos para o desenvolvimento de uma solução a um problema pedagógico. O DBR aplicado a esta investigação seguiu os seguintes passos metodológicos: (a) Análise da literatura para melhor entender o contexto do problema; (b) Professores e estudantes do ensino técnico-profissionalizante definidos como público-alvo da investigação e fazendo parte de todas as fases do processo de desenvolvimento do framework de criação de podcast; (c) Estudo piloto aplicado com o objetivo de coletar informações de como se apresenta o engajamento estudantil em classes de uma instituição de ensino técnico-profissionalizante; (d) Protótipos do framework construídos, testados e refinados utilizando as informações coletadas nas etapas anteriores; (e) A versão completa do framework analisada em 3 turmas do escolas técnicas-profissionalizantes no Brasil e em Portugal; (f) Surveys, entrevistas, análises documentais e diários de bordos utilizados para a coleta de dados junto aos estudantes e professores, e; (f) Dados coletados interpretados e utilizados como feedback de refinamento do framework de criação de podcasts.

Este estudo oferece relevante contribuição pedagógica, pois: adiciona mais uma estratégia para a promoção do engajamento dos estudantes com os conteúdos didáticos, profissionais da educação e instituições de ensino e; identifica como está sendo trabalhado o estímulo ao engajamento estudantil nas salas de aula do ensino-técnico profissionalizante, apresentando uma ferramenta pedagógica inovadora, baseados em uma mídia digital próspera e engajadora.

Keywords: *Podcast, engajamento estudantil, design-based research, ensino técnico-profissionalizante*

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Estratégias de jogo na app educity para aprendizagens autorreguladas no âmbito de uma educação sustentável para a sustentabilidade

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Abstract. Para reduzir danos ocasionados pelo consumo desenfreado dos recursos naturais da Terra é preciso um esforço mundial para pôr em prática ações sustentáveis. A fim de promover competências para ações que promovam a sustentabilidade, o presente trabalho planeja desenvolver um guião de jogo que proporcione atitudes autorreguladas no âmbito de uma Educação para a sustentabilidade. Este guião será integrado na app EduCITY que será explorado por alunos do terceiro ciclo do Ensino Básico. A investigação desenvolve-se numa lógica de Design-based Research, por ser uma abordagem que permite desenhar e refinar protótipos que podem ser vivenciados na prática escolar. Neste caso, o protótipo é o guião educativo que dará origem ao jogo a integrar na app.. Pretende-se testar as intervenções propostas e analisar seu funcionamento, podendo ser melhoradas e testadas novamente para alcançar o objetivo proposto, de forma a promover práticas autorreguladas de sustentabilidade na escola e comunidade.

Keywords: *Jogos; Aprendizagem; EDUCITY*

Music

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As Dimensões da Experiência enquanto ferramenta de avaliação do envolvimento do público em concertos-jogo

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Abstract. Esta investigação tem como objetivo avaliar a incidência das "Dimensões da Experiência" (estética, educação, entretenimento e escapista) - defendidas por Pine e Gilmore (1998) - em concertos colaborativos com obras escritas na estrutura de diferentes tipologias de jogos, criados através da ferramenta de desenvolvimento de jogos Unity. A investigação empírica será auferida por um levantamento de dados sobre a experiência individual e coletiva de cada participante. Através dos resultados, pretende-se validar as quatro dimensões da experiência do público em cada obra e definir um quadro teórico sobre os níveis de envolvimento do público.Esta comunicação, entretanto, é um relato parcial sobre um concerto protótipo de uma obra acusmática na estrutura Gamebook onde o público decidiu a continuidade da narrativa musical respondendo a perguntas dicotômicas projetadas durante a execução da obra. O concerto contou com a participação de 38 pessoas entre 18 e 70 anos formando um público - em sua maioria, de não-músicos. Cada participante recebeu as opções de respostas no seu telemóvel, e todo o processo ocorreu por meio de um sistema de votação on line que permitiu a interação do púbico em tempo real através da plataforma "mentimeter". Ao fim do concerto o público foi convidado a responder um questionário sobre sua experiência num concerto-jogo. Através das respostas pretende-se avaliar em simultâneo a relação do público com o jogo e com a atividade musical, considerando a tecnologia como mediadora desta relação.

Keywords: *nan*

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Experimentation and assemblage with works of Lopes-Graça and Johann Sebastian Bach

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Abstract. Experimentation and assemblage with works of Lopes-Graça and Johann Sebastian BachDuring the course of my preliminary research on Lopes-Graça's Twenty-Four Piano Preludes I came across several points of interaction between this work and (the two volumes of) J.S. Bach's Well Tempered Clavier (WTC). These two compositions have several meeting points: both were composed for the twenty-four tones, following the ascending chromatic order. Lopes-Graça himself, a devout admirer of Bach, recognised the importance of Bach's forty-eight preludes and fugues, as being one of the most important works composed and playing a crucial role in the consecration of equal temperament tuning (Borba ; Graça, 1956, p. 627). This work, Twenty Four Preludes for Piano, is an example of how Graça approaches his predecessors (in this case Bach), and the great questions of musical tonal evolution (writing for the twenty four tonalities).J. S. Bach writes all his work for the meantone tuning system, dedicating exclusively the WTC to the new tuning system. What difficulties did he experience in writing in this way? Since several works were previously transposed to fit the limitations of the previous tuning system (some tonalities caused the undesirable "howling") (Lecky, 2009), in what way the well-tempered system brought the composer a broad view of all the tonalities? By giving wings to the use of all the tonalities without exception and by eliminating the previous "howling's"caused by tuning, J. S. Bach glimpsed a new path, both in music and in the organological perspective of the keyboard instruments of his time and those that were still being developed.Despite the 200 years that separate these two composers and their works under analysis here, both faced similar dilemmas, both in the possibilities and in the difficulties posed by tuning issues. In the attempt to recreate elements from the Portuguese Traditional Music, Lopes-Graça faced barriers and obstacles. The tuning presented itself as one of them, either in the case of some traditional instruments - with a different tuning system - or with the very essence of the original melodies. Through the methodology of Experimental Laboratory, this project, which is performance as creation, address the problems raised aiming to produce an assemblage with recourse to the WTC compositions of J.S. Bach and to the Twenty Four Preludes of Lopes-Graça.

Keywords: *Temperament, Tuning, Performance, Piano, Assemblage*

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Designing a gestural interface for musical expression: notes on recent development

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Abstract. As a multi-instrumentalist I use the studio as a performing and compositional tool, making use of traditional, digital, and augmented instruments, as well as microphones, sensors, DACs, and MIDI interfaces. This process promotes the interaction of different elements that make up the studio to favor composition through timbre as musical material. This dynamic process has suffered constraints due to my need to add new sound materials for composition. My Ph.D. project aims to solve this problem by constructing and mapping a digital musical instrument (DMI) that uses gestures to produce sound. The Physical Computing Instrument (PCI) thus intends to optimize my composition process and foresees the manipulation of scattered elements in the studio while adding new materials. Being a project with a high technological bent, I requested the collaboration of the Department of Materials and Ceramics of the University of Aveiro, which will contribute to the mapping and hardware implementation of the device. For a composer that uses performance as a procedure for real-time composition, gestural expressiveness is key when thinking about the creation of a musical instrument (Carvalho, 2017; Portovedo et al., 2021). Bodiless instruments are great examples of timbre generators but with no direct correlation between physical gestures and sound (Wanderley, 2001; Magnusson, 2018). At the Research Summit 2023, and as a research path for the construction of the PCI, I'll elaborate on the use of gestural DMIs such as the Myo Armband; the Leap Motion, and the Wii Remote, the primary controller for the Nintendo Wii, noted for its motion-sensing capabilities, low latency, and twelve assignable triggers. Their different technological characteristics can contribute to understanding the possibilities of gestural implementation, mapping strategies, and other features, in the PCI's construction. For illustrating that notion, I'll be presenting, several compositional, sound, and notational sketches. I also aim to demonstrate how the PCI may be useful for the growing community of musicians, composers, and academics who carry out research in this area, and for those not familiar with technology but eager to expand their artistic practice – experimenting with an instrument that will have a soft learning curve, will be portable, and that could be used to 'augment' an existing instrument. This project will also promote the sustainability of materials used in the PCI's construction, and through the implementation of technical solutions, that will contribute to making the instrument a self-sufficient device, in terms of its energy consumption.

Keywords: *Gestural Interface; Digital Musical Instrument; Human-Computer interaction*

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Regulation of Status and musical work during the Estado Novo: the case of the National Woodwind Quintet

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Abstract. This presentation aims to contribute to the understanding of the regulation of musical activity during the Estado Novo. Taking as a starting point the itineraries of five musicians belonging to the Quinteto Nacional de Sopro, instigate the discussion about the construction of social and professional status, through which the corporatist regime categorized and controlled the musical activity (Silva 2017, 2005). These itineraries (Bourdieu 2010, 1979) reflect how these musicians responded to the limits imposed by categorizations, developing a broad and multifaceted (Cardoso 2019) activity in the context of philharmonic and military bands, orchestras, chamber groups, and the National Conservatoire, among other institutions.

Keywords: *Estado Novo, social and professional status, broad and multifaceted musicians, regulation of musical activity*

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O espaço acústico da Folia do Espírito Santo: entre a continuidade e a resignificação das suas práticas

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Abstract. Este projeto de tese no âmbito do Programa Doutoral em Música, ramo de Etnomusicologia, propõe estudar as múltiplas dinâmicas que no século XXI resignificam a Folia do Espírito Santo, na ilha de S. Miguel, no Arquipélago dos Açores. Tenho como principal objetivo compreender os processos e as visões do mundo que estão por detrás de ações de continuidade, revitalização e migração de práticas musicais tradicionalmente ligadas ao culto do Espírito Santo. Nesta festa, uma das mais importantes manifestações religiosas do arquipélago dos Açores, a dinâmica dos rituais é acompanhada e dirigida por grupos de músicos instrumentistas e cantadores designados de Folias. A festa do Espírito Santo está documentada em diferentes fontes bibliográficas académicas, historiográficas, etnográficas e literárias contudo, sem enfoque sobre a relevância das práticas musicais e dimensão sónica destes grupos na festa. Assim, neste estudo vou olhar para a interseção dos vários enquadramentos inerentes às festas do Espírito Santo e às Folias, para compreender a integração e resignificação das suas práticas performativas em novas dinâmicas socais e culturais, do século XXI, considerando a dimensão sónica destes grupos musicais na construção de um espaço acústico próprio, as ações e respetivos agentes envolvidos na sua objetivação patrimonial e a recente integração de mulheres na Folia. Nesse sentido, irei aplicar o modelo teórico de análise proposto por C. Isnart e A. Testa (2020b), assente numa rede tridimensional de relações entre conceitos: 1) re-encanto: "migração do sagrado" e revitalização, 2) ritualização: ritual, género e tradição local e, 3) fazer patrimonial: património religioso, "comunidade imaginada", memória social e som e espaço. Irei aplicar o método etnográfico assente em trabalho de campo que desenvolvo junto de um conjunto de Folias pré-definido. Inclui também o recurso a ferramentas complementares como a entrevista, a gravação em vídeo e áudio, e a fotografia, para a materialização da narrativa etnográfica, de modo a fazer convergir na minha escrita os discursos "polifónicos" dos diferentes interlocutores do terreno em estudo. O trabalho de campo preliminar, desenvolvido em torno do terreno em estudo mostrou que se têm observado, nos últimos anos, ações de resignificação das práticas performativas destes grupos musicais, as quais têm incluído um expressivo fazer-patrimonial, com vista à sua continuidade, pela relevância que desempenham na dinâmica da festa, em particular pela tensão devocional criada pela dimensão sónica da sua performance.

Keywords: *Folia do Espírito Santo, Resignificação, Patrimonialização, Género*

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J. S. Bach por Sérgio Abreu: contribuições para compreensão dos processos transcricionais de sérgio abreu a partir da análise de manuscritos

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Abstract. Esta comunicação se propõe a divulgar resultados parciais da investigação em curso sobre as atividades artísticas e pedagógicas de guitarristas portugueses e seus descendentes estabelecidos no Brasil entre 1875 e 1975. A revisão da literatura e os documentos coletados em acervos públicos e particulares e repositórios digitais demonstraram que Sérgio Abreu - pertencente ao grupo de descendentes - ocupou lugar de destaque no desenvolvimento artístico da guitarra clássica no Brasil, com atuações relevantes no campo da performance, na produção fonográfica da época, e na ampliação do repertório - a partir de suas transcrições para guitarra solo e em duo. Pretende-se, assim, apresentar contribuições para a compreensão dos processos transcricionais utilizados por Sérgio Abreu a partir da análise musical do manuscrito da Fantasia em Dó menor (BWV 906), originalmente escrita para instrumento de tecla e transcrita para duo de guitarras.

Keywords: *Guitarristas Luso-Brasileiros, Transcrição, Sérgio Aberu*

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Improvisation and mechanism. Development of a model and digital tools for classical guitar

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Abstract. Improvisation and mechanism. Development of a model and digital tools for classical guitarMy research work addresses improvisation in the contemporary classical domain but explores this practice from other methods and perspectives than traditional classical music approaches. For this reason, I am proposing in my work an approach based on the development of the link between mechanical gesture and audition as it happens in other musical traditions, as described by other authors such as Caporaletti (2018). This has led me to explore and learn not only from other music traditions but also from other researchers from other disciplines, as I am working with two software scientists to develop a solution to help guitarists who are interested in improvisation. The solution we have come up with involves computer systems and my conceptual proposal of approaching improvisation in classical contemporary guitar by departing from the link between mechanical gesture and audition. Our proposal has been concretized in an online application hosted at this link: guitarimproviser. Some findings of this project have been presented at events such as the V Research conferences of the University of Cundinamarca in Colombia and the 40th Anniversary of the Khoury College of Computer Sciences at Northeastern University in San Francisco and Silicon Valley.

Keywords: *Classical music improvisation, classical guitar improvisation, digital tools for music improvisation, artistic research, music performance*

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Rhythmic Reverberations: A Sound Ethnography Exploration of Traditional Bombos

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Abstract. This paper is part of ethnomusicological research on Bombos, a term that encompasses three aspects: 1) a percussion instrument; 2) a set of musical instruments; 3) a predominantly male, collective, intergenerational traditional practice integrated in public celebrations in Portugal, the so-called Festas. Although historically documented, the way scholars listened to those ensembles in the past was very peculiar. It is not difficult to find references alluding to their "noise", a "noise that drives people away"produced by "diabolic orchestras"through "infernal encounters of many percussion instruments"making "music without music"on the streets (Pimentel, 1902; Lambertini, 1902, 1914; Borba, 1907; Oliveira, 1961). Such music-centric approaches resulted in the suppression of the intrinsic values of the practice, including the ethical and aesthetic criteria of the musicians, and the embodied knowledge these individuals possessed. It calls for a more nuanced work in the post-folkloric context of the 21st century.

Drawing on contemporary Ethnomusicology and Sound Studies theory, and employing various qualitative research methods – which include intensive fieldwork observations, active participation in live acts by learning to play the musical instruments, conducting interviews with participants, co-writing texts with musicians, recording their music and sonic environments to convey "ethnographies in sound", following Rice's (2019) framework – this research seeks to propose a comprehensive understanding of the relationship Bombos establish with (i) musicians, audiences, and other facilitators of their activities; (ii) social, physical, and acoustic spaces they go through; (iii) materials, technologies, and aesthetic values that enable collective cultivation of musical endeavors.

The study sheds light on previously overlooked aspects of Bombos. It highlights, for example, the role of social, physical, and architectural spaces in shaping musicians' knowledge and decisions when performing in high-energy settings; the holistic nature of listening when playing, involving the entire body; the significance of mutual agreements among participants and the annual social networks they forge face-to-face.

The research findings are presented in both sound and textual formats. Four sound ethnographies were made, totaling 75 minutes of edited audio, which are available online and distributed by associations such as the British Forum for Ethnomusicology. Additionally, articles were published and the research was presented at scientific events both in Portugal and abroad.

Keywords: *Bombos; Ethnography in/of sound; Sound Studies; traditional music; post-folklorism.*

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Cantocando: self-accompaniment practice challenges

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Abstract. Cantocando is an artistic research project that seeks to generate unconventional performative proposals exploring the practice of self- accompaniment applied to the nineteenth-century repertoire of singing and piano. Problematizing the dyadic relationships that permeate our views on musical practice (piano-singing, solo-accompaniment, among others), it explores the vicissitudes and characteristics of the repertoire and the possibilities offered by its performative realization through the double practice of playing and singing or "cantocar".
The intention is not to result in an arbitrary proposal of interpretation, or in a reconstruction of a historically informed practice, but the use of cantocar to develop new resources and interpretative models as well as to generate, both for the artist and for the audience, new experiences that allow to evoke new scenarios, to generate new spaces, programs and, why not, new musical material.
In its final stage, Pre-performative and performative, the project turns the experiences lived in the “laboratory” and the new practices mapped through the different information channels into a concert-performance that critically highlights the practice itself, contributing to a better understanding of the place that self-accompaniment has, and has had in the composition, interpretation, and teaching of academic music from the 18th century to the present.

Keywords: *Performance studies, Self-accompaniment practice, Opera Performance*

Nanosciences and Nanotechnology

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Functional composite protective coatings based on iron oxide magnetic nanoparticles: materials development

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Abstract. Material degradation caused by exposure to aggressive environments is one of the main causes of premature loss of functionality and reduced service life of systems. The application of polymeric-based coatings is the most practiced approach for material protection. However, conventional passive barrier coatings frequently suffer from the loss of protective functionality due to mechanical damage, exposure to UV-Visible radiation or microorganisms, which cause the appearance of coating defects, allowing penetration of aggressive ions to the substrate. In this context, the development of smart protective coating capable of providing responsive functionality, such as self-reporting, self-healing, self-cleaning, and antifouling properties is an active field of research (Idumah et al.2020; Sushkova et al.2023).

The main goal of our work is, thus, the development of eco-friendly smart remote-control multifunctional coating based on magnetic polymeric composites. Magnetic nanoparticles (MNP) can be used as a powerful tool in the remote-control process (Cerdan et al.2022). Under an applied AC magnetic field, MNP are capable to produce heat through relaxation losses, which could be dissipated to the surrounding environment. The proposed approach is based on the combination of the local heating ability of MNP with their controlled position and orientation by an external magnetic field during the coating curing, aiming at inducing different reversible effects: self-healing, self-cleaning, and anti-fouling.

At the current stage of the project, the work is focused on the development of materials for the functional coatings. Different types of magnetite nanoparticles were synthesized via a facile co-precipitation method to optimize the particles toward high heating ability. The size and shape of the MNP were controlled by varying different synthesis parameters, such as precipitation and crystal growth temperatures and time, type of iron salt precursors, or presence of surfactants. The effect of the synthesis parameters on the resulting properties of MNP was investigated via XRD, HR-TEM, STEM-EDS, and SQUID magnetometer. Induction heating ability was investigated under applied AC fields. Acrylic and polyurethane-based thermoplastic and thermosetting polymers were tested as the possible basis for composite coating. The influence of the applied static homogenous magnetic field on the alignment and position of MNP inside the polymeric matrix was investigated based on water-based thermosetting coating by using an electrical magnet during curing. The magnetic properties of the resulting coatings were evaluated via SQUID magnetometer, the MNP dispersion across the thickness was investigated via SEM/EDS. Particle functionalization is currently underway to overcome the emerging challenge of particle aggregation within polymers.

Keywords: *Protective coating, Composite, Polymer, Magnetic nanoparticles, Iron oxide.*

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In-situ growth of piezoelectric nanoparticles within porous bacterial nanocellulose films

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Abstract. In a world where the internet of things is becoming more and more prevalent, it is imperative to find sustainable ways to build and power the sensors that drive this technological ecosystem. Sensors have always been rigid but nowadays their flexibility is more and more demanded so that their applications can be improved and further diversified. This is where piezoelectricity becomes relevant, being a property that some materials have, to convert mechanical energy into electrical energy. By adding this property to nowadays sensors, their battery lives could be further extended or, even better, they could work autonomously through mechanical energy conversion. Common piezoelectrics include lead-based materials, however they obviously represent issues for health and the environment. Materials like barium titanate (BT) or zinc oxide (ZnO) are environmentally friendly alternatives, being biocompatible and having good piezoelectric behavior. One of the most promising ways to build flexible piezoelectrics is through a nanocomposite approach, where an already crystalline piezoelectric is embed within a polymeric matrix, or better, a biopolymeric one. My work revolves around the in-situ growth of piezoelectric nanoparticles (BT and ZnO) within solid bacterial nano cellulose films. Composites produced were characterized through XRD, SEM and TEM to access particle crystallinity, distribution and size, and films thickness, topography and morphology. A prototype of a piezoelectric nanosensor/nanogenerator was built and its piezoelectric sensitivity measured with a piezoelectric shaker.

Keywords: *Piezoelectricity; Bionanocomposites; Nanosensor*

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Redox-active Covalent Organic Frameworks as electrode materials rechargeable batteries

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Abstract. Today the energy sector is still the main contributor towards global warming, raising the urgency for a faster transition from fossil fuels to cleaner energy sources. Due to the renewable's energy intermittent availability problem, there is an increased need for better, safer, and more sustainable energy storage solutions.1 This communication focuses on the use of Covalent Organic Frameworks (COFs), a type of crystalline porous polymer based on organic building blocks linked by covalent bonds, as electrode materials for rechargeable batteries, especially lithium-ion batteries (LIB). First, the focus is centered on the design, synthesis, and characterization of redox-active COFs with optimized properties that are relevant for energy storage applications.2,3 Subsequently, the synthesized materials are implemented as the electrodes' active material in coin-cell type lithium batteries followed by detailed testing and characterization to further assess the performance of the material.4 Therefore, it becomes possible to uncover relations between covalent organic frameworks and their application as electrode materials for energy storage devices.

Keywords: *Redox-active Covalent Organic Frameworks; Energy Storage; Rechargeable batteries; Lithium-ion batteries*

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Crystalline silicon nanoparticles and quantum dots: electronic doping effects on optoelectronic properties

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Abstract. Crystalline silicon nanoparticles (Si-NPs) are environmentally friendly and biocompatible nanomaterials with size-tunable properties and industrially-scalable synthesis approaches [Kortshagen et al., 2016]. The remarkable properties of Si-NPs are interesting for many technologies from electronics [Chryssikos et al., 2020] and optoelectronics [Kortshagen et al., 2016], e.g. photovoltaics [Francesco et al. 2017], to biochemical applications [Daoudi et al., 2023]. The interest of Si-NPs stems also from their compatibility with well-established fabrication processes of the silicon-dominated semiconductor industry. Small Si-NPs with diameter below ~10 nm, also know as quantum dots (QDs), exhibit electronic confinement effects, unseen in larger nanoparticles and bulk silicon [Pereira et al, 2009]. For instance, quantum confinement in Si-QDs causes a energy bandgap increase compared to bulk silicon. Importantly, Si-QDs exhibit efficient light emission, e.g. photoluminescence [Falcão et al. 2020], due to enhanced overlap of the free electron and hole wavefunctions confined in the QDs. Therefore, Si-QDs are "pseudo-direct" bandgap nanomaterials, unlike bulk silicon, opening their application also in light-emitting devices [Ghosh et al., 2014]. Moreover, Si-NPs have a large surface-to-volume ratio and, therefore, are extremely susceptible to surface and external environment effects.

As for bulk silicon, electronic impurity doping is key to controlling the electronic properties of Si-NPs/QDs [Pereira and Almeida, 2015]. However, the electronic and optoelectronic properties of doped Si-NPs/QDs are not fully understood. In particular, it is still unknow how light emission and electron-hole recombination processes [Falcão et al. 2021] are affected by electronic doping. Also, the doping-related effects on optoelectronic properties of Si-QDs should be affected by surface and external environment. For example, it has been found that the doping efficiency in Si-QDs can change by several orders of magnitude depending on their surrounding medium [Almeida et al., 2016]. Here, we will present our investigations on the optoelectronic properties of Si-QDs electronically-doped with phosphorous dopants and how these are affected by the QDs surface. We address two types of surface structure (surface termination) of the Si-QDs, namely, termination with Si-H bonds and with native oxide, naturally formed of the surface upon air exposure. We use low-temperature photoluminescence measurements, from which the electron-hole recombination processes involving dopant electronic states are understood, and optical absorption spectroscopy, which provides information regarding the QDs electronic structure. The studies are complemented with structural/morphological characterization of the Si-QDs provided by Fourier-transform infrared spectroscopy (surface termination/structure) and transmission electron microscopy (shape/size).

Keywords: *silicon nanoparticles, electronic doping, optoelectronic properties*

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Efficiency improvement study irradiated thin film cells

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Abstract. Renewable energy sources are gaining more and more potential to meet planet's energy needs, having a lower environmental impact compared to non-renewable sources. Photovoltaics are already mature technologies with an extremely fast-growing use. The solar cell market is dominated by silicon-based technologies, with a share higher than 90%. Nevertheless, thin-film technologies have shown a growth in power conversion efficiencies faster than that observed for technologies involving silicon, which represents a high potential for the near future. Additionally, thin-film technologies have some advantages, namely the solar cell mass is significantly lower than that of common silicon-based devices and the radiation hardness is also clearly superior to that evidenced by first-generation cells.

Amongst thin-film technologies, several are based on chalcogenides materials, which correspond to II-VI or I-II-VI2 chalcogenide semiconductors. Chalcogenides are versatile chemical materials for incorporation into photovoltaic energy exploitation processes, based on sulfur (S), selenium (Se), or tellurium (Te), like CdTe or Cu(In,Ga)Se2, which show efficiency records of 22.1% and 23.35%, respectively (Hadke, et al., 2022) therefore close to the values presented by monocrystalline and polycrystalline silicon solar cells.

One of the market niches in which thin film technologies have clear advantages over other technologies is the space such as: i) high efficiency for use on the surface of satellites; ii) high tolerance to radiation damage caused by trapped particles in the radiation belts surrounding the Earth; iii) high resistance to degradation caused by atomic oxygen; iv) reduced mass; v) resistance to cyclical temperature variations (Loferski, 1966).

In the context of the development of strategies aimed at recovering radiation damage, this work studied the effect of exposing thin-film cells to light on their electrical and optical properties. Additionally, these effects were compared with moderately low temperature annealing and a combination of both was performed. The interest in improving the efficiency of irradiated CIGS chalcogenides has been studied, focusing on the effect of light soaking (LS), i.e. exposing the chalcogenide material of the solar cell to light. LS experiments reveal performance changes that differ between various technologies, and these effects depend on the particular chalcogenide material being analysed, showing improvement in efficiency, and electrical and structural parameters.

Keywords: *Solar cells; radiation damage; damage recovery; thin-films; light soaking; annealing.*

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Interface and surface engineering of CIGS films to improve cell performance

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Abstract. In our research, we are working on implementing processes that will enable us to produce high-quality CIGS films with compact structure, high crystallinity, large grain size, and minimal defects. To address this issue, we are exploring methods such as establishing an optimal precursor order, introducing thin metal oxide interlayers, and doping alkaline impurities.
In contrast to what is widely accepted, our findings have shown that in the bi-layer precursors approach (such as Mo/CuGa/In or Mo/In/CuGa), even though the CIGS layers themselves are highly compact, the absorbers formed with CuGa in contact with Molybdenum (Mo/CuGa/In) lead to poorer cell performance. On the other hand, absorbers formed with Indium in contact with Molybdenum (Mo/In/CuGa) result in poor adhesion between CIGS and Mo because of void formation at this interface. This is likely due to wetting difficulties for indium on molybdenum [1]. It also leads to rough surface morphologies as a result of this precursor configuration. Nevertheless, these absorbers yielded cells with higher efficiencies despite voids and rough surfaces.
Using ALD, very thin layers of metal oxides including TiO2 and Al2 O3 were added on top of molybdenum in order to mitigate wetting issues and improve the interface between Mo and CIGS. A layer of TiO2 with a thickness of 5 nm resulted in a more uniform and compact absorber that had better adhesion, while also improving cell efficiency by 1%. In addition, we also noticed that the metal oxide used is very significant since although TiO2 showed favourable effects, Al2 O3> led to non-functioning cells.
We have also experimented with alkali metal doping on the CIGS surface via KF evaporation to improve absorber effectiveness [2], but so far with limited results. Between alkali metal-treated absorbers and those that weren't, a nominal improvement of 1-2% was observed on average.
GDOES provided a depth profile of the absorber's elemental composition, from which a bandgap energy profile could be calculated [3], [4]. The elemental composition showed an accumulation of Ga closer to Mo. The bandgap energy increases near the molybdenum interface of the absorber as a consequence.
We used XRD to identify the phases present in the absorber and determine their crystallinity. We observed an excellent correlation between the obtained XRD profiles and the PDF-4 reference data. The films also had excellent crystallinity.

Keywords: *CIGS, Solar cells, Thin-film deposition.*

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Green synthesis of perovskite quantum dots for solar cells

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Abstract. Solution-processed colloidal perovskite quantum dots (PQDs) are among the most attractive materials for third generation solar cells due to their efficiency and low-cost production. Among the PQDs available, lead containing halide perovskites have been particularly investigated because they offer a realistic path for competitive solar cells, by taking into account their efficiency and production costs associated. However, environmental criteria should be also considered in their production, as part of a technical decision based on sustainable criteria. In this regard, the use of surfactant and toxic solvents in the synthesis of PQDs has been identified as a critical issue, which in practice might compromise device fabrication and commercialization. In fact, most of the reproted methods for the production of PQDs rely on the use of polar solvents, such as N,N.dimethylformamide and dimethyl sulfoxide, which can cause defects at the surface of QDs and are also harmful to the environment. On the other hand, the use of nonpolar solvents improve the stability of the QDs but are not green alternatives, such as the use of octadecene or mineral oil (Tong et al. 2016).
In this research, we explore a sonication-assisted synthesis of PQDs in which the solvents are not derived from fossil resources for the fabrication of solar cells. Hence, a series of colloids of CsPbX3 (X= Cl, Br, I) have been prepared by reaction in different commercial vegetable oils. The phase identification, crystallinity, optical properties, and nanoscale morphology were evaluated. The crystalline phases present in the as-obtained CsPbBr3 QDs were identified by powder X-ray diffraction (XRD) showing the orthorhombic phase for all the samples. The morphological properties of the particles were characterized by transmission electron microscopy that show cubic and fairly uniform nanocrystals with 10 nm dimensions. The CsPbBr3 QDs exhibited bright and narrow photoluminescence (PL) with a quantum yield up to 90%. Strong quantum confinement effects have been observed in the nanocubes, with both the absorption and emission peaks shifted to lower wavelengths compared to bulk perovskite. In brief, this research has demonstrated the successful synthesis of PQDs using vegetables oils as solvents, which provides an alternative method for the preparation of the absorber layer in the next generation solar cells based on perovskites.

Keywords: *Perovskites, Quantum dots, Solar cells, Green solvents, Sonochemical synthesis*

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Biodegradable fruit packaging with ethylene scavenging activity using agrifood by-products as raw materials

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Abstract. Agrifood by-products are largely produced and wasted while still containing valuable biomolecules with film-forming and thermoplastic ability. On the other hand, ethylene is a fruit ripening promoter that, when in excessive amounts, gives rise to large amounts of fruit loss. In this PhD thesis, the feasibility of reusing potato washing slurries, potato frying residues, and pine nut on the development of biodegradable plastics and ethylene scavengers is being studied. Up to now, porous polysaccharide- and clay-based microparticles capable of adsorbing ethylene were developed. The influence of polysaccharide concentration, temperature, water in oil emulsion medium ratio, and inorganic nanoparticles on physicochemical and morphological properties of microparticles was evaluated. Ethylene scavenging activities of the most promising particles are being addressed. Moreover, bioplastic formulations based on potato byproducts with enhanced physicochemical/mechanical performance and processable by blown extrusion and/or thermoforming are being developed. Impregnation of the developed ethylene scavengers into/onto potato byproducts-based films/trays is being studied to achieve an active biobased packaging capable of preserving fruit quality with safety.

Keywords: *Ethylene, fruit packaging, biopolymers, circular economy, byproducts*

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Developing a Clear Beer Bottle with Enhanced UV Protection Using Carbon Quantum Dots

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Abstract. The Superbock Group conducted market research and found that consumers preferred lighter-coloured transparent beer bottles that allowed for better visualization of the product they were purchasing and consuming. In a joint collaboration, the consortium formed by the University of Aveiro, the BA Glass (glass maker industry), and Superbock Group (beer industry) created a project called CLEVER with the aim of developing a clear and transparent beer bottle that had comparable or superior properties to those made of amber glass already on the market to protect beer against UV and visible radiation up to 510 nm. This was necessary because if the beer absorbed radiation in this range, it could lead to the generation of a compound called 3-methylbut-2-ene-1-thiol (3-MBT) through a photochemical reaction [1]. This compound can be detected by the human palate at concentrations as low as 10 parts per trillion, making it critical to prevent its production entirely [2].To achieve this, the CLEVER project pursued two research lines. The first focused on improving the glass mass of transparent glass to increase its UV protection, while the second concentrated on developing a coating to be applied on top of the modified glass. The latter work focused on exploring the development of coatings made with carbon quantum dots using two different heating approaches: the microwave- and the conventional oven-assisted heating. The study investigated the size and dispersion of carbon quantum dots in the liquid matrix and how these parameters related to the coating's UV light absorption capacity. Additionally, it was evaluated the impact of the withdrawn rate of the dip-coating on the colour variation and UV-absorption, discussing the trade-off between colour and UV-shielding.

Keywords: *UV protection; Glass; Coating; carbon quantum dots*

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Development of Advanced Biopolymeric Nanostructured Bioinks for 3D Bioprinting Applications

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Abstract. Three-dimensional (3D) bioprinting is an innovative technology, which allows the fabrication of 3D-living constructs by the layer-by-layer deposition of bioinks. An ideal bioink should possess proper mechanical, rheological, chemical, and biological characteristics, and the engineering of high performance bioinks is still a major challenge. Currently, the development of novel nanocomposite bioinks has been widely explored as a strategy to fabricate bioinks with improved properties. The incorporation of biobased nanofibrous materials into hydrogel-based bioinks improves the structural stability and shape fidelity during and after printing, as well as the cell growth and proliferation in 3D-living constructs. In this context, the goal of this project is the formulation of advanced nanocomposite hydrogel-based bioinks with high performance in terms of bioprintability and mechanical stability, as well as cell density and viability, by means of the incorporation of biobased nanofibers (viz. protein nanofibrils and nanofibrillated cellulose (NFC)) into biopolymeric hydrogels.
In the first work, alginate nanocomposite hydrogel bioinks reinforced with lysozyme nanofibers (LNFs) were developed. Alginate-LNFs suspensions with different LNFs content (1, 5 and 10 wt.%) were prepared and pre-crosslinked with 0.5% (w/v) CaCl2 to formulate the Alginate-LNFs inks. These inks exhibit proper shear-thinning behavior, good recovery properties (~90%) and improved printability. The addition of LNFs also improved several properties of the fully crosslinked hydrogels (2% (w/v) CaCl2), such as the morphology, swelling and degradation profiles, and mechanical properties. Selected Alginate-LNFs inks were loaded with HaCaT cells (cell density 2 x $10^6 cells mL-1), and scaffolds printed with the Alginate-LNF(5\%) bioinks showed the highest cell viability values after 7 days(87.991.2$
$These cond work explored the simultaneous incorporation of LNFs and NFC into pectin hydrogels. A Pectin-NFC suspension with a 70$
$30 ratio exhibited the best performance in terms of recoverability(~68\%) and printability, being chosen as a matrix for the incorporation$
$30(10\%) ink presented improved printability and was loaded with A375 melanoma cells(cell density 3x10^6 cells/mL). Post-bioprinting c$
$Current work is focused on the incorporation of LNFs into-Carrageenan-based hydrogels. These novel bioinks are also being characte$

Keywords: *Bioprinting; Bioinks; Hydrogels; Nanocomposites; Polysaccharides; Biobased Nanofibers*

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Optically active centers in rare-earth implanted Beta–Ga2O3 single crystals

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Abstract. –Ga2O3 is an ultrawide-bandgap (UWBG) semiconductor material that has gained significant attention in the research community in recent years. Its remarkable proprieties, such as the wide bandgap energy (~4.9 eV at room temperature (RT)) and high breakdown field (8 MV/cm), combined with recent advances in the material growth and device fabrication, have led to increased interest and research in this oxide. Its prospect for applications span from power electronics, solar-blind UV photodetectors to biochemical devices, among others, with the potential to outperform other WBG semiconductors such as GaN or SiC (Pearton et al., 2018). Moreover, –Ga2O3, the most chemical and thermal stable gallium oxide crystalline phase, has a high potential for rare-earth (RE) doped photonics and optoelectronics through the optical activation of RE3+, such as Eu3+ and Er3+, allowing tuning the luminescence from the ultraviolet to the infrared (Guo et al., 2019). However, there are other RE3+ less studied in this oxide crystal that are suitable for a different number of optical applications. That is the case of praseodymium (Pr) doped –Ga2O3 which, in its trivalent charge state, is known to emit from both the 1D2 and 3P0,1,2 electronic levels, being of interest for red electroluminescent devices (Guo et al., 2019). Besides that, Pr3+ is a promising qubit candidate for quantum computing applications, since the ions can be optically addressed (manipulated and read out using laser light), which is a common approach for qubit manipulation in ion trap quantum computing architectures (Nakamura et al., 2014).
In this work, commercial –Ga2O3 single crystals were implanted with Pr3+ ions at RT and at 600 ºC, with fluences of 1×1012 and 1×1015 ions/cm2 and an energy of 300 keV. Post-implant rapid thermal annealing treatment during 60 s in an argon atmosphere was performed in all samples at 900 ºC to promote the lattice recovery and ions' optical activation. For the samples' optical characterization, different advanced spectroscopic techniques were used such as Raman spectroscopy, UV-VIS absorption, photoluminescence (PL), lifetimes and temperature energy dependent-PL. Upon implantation and thermal annealing, Pr3+ optical activation was achieved with the main emission arising from the 1D2 state in the red region. Additionally, after thermal annealing, an almost complete recovery of the lattice damage imposed by the implantation was observed by using Raman spectroscopy. These results open a new route for the thorough investigation of Pr3+ ions in –Ga2O3 single crystals using ion beam techniques.

Keywords: *Ga2O3; rare-earth; praseodymium; ion implantation; photoluminescence; red emission*

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Nanofibrillated cellulose-based bioinks for 3D bioprinting applications

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Abstract. Three-dimensional (3D) bioprinting is promoting significant advances in many fields, including diseases research and drugs investigation, among others (Murphy et al. 2014). This technique consists on the deposition of bioinks (biomaterials and cells) in a previously defined pattern following a layer-by-layer approach. Many polymeric materials (synthetic and natural) can be used for the development of bioink formulations (Gungor-Ozkerim et al. 2018). Yet, most biopolymeric materials, such as hydrogels, lack long-term mechanical properties. One way to overcome this limitation is to develop nanocomposite hydrogel-based bioinks using reinforcing agents such as nanofibrillated cellulose (NFC) (Chinga-Carrasco et al. 2018). During this PhD, NFC was combined with different biopolymers, viz gellan gum (GG) (Lameirinhas et al. 2023), gelatin (Gel) or FucoPol (F) to produce hydrogel-based bioinks with improved mechanical and rheological properties. Both the hydrogel-based inks, namely NFC/GG and Gel/NFC, were characterized in terms of their rheological behavior, and the fully crosslinked hydrogels were evaluated regarding their rheological and mechanical properties, as well as their stability in two different media (Dulbecco's Modified Eagle's Medium (DMEM) and Phosphate Buffer Saline (PBS)), morphology, and cytotoxicity towards HaCaT (for NFC/GG) and HEPG2 (for Gel/NFC) cell lines. The obtained results showed that NFC improved the rheological and mechanical properties of these hydrogel-based inks. It was also perceived an increase of the stability of the fully crosslinked hydrogels in DMEM and PBS promoted by NFC. Also, a non-cytotoxic effect of the fully crosslinked hydrogels towards the chosen cell lines was observed. Furthermore, bioprinting the cell-laden hydrogels was not harmful to the different cells since their viability was considerably high throughout the evaluated days (up to 7 days). For NFC/F-based hydrogels (an ongoing work of this last year of PhD) it was also perceived that the increase of NFC concentration led to enhanced rheological properties. The obtained results highlight that the combination of NFC with GG or Gel is a promising strategy for developing novel hydrogel-based bioinks for 3D bioprinting purposes.

Keywords: *3D bioprinting, bioinks, cells, gelatin, gellan gum, FucoPol, nanofibrillated cellulose*

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Development of novel electrolytes for proton ceramic membrane reactors

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Abstract. Dependence on the use of fossil fuels has been one of the main causes of climate change, which in turn has caused a significant increase in the environmental pollution on our planet. Moreover, during the last decades, there has been exponential growth in world energy consumption due to economic and social development around the world. For this reason, the European Union (EU) has implemented policies that aim to promote the use of renewable energy sources such as biogas and biomethane to mitigate global energy consumption. EU leaders have signed an agreement to stimulate the urgent need for an energy transition with the aim of making Europe a neutral continent in greenhouse gas emissions by 2050, guaranteeing the supply of clean, safe, and affordable energy. [1,2].

An important movement in this agreement is that the increase in the level of organic waste production through modern societies is beneficially exploited, in order to contribute to the reduction of global greenhouse gas (GHG) emissions. According to the International Energy Agency (IEA), biogas can play a very important role in this goal, as these gases can be used in the transformation of the global energy system. Here, biogas can also be converted into H2-rich gas using the reforming process to generate useful fuel or feedstock for chemical production [3].

Aligned with these aims, the current study proposes an electrochemical configuration aiming to form green syngas (a mixture of CO and H2) from a biogas precursor, by direct electrochemical pumping across a proton-conducting ceramic-oxide membrane. Differing from traditional biogas to green hydrogen or biomethane routes, this process does not consider the CO2 content of biogas as a hindrance to be removed. Instead, the current pathway permits the conversion and utilization of the entire biogas composition.

A major challenge to this goal is to develop a suitable electrolyte with increased tolerance to biogas composition (CO2, H2S, etc.). Therefore, the main outcomes of the current study are related to the development of novel electrolyte materials that offer increased chemical resistance against biogas feed, while also being stable in contact with the remaining cell components. This project, thus, offers a highly promising green pathway for syngas production with important applications in the chemical industry.

Keywords: *Ceramic electrolyzer; biogas; syngas; electrolyte.*

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Functional biocomposites containing eco-friendly reduced graphene oxide

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Abstract. Graphene derivatives, such as reduced graphene oxide (rGO), are attractive fillers to develop electrically conductive and mechanically reinforced composite materials. The graphene composites market is growing fast, with an evaluation of USD 16.12 million in 2021, projected to reach USD 206 million by 2030 (Straits research, 2023). However, the large-scale production of rGO presents sustainability challenges. The synthesis of rGO is accomplished through the removal of oxygen functional groups from graphene oxide (GO) by thermal annealing at high temperatures or toxic reducing agents (e.g., hydrazine). Therefore, the development of eco-friendly methodologies to achieve sustainable production is necessary and timely (Barra et al., 2022).

Herein, we developed a green methodology to produce rGO (Barra et al., 2021). The GO was hydrothermally reduced in presence of caffeic acid (CA). The reduction efficiency was confirmed by Raman, FTIR and XPS characterization. The GO:CA of 1:0.1 was the optimal ratio for the reduction, achieving a C/O ratio of 5.99, which is one of the highest reported so far for rGO obtained using eco-friendly strategies. Furthermore, the rGO was used to develop two different functional biocomposite materials – a porous foam for Hg(II) removal from water, and an electrically conductive biocomposite film (Barra et al., 2019).

The foams were prepared by immersion of the rGO monoliths obtained after the hydrothermal synthesis into a chitosan solution, followed by freeze-drying. The foam structure, morphology, porosity and their performance for Hg(II) removal from water were analyzed. The foam prepared in absence of chitosan revealed the highest porosity (SBET = 293 $m^2g-1)andHg(II)removalefficiency, achievingover85\%Hg(II)removalusing25mg/Lfoam.$
$Thebiocompositefilmswerepreparedbymixing0˜50\%rGOwithchitosanbiopolymerfollowedbysolventcasting.TherGOwaswelldisp$

Keywords: *chitosan, reduced graphene oxide, hydrothermal reduction, biocomposites, electrical conductivity, Hg(II) removal*

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Physical Engineering

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Advancements in Physical Vapor Deposition Equipment for Enhanced Thin Film Topological Control Deposition on Fiber Optic Surfaces.

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Abstract. Fiber optic (FO) sensors, based on active surfaces have emerged as a promising miniaturizing technology, among other fields, in healthcare1, and environmental2 monitoring. Inside these fields of applications, their specific sensing capabilities are intrinsically linked to the properties of thin films deposited on the surface of the fiber, which require precise control over topological uniformity and repeatability to ensure accurate and reliable sensing performance. However, this remains a significant challenge in the field.The current surface physical deposition techniques, adapted for depositing thin films on FO surfaces have limitations in terms of uniformity, reproducibility, and process efficiency due to the FO intrisnsic cilindrical shape. This issue stems from the difficulty in achieving the desired topological deposition uniformity of the material on the fiber surface while maintaining a clean and stable deposition environment over multiple deposition layers and intermediary surface preparation and post-processing treatments.To overcome these challenges, we propose the development of a princ3equipment, specifically designed for fiber optic sensors development, based on active surfaces. This equipment allows for the controlled rotation of the fiber around its axis, and the use of two crucibles for depositing two different materials, without breaking the vacuum. An integrated induction plasma gun enables sample pre and post-processing, targeting desired plasma surface treatments as cleaning, etching, annealing and functionalization. Although currently assembled for metals, can be adapted for dielectric materials also in future iterations. The possibility for monitoring the deposition through the optical fiber through an outside coupled spectrometer is a novel feature, introduced to fine tune the film properties over direct measurement of a target variable.Currently, a prototype of the proposed tPVD equipment is under construction, and preliminary results from COMSOL and CST Studio Suite simulations show the overal feasibility of the proposed design. Once completed, the tPVD equipment will enable the deposition of multilayer thin metallic films, with fine topology control over the fiber axis, allow multiple plasma surface treatments, while providing an integrated monitoring feedback loop over the target deposition optical properties. The planed integrated features contribute to precise control of the deposition process, improving the expected sensing performance, reliability and reducing development time of fiber optic sensors solutions, based on surface functionalization, contributing to potential new developments in lab-on-fiber (LoF) applications.

Keywords: *Fiber Optic Sensors, Lab-on-Fiber, Physical Vapor Deposition, Plasma Treatment*

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Reliable group-IV color centers in diamond: First steps

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Abstract. Group-IV defects in diamond show great promise for quantum applications, providing significantly improved properties over the more studied nitrogen-vacancy center, such as much higher Debye-Waller factors and narrow inhomogeneous linewidth [1, 2]. Specifically, the tin-vacancy center is of particular interest due to is long coherence time from its large spin-orbit coupling [1].

Structurally, for group-IV-vacancy centers the impurity is in a bond-center position [1, 3]. Such configuration is of great advantage has, due to its inversion symmetry, it is resistant to external noise [1, 4, 5], e.g., from a nearby surface. Such allows for near-surface centers without degradation of their properties, a crucial factor for improved device sensitivity. Also crucial for quantum technologies, is the ability to entangle multiple such centers. This is usually achieved through interference photons emitted from two centers, however such process requires that the emission frequency of both centers is exactly matched, which is often not the cause due to variation of their local environment, e.g., other defects or strain. Due to their symmetry, significant tuning of the emission frequency of group-IV defects is not possible. As such, the production of such centers with reproducible and consistent properties is essential for quantum applications.

In this work, we present the methodology planned to achieve such goal, which includes a combination of ab initio calculations, optical studies and radioactive isotope techniques. The progress along these multiple components is also reported.

Color centers are usually produced by ion implantation. The resulting structural configuration can be measured using emission channeling [3], however the information extraction of such technique currently is a trial and error process that relies on practitioner's expertise. A new analysis procedure which tackles this issue is presented. It is shown that is is able to determine the physical parameters of interest when applied to simulated data with varying noise levels.

Photoluminescence is a key technique of this research to both verify the presence of the centers as well as determine some of their properties. A method developed to extract Huang-Rhys factor, without requiring the approximation by the Debye-Waller factor, and the one-phonon coupling function from low temperature photoluminescence spectra is presented, being applied to both charge states of the nitrogen-vacancy center for comparison with previous experimental and theoretical literature results, supporting its future application to the group-IV defects.

Keywords: *Diamond, color centers, tin-vacancy, production optimization, photoluminescence, emission channeling*

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Influence of cationic ions on bioactive glasses to enhance the biological response in bone regeneration

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Abstract. Nowadays, the treatment of damage or the replacement of some bone structures prioritises the body's natural healing process. Some biomaterials have been developed with specific compositions in order to enhance desired biological responses such as antibacterial, antioxidant, anti-inflammatory, and antitumour, among others. In this way, the use of bioactive glasses has been an alternative for application in bone regeneration and metallic implant coatings for its high bioactivity and the possibility of inserting therapeutic ions with specific properties. Thus, in this work bioglasses with ions such as cerium, strontium and magnesium were developed. The materials were characterized at thermal (DTA), structural (XRD, FTIR, Raman), morphological (SEM) and biological (cytotoxicity, antibacterial activity and bioactivity) levels. The presence of the ions in the bioglass network did not favour the formation of crystalline phases, maintaining the typical amorphous behaviour. All the glasses with the therapeutic ions inserted presented a higher antibacterial effect compared to the base bioglass, and their addition had a positive effect on the cell viability of Saos-2 decreasing the cytotoxic effect of the base bioglass. Furthermore, cerium showed potential application as an antioxidant by the impedance spectroscopy results.

Keywords: *nan*

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Multi-core fiber devices for high-capacity optical networks

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Abstract. Our day-to-day lives rely to a great extent on being connected, which requires multiple devices to constantly send and receive huge amounts of data. During the last years, the capacity of the networks has been able to keep up with the data demand growth, due to the introduction of several technologies. We are however approaching the theoretical limit of the capacity over the current optical systems (Richardson et al., 2013).
Different approaches have been proposed to overcome this limit, spatial division multiplexing (SDM) with weakly-coupled multi-core fibers (MCFs) is one of them (Matsui et al., 2022). In MCFs, the additional cores in the optical fiber act like additional pathways to deliver more data. Besides the potential of increasing capacity, MCFs may offer the possibility of component sharing, which should reduce the space, the number of components and, consequently, power consumption and cost per bit of the systems (Richardson et al., 2013). However, the implementation of MCF transmission systems depends on the availability of cost-effective devices that are mandatory to any transmission system such as optical amplifiers, couplers and switches. MCF based devices have been proposed, but they still lack on efficiency and simplicity. Long-period gratings (LPGs), which have been applied in several devices in conventional optical systems, may play a role in developing efficient MCF devices. LPGs are periodic perturbations of the refractive index of an optical fiber that promote the coupling between the core mode and a forward propagating cladding mode at a specific wavelength (Erdogan, 1997). Their capability for power distribution (Rocha et al., 2015) and switching (Rocha et al., 2016) in an MCF was numerically demonstrated, being power switching accomplished experimentally (Almeida et al., 2016). Thus, the goal of this work is to contribute to the development of MCF devices, based on LPGs, for transmission systems. LPG based couplers for MCF transmission systems were numerically analyzed as a task of the proposed PhD research, showing promising results (Sousa et al., 2021 ; Sousa et al., 2022). However, the inscription of LPGs in the MCF in a controlled and efficient way is needed for the development of the proposed couplers. Thus, this year, the work focused on the inscription of LPGs in the optical fiber: using CO2 laser irradiation for a permanent inscription and pressure-inducing method for temporary LPGs. It is also planned to cover the LPG inscription in optical fibers using UV laser and femtosecond laser irradiation.

Keywords: *Multi-core fiber, Spatial division multiplexing, Long-period gratings, Optical fiber devices*

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Photonic System enabling Neuromorphic Engineering

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Abstract. Neuromorphic Engineering is an emerging field that aims to implement neurobiological-inspired operations at the hardware level. For that, it has been explored in the implementation of biological neural basic blocks, neurons and synapses, to achieve artificial neural networks capable of receive and process information (Shen et al., 2022). These systems can be useful for biomedical research or for efficiency increasing of computational systems, since traditional computers based on the Von-Neuman architecture are ill-suited to implement these networks with low power consumption, due to the required high volumes of matrix multiplications (Indiveri et al., 2011). Since its appearing in the 90s, Neuromorphic Engineering has been mainly studied in the electrical domain. In the last few years, research started in the optical domain, presenting advantages as high-speed, decreased energy consumption, low size and the possibility to resemble closely neurobiological dynamics in, for instance, the visual optical sensing (Nahmias et al., 2018). To contribute to this area, this work proposes the study of optical materials to be integrated in photonic artificial neural networks. Luminescent materials, such as Ln3+-based and persistent luminescence carbon dots, are processed as neural-inspired waveguides and studied towards their use as artificial neurons and synapses, replicating non-linear activation functions. This is possible due to the ability to tune their emission depending on the characteristics of the applied stimuli (wavelength, intensity, pulse frequency, etc.). Additionally, they offer optical sensing capabilities, such as temperature measurement, introducing the ability to have the neuron's response based on external actions, optically monitored (Dias et al., 2022),(Correia et al., 2023). The ultimate goal of this research is to contribute to the implementation of a photonic neuromorphic system, which could advance our understanding of neural functioning and disorders while also providing a foundation for high efficiency computational systems.

Keywords: *Neuromorphic, Engineering, Photonics, Sensors*

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Can early-stage detection of pathogens in plants be enlighted by luminescent nanoparticles?

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Abstract. The timely detection and diagnosis of plant diseases are crucial for ensuring food security and maintaining plant production. This is especially important when dealing with deadly plant pathogens, as they can cause significant crop losses and damage the economy [1]. It is estimated that plant infections account for 20-40% of global production losses every year [2]. Early-stage pathogen detection is thus crucial for which nanoscience/nanotechnology based sensing technologies may play a decisive role. Luminescent nanomaterials are particularly advantageous for bioimaging and in vivo monitoring, as they offer enhanced sensitivity in depth. A similar approach is here proposed foreseeing the development of bio-compatible functionalized luminescent silicate-based nanoparticles (NPs), obtained by pulsed-laser ablation in liquid (PLAL), targeting specific phytopathogens.

The goal of this work is to develop diagnostic nanoprobes that can detect the Neofusicoccum parvum and Diplodia seriata phytopathogens responsible for grapevine trunk diseases. To achieve this, spectral analysis of grapevine stems was performed using a portable light source and a Vis-NIR spectrometer. These experiments were conducted on both healthy and infected plants, as well as on phytopathogen fungi cultures and growth medium (PDA). The results showed that the emission of materials should be in the 500-650 nm spectral range to avoid chlorophyll absorption bands.

To obtain the NPs, Mn2+-doped Zn2SiO4 ceramic targets were firstly synthesized using solid state reaction. The aim is to optimize photoluminescence (PL) intensity and afterglow, adding different Mn2+ concentrations, assessing the influence of H3BO3, and using lanthanide ions as co-dopants. The targets are being structurally and optically characterized using X-ray diffraction, Raman and PL techniques. Then, NPs production through PLAL will be studied by testing different laser wavelengths and solvents, among other parameters. The toxicity of the resulting NPs will be also assessed using foliar disc analysis and culture-based methods to ensure their safety for plants and to the phytopathogen.

Keywords: *Phytonanodiagnostic; Luminescent nanoparticles (LNPs); Laser processing; Early plant-disease diagnostic; Phytopathogens detection*

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Liquid crystal-based polarization immunosensor for Escherichia coli detection

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Abstract. Bacteria are omnipresent. They can be found in food, water, living beings, and in the surrounding environment, being ubiquitous in nature. Escherichia coli (E. coli) bacteria, existing in contaminated food and water, have been identified as the main cause of several health outbreaks. Although many E. coli strains are nonpathogenic, several are hazardous to our health causing different health complications. In the field of aquaculture, the presence of E. coli in water can indicate the presence of fecal contamination, which can pose a risk to both the aquatic animals being raised and to humans who consume them (Bai et al., 2022). The fast and specific detection of the commensal and pathogenic bacteria E. coli is an essential issue in the aquaculture industry.A novel methodology proposed in the present work demonstrates a basic microfluidics system composed of a glass double-chambered cell with an activated surface for E. coli detection. Anti-E. coli antibodies are immobilized on the glass surface through a complex functionalization procedure. During this process, the dimethyloctadecyl[3-(trimethoxysilyl)propyl]ammonium chloride (DMOAP) is used to induce an homeotropic alignment of the nematic liquid crystal molecules. These functionalized glass surfaces in contact with analyte samples will allow the formation of immunocomplexes by the binding of E. coli bacteria to the anti-E. coli antibodies, if present. To detect the presence of E. coli bacteria, the immunosensor cell is then filled with nematic liquid crystal. Using two cross-polarizers in order to visualize the interaction of the incident light with the liquid crystal molecules (Gupta, Skaife, Dubrovsky, ; Abbott, 1998; Kato, 2002), it was possible to observe the results. For a detection range of 2.8 to 2.8×109 CFUs/mL was attained a limit of detection of 2.8 CFUs/mL. Different methodologies to interpret the results, such as the quantification of the bacteria, are also discussed.Our whole-cell biosensor presents several advantages; it is a low-cost device, of simple optical reading and interpretation, relies in portable technology and allows the detection and fast monitorization of a specific threat with immediate application to the aquaculture field, an increasingly important industry. Moreover, the proposed biosensor can also be used to detect other analytes, such as cortisol, depending on the antibodies used in the functionalization procedure.

Keywords: *Escherichia coli, Liquid Crystal, Biosensor, Optical detection, Bacteria, Aquaculture.*

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Distributed Temperature Sensing in Telecommunications fibers: Proof of concept using a 1064 nm pump

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Abstract. Distributed optical fiber sensor systems (DOFSs) are intrinsic fiber optic sensors, in which all the fiber length is used as a sensing element [1]. Recently, the integration of these DOFSs in data transmission fiber networks, avoiding the deployment of fibers for sensing purposes only, has attracted great interest However, in previous trials [2,3], telecommunications channels were allocated for sensing, reducing the total transmission capacity of the network.
In this work, we propose DOFSs using a pump source with a wavelength away from the standard telecommunications transmission windows, in this way the system could allow simultaneous data transmission and sensing, without depleting the network's transmission capacity. Here, we present a proof of concept of a Raman based DOFS for temperature sensing (distributed temperature sensor (DTS)), in the optical-time domain reflectometry configuration, using a pump source with a wavelength of 1064 nm.
The proposed DTS consists of a 1064 nm source pump with 6.7 W peak power pulses and a 50 ns pulse width, which corresponds to a spatial resolution of 5 m [4], launched in standard single mode fiber (SMF). The backscattered light is filtered, and the Raman Stokes (S) and anti-Stokes (AS) bands power are monitored by an avalanche photodiode. To characterize the DTS, we placed a 408 m long SMF inside a thermal chamber where the temperature varied between 20 ºC and 100 ºC, in 20º C steps. We calculated the ratio between the S and AS powers by taking the average of 10 measurements, for each temperature, to decrease the influence of the pump's power fluctuations. The plot of the averaged ratio vs temperature shows that the ratio increases with the temperature, demonstrating our system's ability to detect temperature.
This proof of concept is a first step towards the development of Raman based DTSs with simultaneous data transmission without compromising the network's data capacity. One of the possible applications of such a system is fire detection in forests or along roads, taking advantage of the installed fiber networks.

Keywords: *Distributed Optical Fiber Sensor, Raman backscattering, Telecommunication fiber network.*

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High performance transparent substrates to disrupt thin film photovoltaics

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Abstract. The demand for green energy solutions already requires using large amounts of critical raw materials. Therefore, one path to ease such requirement is to increase the device's output, which is achieved by bifacial and tandem solar cells. However, to benefit from the increased energy production with these concepts, the solar cell substrates need to offer high optical transparency, electrical conductivity, and an increased performance compared to standard devices. Nanoimprint lithography (NIL) was used to nanofabricate high performance transparent substrates (HPTS), suitable for large scale industry integration (Lopes et al., 2022). There is no established transparent architecture applied to standard solar cells (Keller et al., 2022). Hence, this study proposes different architectures on ITO/glass substrates to provide an enhanced electrical and optical performance: (i) nanopatterned dielectric layer; (ii) periodic array of metal nanoparticles (NPs); and (iii) photonic crystals. We fabricated a pattern at the nanoscale of 200 nm holes with a 2 m pitch, in a scalable manner for the architecture (i). This scheme was developed on ITO/glass substrates and implemented as the rear contact in full (Ag,Cu)(In,Ga)Se2 solar cells. First results showed a blocking behaviour that suggests the need to further studies and optimization. The metal NPs in (ii) followed a metal dewetting process of a NIL patterned substrate, which allowed to obtain single NPs arranged periodically. A proof of concept was already achieved with 350 nm NPs and 2 um pitch. Furthermore, this is a work in progress to obtain the desired NPs scheme regarding the optical simulations performed. Nevertheless, these periodic NPs are compared with a random arrangement. Finally, the photonic crystals in (iii) are dielectric arrays of nanostructures achieved through the fabrication of two different structures: nanopillars and hemispheres. The array of nanopillars with 450 nm diameter spaced by 100 nm resulted in outstanding increase of the diffuse reflection when tested in silicon, 40 % peak versus nearly 0% of silicon. Moreover, the hemispheres structure already provide for a broadband 10 % diffuse reflection. Electrical simulations predict that solar cells with HPTS may reach 96 % of a standard cell performance, plus the illumination from the rear contact contributing to an extra 59 % of its front illumination performance. This demonstrates the relevance of high-performance substrates as a fundamental pillar for bifacial and tandem solar cells.

Keywords: *Bifacial, Light Management, Nanofabrication, Solar Cells, Photonic Crystals*

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Optimizing the performance of perovskite solar cells using gold nanorods: a numerical study

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Abstract. In recent years, several approaches have been developed to improve the performance of perovskite solar cells (PSCs). The photon capture ability is impaired at IR frequencies, because of the significant decrease in the absorption coefficient for photons with energies lower than the bandgap of the commonly used perovskite absorbing layers (typically, 1.5-1.6 eV). Additionally, to mitigate toxicological issues related to lead, it is mandatory to minimize the thickness of the perovskite layer. Hence, there is a demand for an optimization of the optical design of PSCs.

One promising strategy for improving the performance of PSCs is incorporating metallic nanoparticles (NPs) into their architecture (Moakhar et al., 2020). The absorption enhancement offered by the NPs, mainly related to the near-field enhancement at the plasmonic resonance, could deploy the potential to use PSCs with ultra-thin perovskite layers. The plasmonic optical properties of NPs can be fine-tuned, and varying their shape is one of the most suitable approaches to do it. A few theoretical works have optimized the perovskite absorption for different NP sizes and concentrations (Carretero-Palacios et al., 2015; Perrakis et al., 2019). Still, the optimization was done only for spherical NPs, and not always in realistic architectures (multi-layered structures).

This work aims to numerically predict the perovskite (MAPbI3) absorption and near optical field distribution in realistic n-i-p PSCs embedding gold nanorods, the most common non-spherical NPs. FEM-based simulations were implemented to optimize the size, aspect ratio, concentration, and orientation of nanorods, at different positions in the perovskite layer, providing a realistic prediction of the absorption enhancement in PSCs embedding nanorods. The results indicate a strong dependence of the absorption enhancement on the orientation and aspect ratio of the nanorods, being the vertical orientation (parallel to the stacking direction of the structure layers) the optimal one. Furthermore, an optimal aspect ratio exceeding the absorption enhancement for the spherical NP case was achieved. The findings provide valuable insights into the optimization of the optical design of PSCs and could pave the way for the development of more efficient and environmentally friendly solar cells.

Keywords: *Perovskite solar cells, Plasmonics, Metallic nanoparticles, Gold nanorods, FEM-based simulations*

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Tailored nanolaminates for photovoltaic solutions

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Abstract. A decentralized energy system in Europe is critical, and to achieve it, the photovoltaic technological portfolio needs to be upgraded. Not just through novel technologies, which will take time to reach the market, but by improving existing established technologies toward more innovative and efficient solutions. In the specific case of second-generation Cu(In, Ga)Se2 (CIGS) solar cells, recent absorber improvements have allowed for light to power efficiency values above 23%. (Nakamura et al., 2019) Nonetheless, solar cell architecture has been kept mostly unchanged. Diverse strategies can be implemented to patch this, but one of the key aspects is the improvement of the interfaces, by implementing passivated selective contacts, for holes and electrons, enhancing carrier collection. (Stanbery et al., 2022) When developing such contacts, distinct, and sometimes competing, properties need to be kept in mind since they must exist simultaneously (band alignment, optical constants, conductivity, interface defects, among others). When devising devices, applications designers are limited by choice of materials and often, there must be a compromise. Therefore, what if we could reverse engineering materials processes, developing materials for a specific application? In this work, the use of nanolaminates to develop key sections of a CIGS solar cell is proposed. A nanolaminate system is a nanometric multilayer concept of alternating materials, whose properties are highly tuneable depending on each sublayer composition and thickness. (Hultman et al., 2007; Zhukovsky et al., 2015) Schemes gathering a high interface/bulk ratio and "deep subwavelength" sublayers can lead to properties that exceed the ones from the individual materials used as sublayers. (Azadmanjiri et al., 2014, 2016; Nasim et al., 2020) For now, the possibility of developing customized electron selective contacts for CIGS, based on nanolaminates, was explored. Diverse multilayer systems of dielectric materials, such as SiOx, SiNx, TiOx, ZnOx, and HfOx, were developed through Plasma Enhanced Chemical Vapour Deposition and Physical Vapour Deposition and studied, as well as their single layer counterparts, to evaluate their applicability. We conducted an in-depth fundamental study of structural, elemental composition, electronic, optical, and electrical properties, using X-Ray Diffraction, Scanning Transmission Electron Microscopy, X-Ray and Ultraviolet Photoelectron, and Impedance Spectroscopy, Ellipsometry, among other techniques. The obtained results clearly indicate the possibility of tailoring properties to match technological requirements, when varying the nanolaminates' architecture. Furthermore, a TiOx-ZnOx nanolaminate showed promising optical properties and electronic potential to be tailored, in order to achieve a selective electron contact in CIGS solar cells.

Keywords: *Nanolaminates, Tailored properties, CIGS, Selective Contacts, Dielectric materials*

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Light Management and Passivation Strategies in Chalcogenide Thin Film Technologies

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Abstract. Despite the monocrystalline silicon dominance of the photovoltaics market, there is an urgent need for cost-effective technologies that are, at the same time, efficient and compatible with building-integrated photovoltaics applications. Thin film solar cells allow for a reduction in material consumption compared to conventional monocrystalline Si, while maintaining high performance (Nakamura et al. 2019). Cu(In,Ga)Se2 (CIGS) and CdTe have reached conversion efficiency values above 22% (Nakamura et al. 2019; PV-tech, 2016). Although being close in efficiency record values, each technology shares limitations related with optoelectronic performance and lack of light management strategies. A breakthrough being sought in CIGS technology is thinning down the absorber to the ultrathin range (<1m), as it enables a decrease in manufacturing time and critical materials usage. However, this approach has drawbacks, such as increased rear interface recombination and incomplete light absorption, which have led to an 8% efficiency gap to the thin film counterpart (Nakamura et al. 2019; Mansfield et al. 2018). Nonetheless, simulation works have proposed efficiency values above 20% by tackling these downfalls (Violas et al. 2022). To address rear interface recombination, a high passivating area SiOx nano-scheme was developed. Ultimately, this architecture allows for a 100mV open circuit voltage (VOC) increase compared to an ultrathin reference device. Regarding the optical losses, two approaches were followed: i) the development of a "moth-eye"architecture, consisting of randomly nano-spaced pillars. This design enables for a broadband and omnidirectional anti-reflectance; and ii) a scattering architecture based on metallic nanoparticles deposited through a microfluidic procedure and encapsulated with a dielectric matrix, ultimately achieving a VOC and short circuit current density (JSC) gain over a reference cell. Optical simulations were also performed to design scattering schemes to further optimize the JSC gain, using plasmonic nanoparticles and dielectric photonic crystals.Regarding CdTe devices, the conversion efficiency can be improved by adding Se. Se alloying enables a JSC improvement, as it leads to a bandgap energy value decrease (Romeo and Artegiani 2021). Furthermore, it has been associated with increased minority carrier lifetimes and favourable band alignment, allowing for high VOC values (Zheng et al. 2019). The solar cell performance can be further optimized by an appropriate Se gradient profile control (Zheng et al. 2019). Thus, an optical model baseline of CdSexTe1-x solar cells was developed. Spectroscopic ellipsometry measurements were conducted to accurately extract the optical constants of evaporated CdSexTe1-x layers providing crucial data for future modelling and optimization works.

Keywords: *Photovoltaics; CIGS; CdSexTe1-x; Light Management; Passivation*

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Biomaterials based on multifunctional bioglass for dental implant coatings

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Abstract. Dental implant placement-associated biofilm is a severe complication affecting the adjacent soft and hard tissue, resulting in its infection and inflammation. This could develop in peri-implantitis, a chronic inflammatory disease that progressively leads to the loss of bone around the implant and thus the need for additional surgeries. These problems could be solved through the development of implants coated with bioactive glass. It has been reported that utilizing bioglass as a coating on dental implants can enhance tissue integration and improve their functionality [1-3]. Furthermore, 45S5 bioglass® has demonstrated effective antimicrobial properties against a range of bacteria by releasing sodium and calcium ions that disrupt the cell membrane and hinder the growth of microorganisms [4-5]. This work aims to address issues in the dental implant sector by developing a biomaterial for implant coatings using 45S5 Bioglass® modified with Cu, Fe, Zr, and Nb ions. Structural and morphological analyses were conducted on the samples using a variety of techniques. In addition, the biocompatibility of the bioactive glasses with human osteosarcoma SAOS-2 cells was assessed, and in vitro bioactivity tests were carried out by immersing the samples in simulated body fluid (SBF). The antibacterial activity of the modified biomaterial was evaluated using Bioglass bacteria, including Staphylococcus aureus, Streptococcus mutans, and Escherichia coli, which are known to be involved in the formation of pathogenic biofilms. The Results show that all of the bioglasses exhibited antibacterial activity against the tested bacteria and showed no cytotoxicity for the Saos-2 cell line at concentrations up to 25 mg/mL. The bioactivity test in SBF revealed that all samples developed a CaP-rich layer on their sample within 24 hours.

Keywords: *Bioglass; Bioativity; Antibacterial; Biocompatibility*

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Physics - MAP-Fis

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Black hole shadows, exotic stars, and all that jazz

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Abstract. In April 2019, the Event Horizon Telescope (EHT) collaboration announced to the world the first photograph of a black hole. A peculiar image whose striking feature is a central dark region surrounded by a bright orange ring (due to hot matter accreting into the black hole). The central dark region is what we call the shadow of the black hole, and it is a consequence of the extreme light bending in the vicinity of the hole – the light trajectories that are bent into the black hole and become trapped forever. From a theoretical point of view though, black holes might not be the only objects capable of such extreme distortion of light. Some families of exotic stars can become compact enough to twist light trajectories and produce images that resemble the ones of black holes. Thus, understanding the distinctive features of such images is going to be essential for us to be able to probe the nature of the astrophysical objects out there.

Keywords: *black holes, gravity, physics*

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Upconverting Nanoparticles: Shedding Light on Liquid Water Anomalies

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Abstract. Water is a ubiquitous and essential liquid that plays a vital role in various industrial and biological processes.1 However, despite its common use, water's anomalous behavior makes it the least understood among common liquids. Recent research has shown that water molecules exhibit two distinct organizations in the supercooled regime, presenting a low-density liquid (LDL), with a more organized tetrahedral hydrogen-bonding network, and a high-density liquid (HDL), with a distorted tetrahedral configuration.2 These distinct motifs may coexist under ambient conditions, and their mixed properties may explain the anomalous behavior of water. To shed light on this topic, we have developed a novel experimental approach to investigating the temperature-dependent Brownian velocity of upconverting nanoparticles (UCNPs) suspended in water.3 The thermal motion of UCNPs arises from the particle-solvent interactions, and the trends in the temperature-dependent Brownian velocity can provide powerful information on the temperature dependence of the hydrogen-bond network in the vicinity of the UCNPs. Our work has shown that the bilinear trend of the instantaneous Brownian velocity of water-suspended UCNPs at ambient conditions presents a crossover temperature (TC) related to the LDL-to-HDL conversion. Changes in the size of the UCNPs or the pH of the aqueous media result in variations of TC that resemble the effect of changing the temperature and pressure in the phase diagram of pure liquid water, respectively. Notably, UCNPs suspended in other solvents containing hydrogen bonds do not exhibit such behavior in their temperature-dependent Brownian velocity trend, highlighting the relevance of our findings. Our experimental evidence supports the existence of two distinct organizations of water molecules under ambient conditions and paves the way for revolutionizing the understanding of biochemistry since water's anomalous properties may be fundamental for the existence of life as we know it.

Keywords: *Water, Thermometry, Luminescence, Anomalies, Nanoparticles*

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Development of Hybrid Nanostructured Electrochemical Sensors for Monitoring Water Contaminants

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Abstract. Microcystin-LR is a cyanobacterial metabolite, which is categorized as a human carcinogen and can create several physiological and metabolism disorders in animals and plants. On the other hand, ibuprofen is an anti-inflammatory drug with growing consumption, making it one of the most used pharmaceuticals worldwide. However, overexposure to ibuprofen, via drinking water or bioaccumulation in food items, may lead to liver, intestine, or kidney injuries in humans. Since the two contaminants have been detected in aquatic environments, effective monitoring tools are crucial to understanding their occurrence, fate, and impact. Traditional analytical techniques require complex, expensive, and sizable equipment, rendering them inadequate. However, progress in nanotechnology and sensor development has the potential to deliver new sensing systems based on novel nanostructured hybrid materials, which show improved performance due to their unique electrical and chemical properties offering various benefits for (bio)sensing.

This Ph.D. project proposes the design of advanced electrochemical sensors for monitoring biotoxins and pharmaceutical water contaminants. To address the main challenges such as enhancing transducer performance, increasing sensitivity and selectivity, shortening response time, and improving reproducibility, nanostructured surfaces based on gold, laser-induced graphene, covalent organic frameworks, and molecularly imprinted polymers will be used. The development of the nanomaterials will encompass a thorough investigation of specific fabrication approaches, characterization processes, tuning properties, integration methodologies and sensing strategies. The new sensing tools will be evaluated regarding their performance, validated using gold-standard methods, and combined with dedicated detection systems.

The nanostructured gold and laser-induced graphene surfaces provide enhanced surface area, conductivity, and electron transfer capability, which is expected to result in superior transducer performance. Additionally, the selectivity of the sensing tools will be enhanced through the integration of covalent organic frameworks and molecularly imprinted polymers, which will function as biorecognition elements and further augment the active surface area. These advancements in nanostructured electrochemical sensors will give a fresh impetus to the development of innovative technologies for environmental monitoring, ultimately benefiting the public health and environmental policymaking.

Keywords: *Electrochemical sensors, nanostructured materials, water contaminants, biotoxins, pharmaceuticals, environmental monitoring.*

Acknowledgements. This PhD project will be developed in collaboration with the International Iberian Nanotechnology Laboratory, the Institute for Nanostructures, Nanomodelling and Nanofabrication, and CINBIO (University of Vigo). T.M. acknowledges the FCT - Fundação para a Ciência e a Tecnologia, I. P, for the Ph.D. research Grant 2022.13224.BD.

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Online Coupled Atmospheric-aerosol Regional Forecast Model for Solar Energy Production

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Abstract. Solar radiation has been explored for energy usage purposes as a renewable energy source. The installation and running of solar energy systems require a good solar radiation climatology and radiation forecast. Such information has been obtained to a great extent using atmospheric numerical models, but aerosol interaction with radiation and clouds is frequently omitted in these models. However, the radiative forcing of aerosols and clouds can be considerable under particular conditions. It is now established that atmospheric aerosols must be included in atmospheric and climate models to improve numerical weather prediction (NWP) and climate simulations. Despite the existence of studies on the feedback mechanisms related with aerosols, there are still scientific questions to answer regarding their influence on the radiation budget, atmospheric dynamics, and thermodynamics. The work proposed here intends to include the effects of the aerosols in NWP and climate models, by implementing an online coupled atmospheric-chemistry model for the Iberian Peninsula, and hence improve the radiation simulation at the surface for solar energy production.

Keywords: *WRF-Chem, online model, Iberian Peninsula, aerosol-radiation-cloud interactions*

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Multidimensional hyperspectral microscopy applied to luminescent nanoparticles for molecular thermometry.

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Abstract. Hyperspectral microscopy and remote sensing via ratiometric luminescence thermometry are both innovative techniques that have been gaining popularity in recent years. Hyperspectral microscopy combines spectroscopy with optical microscopy to obtain both spatial and spectral information simultaneously, while remote sensing via ratiometric luminescence thermometry using trivalent lanthanide ions (Ln(III)) allows for temperature determination based on well-established physical principles. The significance of hyperspectral imaging in biomedical applications has become increasingly apparent, especially in the identification of pathogens and cancerous cells, monitoring bioimaging agents, and the cellular uptake of nanoparticles. On the other hand, remote sensing via ratiometric luminescence thermometry is a promising technique that has numerous applications and has gained popularity in recent years. However, most currently available Ln(III)-based luminescent thermometers require calibration using a reference thermal probe (secondary thermometers) and require frequent recalibration, which can be impractical, particularly when used in different media. Despite the challenges of calibration, primary thermometers based on well-established physical principles are the only way to ensure accuracy. While primary luminescent thermometers are rare, combining ratiometric data from the excitation spectrum of Ln(III) with the emission spectrum can lead to thermometers that do not require calibration (primary-S). The accuracy of these thermometers can be unparalleled, with an accuracy of 0.2% achieved in the physiological range. In the case of Yb3+/Er3+-codoped Gd2O3 nanoparticles, hyperspectral imaging was utilized to identify their location and track their movement within the cell structure. By analyzing 2D optical images acquired in different planes along with the cell culture depth, the internalization of the particles by MNT-1 cells and their 3D localization in a fixed configuration were determined. The emission signature of the nanoparticles also enabled the determination of the intracellular temperature. Although the techniques are different, both hyperspectral microscopy and remote sensing via ratiometric luminescence thermometry have demonstrated their potential in biomedical applications and could pave the way for further advancements in the field.

Keywords: *: hyperspectral images, 3D localization, trivalent lanthanide ions, primary luminescent thermometers*

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Pseudo-analytic Approximation for Spherical Boson Stars

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Abstract. In our Project, we shall construct a Pseudo-analytic approximation of a static and spherically-symmetric Boson Star Solution with a complex massive scalar field .
Given a Boson Star, we get a special combination of Chebyshev polynomials as the basis designed to satisfy the Boundary conditions.
We use Galerkin method to get the coefficients for the bases.
All the information for the Boson Star family of solutions is contained in three matrices. The precision is better than 10ˆ-3. We also check it in Einstein Equation and Klein-Gordon Equation.
We calculate the approximation both in Schwarzschild-like coordinates and isotropic coordinates.

Keywords: *nan*

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Lanthanide-based logic: a promising approach in the field of molecular computing

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Abstract. The exponential growth of information, along with the evolution of networking and the Internet of Things, is posing significant technological challenges. With Si-based integrated chips approaching their miniaturization limit, a new generation of efficient computing systems is needed. Molecular computing, which uses molecules to perform logic operations, has the potential to play a decisive role in the future of the computer industry. Molecular logic gates, like electronic devices, can be stimulated by various input signals to produce optical outputs according to a defined logical transfer function. Ln3+-based materials are particularly promising for molecular logic due to their ability to respond to both chemical and physical stimuli and their unique photophysical properties that make them suitable for photonics applications.
This presentation will focus on the main contributions of Ln3+ -based materials in molecular logic, discussing their potential to integrate with the future molecular photonic-electronic hybrid logic computing system. Examples of molecular logic devices that use Ln3+ and physical stimuli, developed in the Phantom-g research group, will be presented, describing several approaches to define diverse logic functions with distinct degrees of computing complexity such as reconfiguration, reprogramming, and concatenation. The molecular logic gates described respond to a broad variety of physical inputs such as time, temperature, UV radiation, and among others making a further step in the definition of logic operations in the solid state.

Keywords: *Molecular logic, luminescence, physical inputs*

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Stability and physical properties of spherical excited scalar boson stars

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Abstract. We study the time evolution of spherical, excited -- with n radial nodes -- scalar boson stars in General Relativity minimally coupled to a complex massive scalar field with quartic self-interactions. We report that these stars, with up to $n=10$, can be made dynamically stable, up to timescales of $t\sim\frac{10^{4}}{c\mu}$, where μ is the inverse Compton wavelength of the scalar particle, for sufficiently large values of the self-interactions coupling constant λ, which depend on n. We observe that the compactness of these solutions is rather insensitive to n, for large λ and fixed frequency. Generically, along the branches where stability was studied, these excited boson stars are not compact enough to allow for innermost stable circular orbits or light rings. Finally, we discuss the angular velocity of particles along timelike circular orbits, suggesting an application, for solutions in the Newtonian limit, to galactic rotation curves.

Keywords: *nan*

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PIIC - 1st/2nd cycles

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Fur4Star - Development of starch/furan-based bioplastics with enhanced physicochemical and mechanical performance

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Abstract. Currently, plastic is one of the main sources of pollution on our planet, because many of its widerange of applications and the substances that make it up are not biodegradable, taking more than 100years to decompose. As alternative, biodegradable plastics (bioplastics) have been developed. Starch is aone of the biomolecules used to develop bioplastics. However, by itself, starch does not have the desiredhydrophobicity and mechanical strength. To overcome these issues, starch has been blended with othermolecules. In this work, the feasibility of using furan-based polymers, synthetic biodegradable polymers,namely poly(butylene 2,5-furandicarboxylate, PBF), to enhance the performance of starch-basedbioplastics is being studied. The influence of PBF concentration on wettability and traction resistance ofstarch-based bioplastics is being studied. So far, the results demonstrated that at least 15% PBF is requiredto increase the water tolerance and tensile strength starch-based films, indicating that PBF can be a goodchoice to overcome the hydrophilicity and brittleness of starch-based bioplastics.

Keywords: *Bioplastics; Starch; Furan; Melt-mixing; Hot-pressing*

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Plurilingual Kamishibaï Contest An innovative tool for spreading language awareness.

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Abstract. In the context of equal access to inclusive quality education, the European Union and the Council of Europe consider it essential to manage the linguistic repertoire of pupils in an effective, equitable and socially fair way for all members. With that in mind, the contribution aims to highlight the importance of the Plurilingual Kamishibai Contest. Kamishibai as a traditional practice originates from Japan. It can sometimes be referred to as "paper theater"or "picture theater". It consists of telling a story using illustrated boards placed in a butai (a wooden box with three doors).
The Plurilingual Kamishibai Contest represents a great opportunity to enter into multilingual education through an artistic project open to the languages of a group of children. The contest becomes a pretext to engage in actions of opening to diversity. In this sense, it is not the final product that counts but rather the process implemented by each group.
The Plurilingual Kamishibai Contest was launched in 2015 by the French-based association Dulala and it has quickly become established and expanded to other territories, including Portugal in 2018 to encourage education professionals, especially teachers, to enter in a plurilingual and intercultural education. The Plurilingual Kamishibai is likely to accommodate all the languages of the class. The previous editions of the contest in different countries and on different scales have shown, through several hundreds of kamishibais, the use of a multitude of languages, whether regional, national, international, official, known or less known! The aim is to show that every language is a resource for the child and for the group/ class.

Keywords: *nan*

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Laser technology in the local transformation on Fe2O3 surfaces

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Abstract. The application of laser technology for surface modification is well known in several application fields, with very high versatility. The viability of using laser irradiation to promote electrically conductive pathways on the surface of insulator materials is demonstrated. This was performed mainly through the laser-induced conversion of a hematite (-Fe2 O3) surface into a magnetite (Fe3O4) pathway. The results evidence the ability of laser technology to transform an electric insulator phase (-Fe2O3) into a conductive material (Fe3O4), being possible to promote a localized electrical pathway. Optimal laser speeds and laser powers that promote larger magnetite pathway widths, depths and grain sizes and therefore higher electrical conductivity, were also observed. The optimization of the laser processing parameters allowed a maximum magnetite pathway width of 218 ± 8 m, depth of 66 ± 2 m. A maximum conductivity of 1062 ± 6 mS/m was reached for a laser power of 90 W, which corresponds to the highest magnetite grain size. The effect of temperature on the electrical resistance was also studied, showing an inverse relation between the two. Lastly, the effect of humidity on the electrical resistance of a pair of parallel pathways, was studied, reveling is sensitivity to it. This procedure was also repeated for three other oxides: TiO2, Nb2O5 and Cr2O3. This study allows foreseeing applications in other oxide systems to promote localized electrical pathways on insulator surfaces, to be applied as future ceramic sensors.

Keywords: *nan*

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The REVEALING Project: virtual reality in education

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Abstract. The increased interest in the use of Virtual Reality (VR) technology allows new opportunities for teaching and learning to emerge. However, to effectively use VR in education, it is crucial to develop instructional design models and teaching resources that any educator can use in their teaching practices.
In this context, the REVEALING project (REalisation of Virtual REALity Learning Environments for Higher Education) funded by Erasmus + programme of the European Union, aims to create Virtual Reality learning environments (VRLEs) to be implemented in Higher Education Institutions (HEIs) using VRChat plataform. This project involves six partners: Johannes Gutenberg-Univsersitatmainz (Germany) - Coordinating Institution, Panepistimio Aigaiou (Greece), Universidade Aberta (Portugal), European Association of Erasmus Coordinators (Cyprus), IDEC (Greece) and Pedagogical University of Krakow (Poland). The VRLEs environments will resemble virtual classrooms, with students and teachers with their avatars with various characteristics (gender, race, age, among others), and with the didactic material of the class more immersive and interactive.
During the project I participated in, it was important for me to acquire skills through various activities. It was essential for the project's success that I learned how to search for resources to create a directory on different platforms, which required great research and organizational skills.
Another activity that contributed greatly to my development was participating in the project's activity planning, which allowed me to work in a team to ensure that all stages were aligned with the final goal. Additionally, I had the opportunity to experience virtual reality and better understand its functioning and potential.
The project I participated in was part of the Erasmus+ program, which allowed me to have a broader view of its functioning and the opportunities it offers. It was interesting to understand how this European initiative promotes international cooperation and mobility for young students and professionals in different areas of knowledge.
Another important activity I participated in was project management, which included registering dissemination activities. This allowed me to understand the importance of documenting all stages of the project and how disseminating information can amplify its impact.
To conclude the experience, I will work on writing an article and creating news for the project's dissemination. I will also have the opportunity to participate in exhibitions and classes related to the project's theme, which will allow me to continue learning and sharing knowledge with other people interested in the subject.

Keywords: *VRLEs, Virtual Reality (VR), Immersion, Interactive, Higher Education Institutions (HEI), VRChat*

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Bioactive zirconia dental implant surface functionalisation via laser technology: mineralisation behaviour and cells morphology

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Abstract. In the natural dental system, the alveolar bone, periodontal ligament and healthy gums ensure and support chewing without occlusal load. However, this system suffers daily exposure to several physical and chemical factors that cause deterioration and can lead to total tooth loss (Mesquita-Guimarães et al., 2020), (Galarraga-Vinueza et al., 2018). The area of dental implantology has significantly improved the quality of life of many people. Recently this industry has been investing in zirconia-based implants. Several studies have been conducted to improve zirconia's bioactive characteristics, making it an increasingly functional material to promote rapid osseointegration (Chopra et al., 2021), (Qu et al., 2021). In this topic, surface modification to bioactive, antibacterial and angiogenic coatings has gained significant relevance (Sun et al., 2021). In this work, three patterns were laser textured on zirconia and coated with a mesoporous bioactive glass S53P4 to improve cellular activity. The coatings were sintered using conventional and a laser sintering treatment to evaluate laser sintering as a potential fast sintering process. Analyses using SEM, profilometry, XRD and EDS were performed to select the optimised laser parameters and obtain the best quality patterns and bioactive coatings. The in vitro tests as apatite mineralisation, cell morphology and viability expression in MC3T3-E1 cells were performed to address the best pattern and sintering condition as the candidate of a new mesoporous bioactive coating for zirconia dental implants osteointegration improvement.

Keywords: *Zirconia Dental implants; Laser surface functionalisation; cell differentiation*

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TAMAT: A Web App for question authoring and math content sharing

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Abstract. TAMAT[6] is a newly developed web application with two main objectives: to author a wide range of parametrized questions for Moodle[1], SIACUA[2,3,4], and other computer systems, and to share digital content for learning mathematics.
This web application created using C#, SQL, and Javascript, extends the functionality of MCQEditor[5] to allow for the creation of various types of parametrized questions. Users with minimal programming knowledge can easily create parametrized questions using simple parameters without requiring knowledge of Python. TAMAT is more versatile than using Moodle directly and allows questions to be exported to various formats such as Moodle, SIACUA, and LaTeX.
Additionally, the system's secondary goal is to make it easier for teachers to search for existing digital materials using tags, the Mathematics Subject Classification[7], and searching all data fields of the digital content to minimize waste of resources and prevent duplication of effort.

Keywords: *Mathematics, Web application, Parametrized questions, Moodle, Reusing*

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[4]Sistema Interativo de Ensino e Aprendizagem da Universidade de Aveiro (SIACUA), https://siacua.web.ua.pt
[5] Multiple Choice Question Editor (MCQEditor). https://mcqeditor.web.ua.pt/
[6] Teaching and Assessment in Mathematics (TAMAT). https://tamat.web.ua.pt/
[7] Mathematics Subject Classification (MSC). https://mathscinet.ams.org/mathscinet/msc/

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Tasks using Poly-Universe – An Experiment with 7th grade Portuguese Students

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Abstract. The present work was developed within the framework of the Scientific Initiation Scholarship Programme (BII in Portuguese), a programme that promotes the integration of students in research teams in the field of Education, especially the "PUNTE – Poly-UNiverse in Teacher Training Education" project.The main objective was to analyse how the didactic instruments available through Poly-Universe and the tasks developed could be integrated into the teaching and learning of contents of the 7th grade of elementary school. In order to achieve this objective, an exploratory study was carried out with 7th grade students, adopting a qualitative methodology. In line with the previous goal, geometry tasks were designed with a focus on geometric visualisation as well as the composition and decomposition of figures that served as support for students to infer Euler's formula using the Poly-Universe pieces.
Through the analysis of the students' activity using the Poly-Universe pieces, it was concluded that the resource should be integrated into teaching practises and contents, in the specific case of geometry, since it constituted a support for the resolution of the proposed tasks. It can be concluded that the application of the Poly-Universe was extremely important to get the full attention of the students, which allowed them to have better results.
The dynamic aspect of the pieces allowed the students to follow the path from the construction of different figures through the manipulation of the Poly-Universe pieces, to the identification of regularities through the visualisation of the constructions carried out, promoting abstraction.

Keywords: *PUNTE; Poly-UNiverse; PIC-Edu*

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Tasks using Poly- Universe - A STEAM Approach

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Abstract. Tasks using Poly- Universe - A STEAM ApproachThis work is developed under the Scientific Initiation Programme (PII) with the project "PUNTE - Poly-UNiverse in Teacher Training Education"promoting the integration of students in research and, working on projects in the area of Education.One of the objectives of this work was an interdisciplinary approach, which began with the exploration of stories, designed with a certain intentionality in order to establish connections with the various disciplinary contents. Another objective of the work, was to focus on mathematics, and work as a didactic tool in teaching and learning mathematics, using the Poly-Universe didactic material.
To answer this goal, the research assumes a qualitative case study plan, based on a descriptive-interpretive paradigm, with the application of didactic materials, namely the Poly-Universe pieces, in a 4th grade class of the 1st cycle of basic education.
Creative stories were developed to answer the research question: Are stories important in the development of students' mathematical skills, using the Poly-Universe didactic materials?
At the culmination of the operationalization of the tasks performed by students, it is concluded that through the handling and creation of stories, they will enjoy the opportunity to formulate hypotheses, experiment, analyse, investigate, optimise, evaluate and reformulate strategies, with the teacher being only the mediator.Thus, it can be concluded that the use of the didactic material, Poly-Universe, is a material that allied to the STEAM approach, provides students with the opportunity to develop skills for their future, namely problem solving and creativity.keywords: Poly-universe, , Manipulative tools, STEAM, and interdisciplinarity

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Keywords: *Edication STEAM*

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Digital ELP - Enhancement of language biographies

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Abstract. In a mobile world, where the European Union is destined to become an increasingly interconnected space with a common identity, the Council of the European Union calls for the construction of a European education area, which would be a space where "education would not be hindered by borders". Spending part of one's education in another state would become the norm. Thus, while the acquisition of multilingual (linguistic and social) skills is increasingly recognized as a competitive advantage as well as a means of strengthening social cohesion, it is becoming strategic to acquire effective resources, by exploiting the new possibilities offered by digital technology. Indeed, we want to complete the modernization of an already existing tool that has proven to be very useful - the European Language Portfolio (ELP) - by offering a new digital dimension to make it more accessible, sustainable, fun, and interactive. Today the portfolio approach seems more relevant than ever because it encourages the global and continuous consideration of pupils, the promotion of formal and informal learning and the diversity of school and family cultures. The context is therefore conducive to the invention of new tools, whose usefulness will be quickly perceived, especially when they are accompanied by a robust training path - which we propose - to accompany the change in the practices of all those involved in education.
The main objective of this project is therefore to ensure a better consideration, appreciation, and promotion of multilingual profiles in the school area, so that they are perceived and considered as a wealth and a resource, but also to value the diversity of languages present in the environment of monolingual children.
Following the logic of action research, training activities, dissemination and intellectual productions will be set up based on field experiences and research.
The expected results are an educational guide, a digital application inspired by the European language portfolio and an international training course. Questionnaires were implemented aiming to know the impressions of teachers, family members and students about the ELP, as well as the possible interest in using this digital application. The results obtained in Portugal show a great lack of knowledge about the portfolio. In this context, it is imperative to implement a set of measures aimed at promoting the recognition of students' linguistic and intercultural journeys.

Keywords: *European Language Portfolio, Language diversity, Tecnology, Inclusive Society*

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Robust Mortality Prediction on a Recirculating Aquaculture System

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Abstract. Aquaculture presents itself as one of the most rapidly developing means of sustainable production of animal protein to feed the ever-growing populations. Recirculating Aquaculture Systems offer higher control and fewer inconveniences than traditional systems, making them an attractive option for fish production. Although the sector's digitalization is in its early stages, its application should increase its rentability while conserving the environment. This project aims to promote the sector's evolution by assessing parameter importance on mortality, verifying the method's robustness, and evaluating the concept's relevance in predicting categorical mortality values. In particular, to better understand the aquaculture production process through a systematic data evaluation and exploration based on real-time data acquisition. Moreover, algorithm robustness plays a key ingredient in this application since measurements are greatly affected by errors. Such invalidates the application of traditional machine learning methods, where models are sensitive to production data variations and sensor noise. The study found the parameters that play relevant roles in the production phases. While the obtained predictive metrics are still sub-optimal, they clearly show the impact costs of using adjusted machine learning metrics, the importance of data rounding on pre-processing, and directions of improvement regarding data acquisition and transformation.

Keywords: *Digitizing Aquaculture; Recirculating Aquaculture Systems; Machine Learning; Sustainability; Populational Growth*

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Improving the purification of RNA using biocompatible ionic liquids as agents for aqueous biphasic systems formation

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Abstract. RNA holds promising potential as a biopharmaceutical either to prevent and treat several human diseases. Nevertheless, the unstable nature of RNA, as well as the expensive methods currently required for its extraction and purification still constitute serious barriers toward its broad application. In this sense, a set of amino-acid-based ionic liquids (AA-ILs) is herein studied as phase-forming agents of aqueous biphasic systems (ABS), ultimately applied for the isolation and further storage of RNA. On the basis of the high affinity of RNA toward amino-acids [1], the global aim of this work is to purify RNA from complex bacterial lysates, envisaging at the end the development of integrated purification-preservation platforms able to guarantee that the integrity of RNA is preserved throughout the purification process.

AA-ILs comprising cholinium as the cation and L-phenylalanine, L-tyrosine, DL-aspartate or chloride as the anions were studied ([Ch][Phe], [Ch][Tyr], [Ch][Asp] and [Ch][Cl], respectively). These AA-ILs were synthetised by a neutralization reaction between choline bicarbonate and the respective amino acid, with a slight equimolar excess, in methanol reaction medium [2]. All AA-ILs in study were able to form ABS with polypropylene glycol with a molecular weight of 400 g mol-1 (PPG 400) and were subsequently studied for the extraction of RNA from bacterial lysates. After the separation of two phases, nucleic acids were recovered by alcohol precipitation and analysed by electrophoresis to verify if the structural integrity of the RNA is maintained throughout the process [1]. Ongoing work is focused on the optimization of the extraction process, namely to obtain high-quality and high-purity RNA

In general, this method will avoid the use of volatile solvents and reduce the need for freezing RNA, thus decreasing the environmental and economic impacts in the isolation and storage of the biomolecule. A better understanding of the behaviour in the different AA-IL ABS allows to take a step forward towards the development of RNA-based therapeutics as well as to obtain high-quality RNA molecules for research purposes.

Keywords: *Aqueous biphasic systems, Amino-acid ionic liquid, Extraction, Purification, Sustainability, Biopharmaceuticals.*

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Assessing the metabolic crosstalk in the pancreatic cancer microenvironment through metabolomics of 3D in vitro models

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Abstract. In pancreatic cancer (PC), malignant cells are surrounded by a dense and stratified stroma, which plays an intricate role in tumour progression, aggressiveness, and resistance to treatment. Cancer-associated fibroblasts (CAFs), which are abundant stromal cells in the PC TME, are key producers/regulators of most extracellular matrix components and strongly associate with immune regulation, drug resistance and metastasis. Hence, characterizing the crosstalk between PC cells and CAFs is of utmost important to improve current understanding of PC behaviour and to unveil new therapeutic targets. In this work, we have developed monoculture and co-culture 3D models of PC cells and CAFs and we have investigated their metabolic activity by NMR exometabolomics.

Keywords: *Pancreatic adenocarcinoma; fibroblasts; tumour microenvironment; cell metabolism; NMR spectroscopy; metabolic profiling*

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Self-regulated learning and well-being in university students

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Abstract. In recent years, there has been a growing interest in studying the relationship between self-regulated learning (SRL) and well-being (WB) in students, mainly university students. These often report exhaustion from academic work, high levels of distress and anxiety and compromised academic learning (Davis ; Hadwin, 2021).
Self-regulated learning (SRL) despite presenting a complex conceptualization, it can be understood as the metacognitive, motivational and behavioural processes that students use during learning (Zimmerman, 2013) to achieve their academic goals.
Well-being (WB) can be explained in two main perspectives: hedonic and eudaimonic. The hedonic view focuses on happiness, obtaining pleasure and avoiding pain. The eudaimonia, which understands that WB is more than happiness per se, is concerned with living well or realizing human potential (Ryan ; Deci, 2001).
Thus, it is important to understand how these constructs are related. In under the PIC-EDU program, we are performing a literature review of papers that focus on SRL and WB in university students, particularly: a) the operationalization of SRL and WB; b) the theoretical models associated with each of the constructs; c) the instruments used to measure and the relationship between them and d) the conclusions of how the constructs relate to each other.
Initial results indicated that psychological well-being has been the component of WB must study in this area and SRL is often operationalized as strategies or components of regulation. Instruments that relate to the two constructs are predominantly qualitative methods. In contrast, quantitative methods seem preferable to collect data on a single construct. Even though many studies associate the two constructs, it is not clear if WB and SRL have or not a causal relationship. For future investigation, it could be interesting to study this relationship. Our review is still in progress.

Keywords: *Self-regulated learning, Well-being, University students, Literature review*

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Hydrophobic paper-based substrates for SERS detection of pesticides in water

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Abstract. Due to the constant population increase, the demand for food is increasing, and in turn, large amounts of pesticides have been used in agriculture to increase production. When pesticides are applied to fields, they can be washed away by rainwater or irrigation, resulting in runoff that contaminates nearby rivers, lakes and groundwater. This can lead to the contamination of drinking water sources, posing risks to the health of humans and animals [1]. Therefore, monitoring trace levels of pesticides in water is crucial in identifying potential risks and implementing appropriate measures to protect public health. Surface-enhanced Raman spectroscopy (SERS) has been explored as an alternative to conventional analytical methods for detecting pesticides [2]. Developing materials that can act as highly sensitive substrates in SERS is crucial in this type of surface analysis. In this context, hydrophobic SERS substrates are attracting significant attention because they allow the analyte molecules to concentrate in a smaller area of the sensor, thereby increasing its sensitivity [2].
This research work aimed to prepare paper-based hydrophobic substrates for the SERS detection of pesticides in water. First, inks containing different percentages of poly (tert-butyl acrylate) [PtBA], a hydrophobic polymer, were produced and printed on paper with the aid of a conventional inkjet printer. Paper with different hydrophobic levels was manufactured, changing the % of the polymer on the ink and the number of printed layers. The hydrophobicity of the papers was evaluated by water contact angle measurements. After that, silver nanoparticles were spin-coated on the hydrophobic papers to produce SERS sensors with high sensitivity for pesticide detection. SERS performance of the substrates was optimized by varying the number of Ag deposited layers and the concentration of the silver colloid, using thiram as a pesticide model. The results of our research demonstrate that the hydrophobic paper-based SERS substrates allow the detection of thiram at concentrations as low as $10^{-}7M$.

Keywords: *SERS, pesticides, spin coating, paper sensors, PtBA.*

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Green production of Exfoliated MoS2 using Biopolymers for Optical Detection Applications

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Abstract. Molybdenum disulphide (MoS2), as other layered materials have garnered significant attention for application in electronic devices, optical sensors, energy generation, and, more recently, as a substrates for surface-enhanced Raman scattering (SERS). The MoS2 properties are layered dependent, making proper exfoliation crucial for its successful application. Liquid-phase exfoliation with ultrasonic energy has been widely used to produce large quantities of graphene. Similar method has been reported for MoS2 exfoliation in organic solvents such as N-Methylpyrrolidone (NMP). However, producing exfoliated MoS2 in more environmentally friendly conditions remains a challenge. To date, liquid-phase exfoliation of MoS2 using biopolymers of natural origin has not been reported.

Herein, we report our findings on the green liquid-phase exfoliation of MoS2 using carrageenan, a polysaccharide obtained from red algae, as both a solvent and stabilizer. Several experimental parameters were evaluated to achieve mono-layer MoS2 sheets, including temperature, sonication time, sonication type (pulsed or continuous), and the type and concentration of carrageenan. The 2D MoS2 sheets were then conjugated with metal nanoparticles prepared by wet chemical routes (Au and Ag NPs) to be applied as SERS sensors to detect emerging pollutants (e.g. pesticides).

Keywords: *inorganic layered materials, liquid-phase exfoliation, biopolymers, molybdenum disulphide, SERS*

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A double-sided Coin: Exploring the Animacy Effect with Ambiguous Words

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Abstract. Animacy is an important dimension in memory, with a clear mnemonic advantage for animate items (i.e.,living beings) compared to inanimate items (i.e.,nonliving things). This phenomenon is known as the animacy effect (Nairne et al., 2013). Memory systems have evolved to detect potential threats (e.g.,predators) and opportunities in the environment (e.g.,mating partners), making this tuning to animates crucial for human survival and reproduction (Nairne et al., 2017).
Previous studies on the animacy effect have used item-based procedures, in which participants are presented with to-be-remembered words that are either animate (e.g.,cat) or inanimate (e.g.,desk); i.e., items are animate or inanimate due to their intrinsic characteristics (one-meaning words). Item-based procedures may raise questions to whether the effect emerges due to other characteristics of the words, rather than just their meaning. An alternative would be to use processing-based procedures: the exact same item/word is used, but its interpretation as animate or inanimate depends on the context in which it is presented, [e.g.,The BAT is made of wood (inanimate)/The BAT is a mammal (animate)]. We term these as ambiguous/two-meaning words. To date, only one study has explored the animacy effect from a processing-based procedure (VanArsdall et al., 2013). This study aims to use a new processing-based procedure to further investigate the effect. Seventy-six European Portuguese native speakers (aged 18-35) will participate in the study (aming for a small-to-medium effect size, Dz=.35,=.05, =0.85; as per GPower; Faul et al., 2007). The task will contain three stages: encoding phase, distractor task and recall task.
During encoding, participants will read a list of 20 sentences, one at a time, in a random order. In each sentence, there will be a capital-letters word. Half of the sentences will present an ambiguous word (5 animate/5 inanimate) and the other half will have one-meaning words (5 animate/5 inanimate). The sentences with one-meaning words (e.g.,The DESK is old) will be the same for every participant. In sentences with ambiguous words, the meaning of the word (animate/inanimate) will be counterbalanced across participants. A short distractor task will follow. Finally, in the recall task, participants will write down all the capital-letter words they can remember from the encoding phase.
We predict participants will recall better the animate ambiguous words, followed by animate one-meaning words, with inanimate words (both one-meaning and ambiguous) being recalled the least. By using a processing-based procedure, this study will provide further insights into the animacy effect in memory.

Keywords: *Animacy; Memory; Item-based; Processing-based; Ambiguous words*

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Supramolecular Self-Assembled Bioactive Colloidal Gels as Injectable Multi-Particle Platforms

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Abstract. In native tissues, nano-micro sized extracellular vesicles are constantly being produced by living cells as natural bioinstructive particles to tune the tissue microenvironment and consequently, their homeostasis (Bjørge et al., 2018). Leveraging on this bioinspiration, nanoparticles represent an interesting technology for modulating cellular phenotype, presenting higher programmability, and custom cell target specificity, and bioactive molecules loading capacity (Chen et al., 2019). Conventional platforms for nanoparticle delivery usually consist of free administration of nanocarriers and/or composite hydrogels. However, such platforms are commonly associated with poor local retention and sub-optimal therapeutic efficiency (Gao et al., 2016; Huang et al., 2016). In this context, colloidal gels emerge as highly attractive advanced nanotherapeutic platforms that employ nanoparticles as nano-sized building blocks capable of self-assembling into hierarchically complex 3D networks relying on intrinsic supramolecular interactions (e.g., Van der Waals forces, magnetic interactions, and electrostatic forces) (Freitas et al., 2020). Owing to their supramolecular nature, these versatile platforms exhibit attractive physicochemical properties, including self-healing, multimodal degradation, viscoelasticity and shear-thinning, which allied with their superior drug delivery properties (higher cargo load capacity, prolonged lifespan, and focalized delivery) result in an advanced injectable platform for autonomous and localized nanoparticle delivery, capable of overcome concerns regarding the rapid clearing of freely administrated nanotherapeutics (Freitas et al., 2020; Gao et al., 2016). Herein, colloidal gels were exploited as versatile bioactive 3D platforms for localized and autonomous release of bioactive Quercetin flavonoids. These flavonoids were exploited owing to their potential for bio-instructing the inflammatory profile of human macrophages. Colloidal gels were generated via electrostatically driven self-assembly of oppositely charged nanoparticles of poly (, -lactide-co-glycolide)-polyethylenimine (PLGA-PEI) and zein-hyaluronan (zein-HA), synthetized via an in-house optimized nanoprecipitation solvent evaporation technique. Overall, the generated colloidal gels revealed autonomous multiparticle shedding features, providing a localized and efficient delivery of bioinstructive cues, capable of reducing key proinflammatory biomarkers, pro-inflammatory macrophages in vitro. These findings demonstrate colloidal gel platforms potential for immunomodulaton in different pathologies in the foreseeable future.

Keywords: *Colloidal gels, Nanoparticles, Bioinstructive platforms, Multiparticle shedding, Immunomodulation*

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Web-based cognitive rehabilitation programs for non-CNS cancer survivors: an overview of the publications on the development, efficacy, usability and acceptability.

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Abstract. Cognitive complaints associated with cancer are frequently reported among non-central nervous system (CNS) cancer survivors and can have an important adverse impact on quality of life (QoL). Various interventions have been proposed, but currently there is no standard treatment. Web-based cognitive rehabilitation programs have been studied as an effective treatment option to alleviate subjectively reported and objectively assessed cognitive complaints in this population. Here, we reviewed published data on these programs and selected a sample of studies to analyze their development and efficacy.

The Web of Science and Scopus databases were searched for eligible articles. We included 12 randomized controlled trials, two single-arm studies and one mixed methods study that involved a total of 1300 participants, with ages comprised between 18 and 65 years. The majority of participants were women, as we found that most studies were web-based cognitive rehabilitation programs created for breast cancer survivors.

According to these studies, web-based cognitive rehabilitation programs for non-CNS cancer survivors significantly reduces self-reported cognitive problems as well as cognitive-related quality of life problems suggesting that it is a viable treatment of cognitive impairment in cancer patients.

Additionally, we did an overview of the articles that explored the usability of web-based cognitive rehabilitation programs. Few studies evaluating usability and acceptability for these programs have been found. Therefore, we included eight studies that evaluated the feasibility and effectiveness/efficacy of these interventions, comprising 339 participants.

According to these studies, the majority of participants were overall satisfied with the intervention program and were likely to recommend the program to a friend with similar problems. Reasons for non-compliance included time constraints due to employment or lifestyle, technical problems (lack of Internet access or computer issues), disease progression and interference of physical symptoms, or side effects such as hand pain or eye strain.

This overview suggests that the next steps in this research field should include more studies that systematically evaluate the usability of web-based programs for cancer survivors.

Keywords: *Cancer-related cognitive impairment, Cognitive rehabilitation, Web-based programs, Efficacy, Usability.*

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Aqueous Two-phase Enabled Emulsion Templating for fabricating Microporous Hydrogels for Biomedical Applications

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Abstract. Collagen is a cell degradable, protein-based polymer that represents the main constituent of the extracellular matrix (ECM) where it provides support for the cells in the tissues, allowing their adhesion, proliferation and function. Gelatin is an easily obtainable version of denatured collagen that retains most of its biomolecular and bioinstructive features . The addition of metacriloil groups to gelatin, yielding GelMA allows its photocrosslinking in aqueous solution into hydrogel scaffolds that can replicate the mechanical and biochemical properties of the ECM, supporting cell proliferation and their gradual development into functional organotypic tissues.1,2 Yet, tehe resulting hydrogels generally consist of nanoporous networks that limit cell motility, cell-cell interactions and the diffusion of nutrients, oxygen, and waste, thus limiting their potential in tissue engineering applications. Interconnected microporous hydrogels (IMPHs) are being increasingly explored to mitigate these issues as their cell scaled pores provide space for cell and medium movement. 1,2 Emulsion templating is a simple and highly versatile technique to manufacture IMPHs based on the mixing of a pre-gel with an immiscible liquid porogen to form an emulsion where the porogen phase is volumetrically suspended throughout the pre-gel. Originally porogen phases consisted on organic solvents such as toluene or chloroform, but aqueous two-phase systems (ATPS), based on immiscible aqueous biopolymer solutions, have been replacing them as greener and citocompatible alternatives allowing the inclusion of cells in the pre-gel, further simplifying the construction of the scaffolds.1-3 Herein we explored, ATPS-enabled emulsion templating to produce porous Gelatin-methacrylate (GelMA) hydrogels through the use of Poly(ethylene oxide) (PEO) and dextran based porogens. Different volumetric fractions ranging from 30 to 50% were investigated. The obtained hydrogel constructs exhibit different microarchitectures and interconnected pores with sizes ranging from 10 to 50 μm. Overall, both PEO and dextran porogens were successfully leveraged to produce IMPHs GelMA hydrogels with intrinsic cell adherent features that are to be further explored for tissue engineering and disease modelling applications in the foreseeable future.

Keywords: *Microporous Hydrogels; Emulsion Templating; Aqueous two-phase systems;*

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Hybrid films composed of 2D materials for environmental monitoring

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Abstract. One of the biggest concerns about the rapid development of modern industrialization at a global level is the increase of environmental pollutants, including several harmful molecular and ionic species, such as gases, pesticides, heavy metals and pharmaceutics.
In order to find viable solutions to monitor this problem, research has been carried out on developing low-cost and highly sensitive surface-enhanced Raman spectroscopy (SERS) sensors. SERS is a powerful vibrational spectroscopy technique used to detect lower concentrations of analytes adsorbed on the surface of plasmonic colloidal nanoparticles or metal nanostructures containing Au or Ag,1 being a valuable technique for the potential identification of environmental pollutants. Although presenting the best SERS activity, there has been interesting in exploring SERS platforms containing non-plasmonic nanostructures.
Two-dimensional (2D) layered materials, such as graphene oxide (GO) and molybdenum disulphide (MoS2), have attracted particular attention due to their unique physical, chemical, mechanical, thermal, optical and electrical properties.2 In addition, these 2D materials have been demonstrated as promising candidates for SERS analysis due to their large surface area and the high contribution to the chemical mechanism by ground state charge transfer between the layered materials and the analyte.3
Here, we develop a comparative study with hybrid films containing GO and MoS2 to be used as highly sensitive optical sensors to uptake and detect water contaminants. The hybrid films were prepared by filtration under reduced pressure of GO/MoS2 mixtures using a method used in our laboratory.3 Several parameters were studied in order to prepare the hybrid films, namely, the order of 2D material filtration (mixture and GO filtered first), the thickness of the film and the amount of MoS_2. Our preliminary results demonstrate that these hybrid films have a higher SERS sensitivity to detect rhodamine B in aqueous solutions than those produced with the semiconductor counterparts (GO or MoS2).

Keywords: *Graphene oxide, molybdenum disulfide, SERS, environmental pollutants.*

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Enhancing Lifelogging with Digital Image Annotation: The MEMORIA Application

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Abstract. The development of modern technology and devices has made it possible to record moments from our daily lives more frequently and in a variety of formats. The value that these records hold is immense, since various information relating to the activities, experiences and behaviors of an individual can be extracted from them and then employed in numerous applications, such as memory augmentation, disease prevention and diagnosis using information related to an individual's health, and identification of behavioral trends.However, because of the wide range of devices presently available, the data acquisitionprocess, typically called lifelogging, generates a massive volume of highly unstructured and heterogeneous data, composed of several records named lifelogs. To extract value and insights from the lifelogs, they must be carefully evaluated.Lifelog images are one of the most significant data sources in the context of lifelogging, and when analyzed, they can provide useful knowledge regarding an individual's everyday experiences. This can be achieved with image annotation, which is supported by several algorithms that extract rich and diverse information on multiple levels of detail from images. These annotations can then be used to retrieve these images when an individual is searching for a specific moment from their lives that they want to recollect. Given this, it is essential to discover which computer vision models can assist in extracting useful insights from images and what type of annotations are intended to be collected from lifelog images. Since the scene depicted in each image can range from being simple to being a more intricate and object-dense scene, lifelogs can carry varying amounts of information. Each image should then be analyzed on different levels of detail, meaning that lower-level annotations such as the identification of objects and optical characters should be allied to higher-level ones such as the global understanding of the scene depicted in the lifelog.Currently, there is a research team from the University of Aveiro working on the development of a system named MEMORIA, A Memory Enhancement and Moment RetrIeval Application (Ribeiro et al., 2022), that will enable lifelog retrieval in an efficient and user-friendly way. The need for an efficient image annotation process for this system prompted this research task, and the integration of these new models in the system will result in a solution that allows effective lifelog retrieval utilizing information derived from lifelog images submitted to MEMORIA.

Keywords: *Lifelog, Lifelogging, Image Annotation, Object Detection, Scene Understanding, Machine Learning*

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Political Science

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Os Jovens e a Política: A Socialização Política no Ensino Secundário em Portugal

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Abstract. Numa sociedade portuguesa em que os jovens demonstram pouco interesse pela política, os níveis de abstenção eleitoral são elevados e a participação política é diminuta (Costa et al, 2022), consideramos necessário localizar os pontos-chave do sistema e agir em relação àqueles que possibilitem o aumento do interesse, do conhecimento e da participação dos jovens na política, enquanto nova geração que pode alterar esta realidade.

A Escola tem um importante papel a esse respeito e a ligação ao tema política poderá ser uma relação de proximidade, na medida em que a escola é vista como um espaço onde educamos as novas gerações, uma arena pública propícia para incrementar mecanismos que levem os jovens a ter um maior interesse e a participar mais na vida política. Pensar a escola como um local estratégico de participação e formação de jovens ativos, é pensar a educação como um espaço privilegiado para o envolvimento dos jovens estudantes, enquanto sujeitos autónomos e políticos. A socialização política constitui-se como um complexo de socializações secundárias (Berger ; Luckman, 1999); um conjunto de socializações renovadas que se justapõem à socialização doméstica e cuja intensificação tem início com a socialização escolar (Resende, 2010).

Embora tenha havido uma grande quantidade de trabalho na área da socialização política no ensino (Campbell, 2009; Battistoni, 2013; Manning ; Edwards, 2013) ainda há lacunas existentes que precisam ser abordadas na pesquisa científica. Uma delas é a falta de pesquisas específicas sobre a socialização política no contexto português, o que pode levar a generalizações impróprias de estudos realizados em outros contextos. Em Portugal alguns estudos têm abordado a socialização política no ensino secundário, incluindo os trabalhos de José Manuel Resende e Pedro Jorge Caetano (2010), mas consideramos que há uma necessidade de estudos mais aprofundados sobre os efeitos da socialização política no ensino secundário na participação política dos jovens.

São objetivos da presente investigação, através de um estudo empírico baseado na investigação-ação, analisar os efeitos dos mecanismos existentes no ensino português, com particular enfoque no ensino secundário, no que concerne às atitudes, ao conhecimento e à participação dos jovens na política. Analisaremos como a instituição escolar desenvolve dispositivos diversos, seja através de projetos específicos como o parlamento jovem, as associações de estudantes, ou a lecionação da disciplina de ciência política, entre outros, para a formação prática de jovens ativos no espaço público.

Com a presente investigação procuraremos contribuir para mapear e identificar as abordagens atuais desenvolvidas no ensino secundário português.

Keywords: *Palavras-chave: Jovens – Política – Ensino Secundário - Educação Cívica – Participação Política*

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Digital Platforms Transforming Local Democracies

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Abstract. A rapid increase in the use of digital platforms has been shifting paradigms in all aspects of the society, bringing the debate on the future of democracy. Academics, citizens, and decision-makers from different levels of government have a surging interest in knowing how to properly frame and adapt the transforming social patterns brought by technologies, which allow sharing data and processes, expanding digital capabilities, and combining services and governance models [10]. In parallel, with the impacts of 'commercial' digital platforms on society over the past decade, the lack of accountability, access and security take up more space in the debate around digitalization of governments [14,18].Digital innovation in public administration, increasingly relying on ICT to provide citizens with information and services, have been creating new forms of interaction between (democratic) actors [2,6]. Mobile applications (apps) and web-based platforms allow governments to gather huge amounts of information, crowdsource ideas and test community engagement algorithms in real-time, paving the way for the implementation of 'smart' environments [1,3,11]. Despite being a centralized country, compared to most European counterparts [15], Portugal is no exception to the debate on the emerging influence of technological solutions on democracy [4,5,7,8,9], particularly at the local level [5,6,12]. Although, the crucial question is whether technology breakthrough will only bring improvements to governance systems without creating a disruption between democratic values [18]. On the one hand, technology can be used to legitimise the public sector, bringing citizens closer to politics, and reducing civic apathy [16,17]. Yet, on the other hand, if this digitalization process is left unquestioned, the foundations of democracy as we know it will be eroded [13,14].This research seeks to map the level of penetration of digital platforms in Portuguese municipalities and assess their impacts, departing from the following research question: How are digital platforms impacting public scrutiny and democratic control at the local level? Firstly, it aims at identifying the 'platformization' level of Portuguese municipalities by building an index through an exploratory sequential mixed approach. Secondly, an in-depth analysis will be conducted using comparative methods, in order to capture distinctive patterns within actors of different levels and typologies, within selected municipalities. The outputs of this research will not only contribute for mapping Portuguese municipalities' penetration of digital platforms, but also for broadening the evidence on the impacts of legitimization of these technologies in the context of local democracies.

Keywords: *Local governments, Digital platforms, Democracy, Public scrutiny, Citizen Participation*

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Os presidentes de câmara e as redes de governação local

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Abstract. Os presidentes de câmara e as redes de governação local
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Abstract:
Ser presidente de uma câmara numa rede de governação local é um papel difícil. O presidente da câmara é o mais alto funcionário de uma cidade ou vila e é responsável pela supervisão das operações quotidianas da administração local, incluindo a gestão dos orçamentos, a definição de políticas e a tomada de decisões que afetam a vida dos residentes. Os presidentes de câmara têm de equilibrar as necessidades e exigências de vários intervenientes, incluindo residentes, empresas e funcionários públicos. Para tal, é necessário tomar decisões difíceis sobre a afetação de recursos e a definição de prioridades. Os autarcas são frequentemente chamados a responder a crises como catástrofes naturais, emergências de saúde pública e agitação social. Nesse contexto, ser presidente de câmara numa rede de governação local é um papel complexo e exigente que requer fortes capacidades de liderança, uma comunicação eficaz e um conhecimento profundo das necessidades e prioridades da comunidade. O foco principal deste trabalho é investigar as perceções dos presidentes de câmara em relação aos seus papéis e responsabilidades nas redes de governação local. Isto poderia implicar examinar como os presidentes de câmara veem o seu papel na promoção de uma governação eficaz, no reforço da participação pública, na promoção do desenvolvimento económico e na abordagem dos desafios sociais e ambientais nas suas comunidades. Para conduzir este projeto de investigação, serão recolhidos dados através de entrevistas com presidentes de câmara, inquéritos aos residentes e partes interessadas, e estudos de caso de cidades com diferentes estilos de liderança, prefeitura e resultados de governação. Os resultados serão utilizados para informar o desenvolvimento de um quadro de melhores práticas para a liderança de presidentes de câmara, e para fornecer conhecimentos aos decisores políticos e profissionais que procuram melhorar as redes de governação local e aumentar a eficácia da governação local.
Palavras-chave: governação local, liderança, presidente de câmara.

Keywords: *governação local, liderança, presidente de câmara.*

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Implementing local cultural heritage management policies in World Heritage cities: views from practitioners and decision makers

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Abstract. Implementing local cultural heritage management policies in World Heritage cities: views from practitioners and decision makersThis paper aims to present the results of 10 interviews made to practitioners and decision makers in cultural heritage from six different European World Heritage cities.The interviews were developed within the framework of a Ph.D. in Political Science at the University of Aveiro, which is still ongoing. This research has the goal of answering the following research question: how do different typologies of management systems of World Heritage cities influence the processes and outputs of the implementation of its management policies? The main objective is to map World Heritage cities cultural heritage management systems and their influence on the implementation of cultural heritage public policies.The field of public policy implementation has been characterized by different levels of attention since it started in the 1970's. After a first phase of great interest until the mid-1980's, this field has been attracting less scholarly attention and has made less progress than expected. Nonetheless, the translation of policy into practice continues to be an important subject of study, with an increase in comparative research.Also, the field of heritage studies has been marked by few comparative studies and lesser attention on the process of implementation than on other issues.In this context, the main goal for these interviews was to know the opinions and perspectives of those involved in the process of managing cultural heritage on the local level, namely in terms of expected and actual outputs and outcomes, institutional and interinstitutional relations for heritage management, factors that influence the implementation of cultural heritage public policies and main challenges faced in each city.The cities chosen for this study were Bath (U.K.), Krakow (Poland), Naumburg (Germany), Salzburg (Austria), Santiago de Compostela (Spain) and Strasbourg (France). These cities were selected based on the different cultural heritage management systems they are using, within a matrix developed for this research that classifies management systems according to the levels of government and the characteristics of the institutions directly involved in heritage management at the local level.The results of the study will be presented using a comparative approach, according to the following categories: cultural heritage management system in place; objectives; funding and human resources; interinstitutional relations; citizen participation and involvement; outputs and outcomes; main challenges; negative and positive factors for policy implementation.

Keywords: *Public policy implementation; Cultural heritage; Heritage management*

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‘An Ocean in between the waves’: A systematic approach to party transnational ties of the Latin American Radical Left

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Abstract. The wave of electoral success of the European Radical Left in 2015 has beenregarded as a phenomenon that not only fed on the Latin American (Radical) Left’sexperience but that appears to have also influenced it in return. Nonetheless, theseapparently relevant transatlantic links remain largely under-researched. This study seeksto map these ties, as well as assess their relevance vis-à-vis ties with other parties and(regional) party families as well as their nature. Contrarily to other studies on partytransnational relations, we attempt to provide a systematic mapping and analysis of theseties. To achieve this end, we focus on trying to understand how the electoral success ofthe European Radical Left was reacted to by 4 of its Latin American counterparts. Werely, hence, on the gathering and analysis of social media data (Twitter and Facebook)from 2015 of 4 Latin American Radical Left parties with distinct ideological andorganisational profiles. This paper provides an overview of the transnational network of3 of the 4 selected parties as well as an early discussion of the findings.

Keywords: *nan*

Psychology

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Research project on work ability and stress-related factors in cancer survivors and family caregivers at working age: a dyadic approach

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Abstract. Scientific evidence suggests that by 2026, a significant segment of the working population, will incorporate nearly 20 million cancer-survivors (CS) worldwide and more than 60% have chemotherapy-induced neuropathy, physical and psychological side effects that can affect work ability (WA) (Seifart ; Schmielau, 2017; Sung et al., 2021).Work performs a central role in individual and social dimensions (Xiang et al., 2022) as it is related to a purpose in life, sense of contributing, distraction and self-esteem (Tengland, 2011; Vecchio, 1980). Returning to work is important for CS and their family-caregivers (FC) as a symbol of coping, recovery and regaining a normal life. Building on existing literature, stress-related factors such as fear of disease progression, anxiety, depression and unmet-needs, can affect adjustment to cancer. Also, dyadic functioning, sex, role (CS, FC) and clinical-characteristics may influence the dyads' adjustment (Kiasuwa Mbengi et al., 2016; Sender et al., 2020). Still, there are gaps in knowledge regarding the interdependence effect of the dyad CS-FC on WA and how the stress-related factors of both CS and FC interact. This project includes two studies: 1) adapt and validate the Fear of Progression Questionnaire-Short Form (FoP-Q-SF) for FC; 2) and main study scope is to identify individual and dyadic stress-related factors associated with WA in CS and their FC at working-age. Family functioning, unmet needs, fear of progression, anxiety and depression symptoms are defined in this project as stress-related factors. A convenience sample of 160 dyads will be recruited in hospitals and the research protocol of this study will include Portuguese validated instruments: FoP-Q-SF, Work Ability Index (WAI), Short-Form Survivor Unmet-Needs Survey (SF-SUNS-30), Family Assessment Device (FAD) and Hospital Anxiety and Depression Scale (HADS). Questionnaire data on the variables of interest will be analysed using descriptive statistics, structural equation modelling and actor-partner interdependence model. All procedures and protocols will be carried out in accordance with the Declaration of Helsinki, reviewed and approved by the Ethics Committees of the Hospitals and the University of Aveiro; informed consent will be given to eligible participants. The major innovation is to emphasize a comprehensive overview of the relationship between dyadic interdependence and dyadic outcomes and how they mediate/moderate WA. Filling a gap in the literature, this project will explore the extent to which CS and FC influence one another's WA. It is expected that these findings will highlight a relevant interdependence and contribute to the development of dyadic tailored interventions.

Keywords: *cancer survivors; family caregivers; work ability; stress-related factors; dyads.*

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Beyond Visual Contamination Cues: Development and validation of a multisensory stimuli database

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Title:Beyond visual contamination cues: development and validation of a multisensory stimuli database
Abstract:Our sensory system is constantly exposed to various cues that signal the presence of harmful pathogens in the environment. These cues include audible signals, such as the sound of someone sneezing, and audiovisual cues, such as seeing someone cough.
We created a novel dataset of stimuli that relate to potential contamination (sneezing and coughing) or not (yawning and whistling). Actors were filmed while performing these actions (audiovisual stimuli); frames were then extracted from these videos to provide visual stimuli, whereas their sounds were used to provide audio stimuli. This approach ensured that, across all sensory modality conditions, the stimuli were as similar as possible.
These stimuli were then validated for action identification and rated for familiarity, arousal, valence, disgust, discomfort, sickness, and contagion. Our findings demonstrated that both the type of action and the sensory modality of the stimuli influenced the accuracy of the action identification and the ratings across the various dimensions examined.
This dataset is a valuable resource for investigating the influence of sensory modalities on several cognitive processes, such as attention and memory. For example, previous research has demonstrated that memory is highly tuned to potential sources of contamination. By selectively remembering such contaminants, individuals can engage in preventive behaviors more easily, such as avoiding potential sources of infection. Previous studies on the contamination effect on memory have only used visual stimuli to signal the possible presence of contaminants. Whether different sensory cues influence this effect is still an open question. Our dataset is envisioned to address gaps like this in research.
We intend to make this database openly available to other researchers, anticipating that it will be a useful tool for further research.
Keywords:Contamination, Emotion, Stimuli, Actions, Memory

Keywords: *Contamination, Emotion, Stimuli, Actions, Memory*

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The competitive attitude side of videogaming: Unlocking the role of competition, cooperation, and aggression.

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Abstract. Competition is a ubiquitous feature of human societies, and it is fostered in many popular videogames. This type of entertainment has become increasingly popular over the last 40 years, which led investigators to explore both the benefits (e.g. emotional regulation "tool") and drawbacks (e.g. aggressiveness) of playing videogames. It has been suggested that personality characteristics and preexisting dispositions play an important role in the way individuals approach videogames and in their influence on the individual's short- and long-term behavior/emotional state. Accordingly, since many of the popular videogames call for competition and it is expected that those who continue to engage in this activity enjoy it, seems important to access trait competitiveness in this population.

Therefore, the present investigation aims at exploring trait competitiveness in the context of competitive videogame playing. To do this, we first tested the psychometric proprieties of two instruments that access competitive and cooperative attitudes.

A sample of 666 young Portuguese adults was collected to conduct a validation study the Competitive Attitude Scale and the Cooperative/Competitive Strategy. Afterwards, a subsample of 170 participants was used to match the groups by individual characteristics (i.e. age, sex, schooling, and frequency of sport competition), using case control-matching, to understand which variables were distinctive to each group.

Results indicate that the Competitive Attitude Scale and the Cooperative/Competitive Strategy Scale show good psychometric proprieties in the Portuguese young adult population. Importantly, to the main aim of our study, competitive videogame players presented higher levels of Personal Development Competitiveness, associated with a more positive approach to competition, and did not differ in other measures, notably aggression scores. Only Personal Development Competitiveness and Competitive Strategy for Success were significant predictors in a binary logistic regression for the variable "group". Specifically, the odds of having greater Personal Development Competitiveness were 2.6 higher for individuals who reported playing competitive videogames regularly, but the opposite occurred for Competitive Strategy for Success (0.4 lower).

Our findings suggest that those who play competitive videogames are more prone to compete for self-improvement rather than wanting to win at all costs, which can lead them to be more intrinsically motivated when the task fosters this type of approach. These results can help investigators understand what type of competitive attitude define each individual and possibly account for some short- long-term effects of competitive videogame play, as it is known that dispositional competitiveness can significantly affect situational competitiveness and its outcomes.

Keywords: *Videogame play, Competition, Cooperation, Aggression, Personality traits*

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Futher examinations of the animacy effects: age-specific word-ratings and memory performance in older adults

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Abstract. Evolutionary Psychology posits that human cognitive systems, including memory, evolved to enhance our odds of survival and/or reproduction. Therefore, memory is hypothesized to be tuned to the adaptive challenges faced throughout evolution. One example of this is the animacy effect which shows that we remember animates/living-beings (e.g., cat) better than inanimates/objects (e.g., spoon). Indeed, animates were, and still are survival- and reproduction-relevant stimuli, as they could represent predators, prey, partners, etc. (Nairne et al., 2013).

While the animacy effect is well-established in young adults (YA), evidence for older adults (OA) is scarce and contradictory (see Bugaiska et al., 2016; Félix, 2018). These studies typically use animate/inanimate WORDS as the to-be-remembered stimuli and all studies with OA used words previously characterized for animacy by YA. Considering that different age-groups may process words differently (e.g., Grandy et al., 2020) those studies may have an item-selection problem.

The aims of our studies were: 1) to collect age-specific animacy word-ratings and, 2) to explore the animacy effect in OA using properly selected stimuli.

A total of 500 British English words were rated (scale: "1-totally inanimate" to "7-totally animate"; cf. VanArsdall ; Blunt, 2022) by 207 OA and 161 YA, all English-speakers. Our results showed that, despite the high agreement in the animacy ratings, older adults rated words as more animate than young adults (e.g., "earth", "egg"; Félix et al., 2023).

Using these age-specific animacy ratings, we then conducted a free recall task with 41 YA and 42 OA English-speakers. Participants memorized a series of 24 words (half animate/half inanimate) for a later memory test (cf. Nairne et al., 2013). The results showed a significant animacy effect and no Age X Animacy interaction. These results extend the robustness of the animacy effect to OA when properly selected stimuli were used.

Our studies highlight the importance of investigating diverse populations (e.g., OA) beyond convenience samples (e.g., YA/university students) while considering their specific needs. One such example is the need for age-specific word-ratings to select appropriate stimuli for research. Our animacy word-ratings will be freely available to other researchers via Open Science Framework.

Keywords: *Animacy; Aging; Convenience samples; Evolutionary Psychology; Memory; Older adults; Word-ratings*

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Interpersonal distance as a measure of approach-avoidance behaviour when facing sickness cues

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Abstract. The distance we keep between ourselves and others without feeling uncomfortable is called interpersonal distance (IPD). IPD might be implicated in pathogen avoidance, as keeping greater distances from those who are (or are perceived as) sick can decrease contamination risk. While some studies have started to investigate this hypothesis, no study to date has used conspicuous disease-connoting cues in faces. Thus, the present study sought to explore whether commonly found facial disease cues (i.e., flu-like appearance and facial rash) could modulate participants' IPD behavior. In a computerized version of the paper-and-pencil IPD task, participants (N = 70) were asked to indicate, by moving a virtual silhouette representing themselves, the distance they would be comfortable taking in social interaction with a male or female stranger that could display (or not) a facial disease cue. Results showed that, on average, participants assumed greater distances toward stranger avatars when they were associated with facial disease cues, compared to control avatars. Furthermore, whilst male avatars were associated with a greater IPD across conditions, female avatars suffered a greater IPD increase when exposed to facial disease cues, compared to the former. These findings support the defensive role of the behavioral immune system and highlight the relationship of the latter with gender stereotypes. Implications regarding how the threat of contagion can lead to aversive responses towards those who bear facial "disfigurements" are also discussed.

Keywords: *Interpersonal distance, Approach-avoidance, Behavioral immune system, Disease cues*

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Development and evaluation of the usability, usefulness and acceptability of a web-based cognitive rehabilitation program for cancer survivors reporting cognitive complaints: The CanCOG® program

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Abstract. One of the most feared and common side effect of cancer and its treatments reported by non-central nervous system (CNS) cancer survivors is cognitive impairment (Mayo et al., 2021). Although these changes are subtle, some survivors report a great impact on their overall quality of life and daily, social, and occupational functioning (Ahles ; Root, 2018; Boykoff et al., 2009).

Considering its negative impact, it is necessary to develop and establish evidence-based interventions to manage cognitive difficulties (Lange et al., 2019; Von Ah ; Crouch, 2020). Among the interventions that have been tested to manage cognitive impairment (Mayo et al., 2021; Zeng et al., 2020), cognitive rehabilitation is considered a first-line intervention. Nevertheless, its conventional in-person format is not always accessible for every patient in clinical practice, which has generated interest in alternative rehabilitation approaches using Communication and Information Technologies (van der Linden et al., 2018; Zampolini et al., 2008). Therefore, although literature is recent, web-based interventions have been increasingly explored as a potentially valid method in the field of cognitive rehabilitation in non-CNS cancer (Kim ; Kang, 2019).

For this purpose, the main focus of this work consists on reporting the development process and evaluation of the usability, usefulness and acceptability of a web-based cognitive rehabilitation program for cancer survivors: the CanCOG® program.

CanCOG® is a web-based cognitive rehabilitation program for non-CNS cancer survivors reporting cognitive complaints, developed from the cultural adaptation of the evidence-based UCLA Cognitive Rehabilitation Intervention Program (Ercoli et al., 2013, 2015; Oliveira et al., 2023). It is composed of 5 modules focusing on attention, executive functions, and memory. The program has several cognitive rehabilitation components, including psychoeducation, compensatory strategy training, cognitive training, and goal setting, as well as interactive features based on images, videos, audio files, gamified cognitive exercises, etc. Integrated 2-way communication features support the intervention (e.g., email, chat, forum, videoconference).

CanCOG® is being developed using a user-centered approach, with an iterative and multidisciplinary method, comprising three phases: 1) Ideation and prototyping (development phase in which the project currently is), including heuristic evaluation and usability testing with prospective end-users (i.e., non-CNS cancer survivors and (neuro)psychologists); 2) Software development; and 3) Improvements and final testing.

This work intends to develop and provide an eHealth evidence-based intervention with the potential to improve cognitive impairment reported by non-CNS cancer survivors, which will also be useful for professionals working with this population.

Keywords: *Cancer survivors, Cognitive impairment, Web-based cognitive rehabilitation, Development, Usability*

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Ph.D. Project Title - Visuospatial orientation and motion perception: The effect of contextual visual cues in phenomena of spatial localization

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Abstract. Abstract
When observers are asked to indicate the spatial location where a moving object disappeared, they systematically indicate a forward position, in the direction of motion (Representational Momentum;RM) and downward position, in the direction of perceived gravity (Representational Gravity;RG). These phenomena, are thought to reflect the functioning of internal models of relevant physical regularities, such as gravitational acceleration. However, concurrent lines of research emphasized that the perceived direction of gravity depends on a complex interaction between vestibular signals, somatosensorial receptors, and visual cues. A recent study reported that contextual visual cues influence these patterns of spatial mislocalization, such that perceived horizontal target movement are moved forward- Representational Horizon (RH). While this work was successful in demonstrating that visual orientation cues do modulate spatial localization phenomena, some aspects are still to be ascertained. For instance, it is yet to be determined whether these effects generalize to other types of background scenes and visual polarizing cues, how do visual context modulates the time course of RM and RG, and how is visual context orientation integrated with vestibular signals in determining spatial localization judgements. The present project aims to explore these questions, and so on to clarify which features of an orientation inducing visual context affect RH, its links to RM and RG and how vestibular signals modulate its effects.
Palavras-Chave
Spatial Orientation; Motion Perception; Visual Perception; Representational Gravity; Representational Momentum.

Keywords: *Spatial Orientation; Motion Perception; Visual Perception; Representational Gravity; Representational Momentum.*

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The effect of anxiety and its interplay with social cues when perceiving aggressive behaviors

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Abstract. Contextual cues and emotional states carry expectations that are used to attribute meaning to what we see. In addition, emotional states, such as anxiety, shape our visual system, increasing overall, and particularly threat-related, sensitivity. This sensitivity is a direct consequence of a more sensory-driven perception, which reflects itself in a greater ability to detect sudden or minor environmental changes. Consequently, however, perception is less reliant on internal models, reducing the role of expectations over our perception. It remains unclear, however, how this shift in perception might impair our ability to incorporate other social cues (expectations) when interpreting our social environment. This is especially important in social scenarios where ambiguous gestures are commonplace, thus requiring the integration of cues for a proper interpretation. To this end, we decided to assess how states of anxiety might bias the perception of potentially aggressive social interactions, and how external cues are incorporated in this process. Participants (N = 71) were tasked with signaling the presence of aggression in ambiguous social interactions. Simultaneously, an observer (facial expression) reacted (by showing an emotional expression) to this interaction. Importantly, participants performed this task under safety and threat of shock conditions. Decision measures and eye tracking data were collected. Our results showed that threat of shock did not affect sensitivity nor criterion when detecting aggressive interactions. The same pattern was observed for response times. Drift diffusion modelling analysis, however, suggested a quicker evidence accumulation when under threat, prompting further research. Lastly, dwell times over the observer were higher when under threat, supporting the association between anxiety and a bias towards potentially threat-related indicators. Future probing into this topic remains a necessity to better explain the current findings.

Keywords: *Anxiety, Threat, Visual Perception, Social Perception, Expectations*

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Public Policies

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Progress of the project "Electronic Government contributions to increase citizen participation in the government decision-making process"

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Abstract. The objective of the present work is to present the current state and the execution of the schedule according to the schedule foreseen in the project. As of October 2022, the updating of the systematic review related to ICTs, e-government, open government and e-democracy began. After reading the abstracts and conclusions of 584 articles searched on the Scopus and Web of Science platforms, 229 articles were selected to be the object of content analysis. During this work, 10 more articles were inserted, totaling 239 articles, of which 34 were not coded. After preliminary coding, the created codes were divided by themes, totaling 24 themes. Priority for the thematic analysis, at the moment, were themes 20 – Models and 24 – Indices, in order to seek to improve, based on the theoretical framework, the proposed conceptual model, inserting other categories in the two initially proposed categories, that is, electronic government (open government and use of ICTs) and e-participation. Thus, to date, the theoretical model has been updated, including other variables to those initially predicted, selected and the collection of the databases to be used started. Based on this update, research hypotheses were constructed that will be tested based on the proposed model.

Keywords: *E-government; e-participation; open government; ICT; transparency.*

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Política pública de drogas. Conhecimento, atitudes e perceção da comunidade académica perante a legalização/ regulação da canábis para uso adulto ou fins não medicinais.

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Abstract. A canábis é a substância ilícita mais consumida a nível global. O seu uso tem vindo a ser objeto de regulação por parte do poder político. Em Portugal, o seu consumo destaca-se entre os adolescentes e jovens adultos (29%) (Carapinha et al., 2022)assinalando-se a continuidade do seu uso, assim como a facilidade de acesso e a diminuição da perceção do risco. Esta perceção é um fator determinante para a experiência de uso da canábis. Ao assumir uma menor perceção de risco físico, psicológico e social, tende-se a adotar uma atitude de maior tolerância ou de normalização (Benedetti et al., 2021; Carliner et al., 2017; Wen et al., 2019). Desta feita, é particularmente relevante analisar esta problemática no contexto da comunidade académica. Assim, na presente investigação, analisam-se as perceções e as atitudes da comunidade académica face à introdução de um novo modelo de política pública de regulação da canábis para uso adulto em Portugal. Trata-se de um estudo exploratório, descritivo e transversal, com abordagem quantitativa. O método adotado é o inquérito por questionário. Os resultados permitirão aos agentes de saúde pública e aos decisores políticos discutir e refletir sobre ações legislativas futuras na área da política de drogas. O questionário será constituído, por quatro partes ou secções temáticas cada uma delas extraída do conjunto de dimensões teóricas assumidas no modelo analítico da investigação. A primeira secção será para as características sociodemográficas: ano de curso, curso, instituição de ensino – privado / público; idade, género, estado civil, residência em tempo de aulas, ocupação atual; orientação político-religiosa; a segunda parte, referente as atitudes face à canábis e ao seu consumo; a terceira parte, perceção dos danos e riscos/acessibilidade/facilidade; a quarta parte, conhecimento da lei portuguesa, a legalização e os modelos regulatórios de canábis, perspetivas e pontos de vista.

Keywords: *Legislação, Canábis, Regulação, Atitudes, Comunidade Académica.*

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Governança urbana colaborativa: coligações de atores, mitigação de conflitos e construção de consensos

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Abstract. Esta investigação visa compreender como abordagens colaborativas contribuem para mitigar conflitos e construir consensos em processos de planeamento urbano. Parte-se do entendimento de que a elaboração ou revisão de um Plano Diretor Municipal é uma oportunidade para ampliar o caráter democrático da produção das cidades na medida em que envolve a articulação e negociação entre diferentes atores, podendo ser caracterizada como um processo de governança colaborativa. A partir de metodologia mista envolvendo pesquisa documental, aplicação de inquéritos e Análise de Redes Sociais, serão elaboradas e analisadas redes de atores relativas a cinco PDMs da Região Metropolitana do Porto, buscando identificar clusters e apreender em que medida as relações ampliam a arena democrática ou, por outro lado, reforçam as relações de poder existentes. Pretende-se contribuir criticamente para o conhecimento sobre o planeamento urbano colaborativo e formular possibilidades de replicação em outros contextos.

Keywords: *governança colaborativa; rede de atores; coligação; planeamento urbano; políticas públicas urbanas*

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Descentralização de competências de Educação: autonomia ou dependência dos Municípios?

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Abstract. A participação das autarquias locais no domínio da educação tem vindo a assumir uma importância crescente. A 30 de janeiro de 2019 era publicado o decreto-lei de transferência de competências no domínio da educação para os municípios, naquela que foi a concretização de um novo paradigma de gestão da educação e tomada de decisões numa lógica de proximidade. Nesta investigação, pretende-se fazer uma análise da evolução da atuação municipal na área da educação, identificando as esferas de ação e projetos-piloto desenvolvidos, para chegar à apreciação deste novo modelo de administração e gestão dos estabelecimentos públicos da educação pré-escolar e dos ensinos básico e secundário. Por outro lado, importa identificar em que medida este novo modelo influenciou as prioridades dos municípios e analisar a forma como se tem vindo a aplicar no terreno, com verdadeira autonomia dos municípios na definição das prioridades e na gestão da educação, ou como meros interlocutores do Estado e da Escola/Agrupamento de Escolas (dependência financeira e administrativa).

Keywords: *Políticas de educação, Autonomia, Poder Local, Descentralização, Gestão autárquica, Municípios*

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Governança intermunicipal e os desafios das Autoridades Regionais de Transportes em Portugal: Perspetivas da prática

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Abstract. Governança intermunicipal e os desafios das Autoridades Regionais deTransportes em Portugal: Perspetivas da práticaPaulo Rodrigues (2023)ResumoO reforço do associativismo municipal e a tendente descentralização de cada vez mais competências para os municípios e estruturas intermunicipais, especialmente depois do fracasso do referendo de 1998 sobre a criação de regiões administrativas, tem criado novos desafios às entidades intermunicipais. Os arranjos Intermunicipais, resultantes do associativismo municipal, vieram permitir novas parcerias de cooperação entre municípios que visam frequentemente otimização de recursos e ganhos de escala na implementação de políticas públicas, no entanto a transferência de competências para estas entidades nem sempre tem garantido os instrumentos necessários à operacionalização eficaz dessas competências pelos Agentes locais. As entidades intermunicipais têm vindo a assumir competências descentralizadas pelo estado e delegadas pelos municípios associados, designadamente no âmbito dos transportes públicos, mas estas entidades aludem a frequentes e persistentes constrangimentos que condicionam ou limitam a sua operacionalização. Tratando-se de uma realidade relativamente recente, a literatura visitada foca principalmente na análise dos processos de cooperação intermunicipal e suas virtudes ou riscos, revelando-se menos frequente quanto às questões da operacionalização de políticas públicas. Cingindo-se à realidade intermunicipal, este estudo vem refletir sobre as dificuldades sentidas na operacionalização das novas competências das Entidades Intermunicipais através do contributo crítico dos agentes técnicos responsáveis pela implementação das Políticas públicas no âmbito dos transportes públicos, e com vista à construção de um referencial de boas práticas. Para isso, e após o respetivo enquadramento teórico, pretende-se uma análise documental aos resultados da(s) discussão(ões) em grupos focais. Palavras-chave: governança, intermunicipal, descentralização, transportes públicos.

Keywords: *governança, intermunicipal, descentralização, transportes públicos*

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Public Value in Portuguese SNS: a case study

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Abstract. Facing limited resources and when it is not possible to fully meet the needs of society, the choices made within the scope of public policies need to be substantiated. The evaluation of public policies is thus assumed to be a relevant topic for the literature on Public Administration. The definition of priorities is particularly sensitive in the specific case of health sector, given the impact of decisions on the human condition. As an alternative to evaluations based on cost-benefit analyses, appears an emerging approach based on public value theory, which intends to go beyond indicators based on efficiency and effectiveness.
With this study, we intend to analyze the importance of public value theory for the Portuguese SNS and how measures have been taken to incorporate the guiding principles of public value theory. We also intend to investigate the resulting implications for the public hospital organizations that make up Portuguese SNS.
To pursue these objectives, we will use a qualitative methodology based on document analysis and semi-structured interviews, adopting a case study based on public hospital entities belonging to SNS.With this investigation, we intend to contribute to the literature on Public Value, to establish a relationship between the way SNS has carried out its course and the theory of public value and to help public hospital organizations that make up SNS to be able to draw lessons from decisions based on public value for the definition of their management processes.

Keywords: *Public Value, Health, Public Policies, SNS, hospitals*

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Redes de inovação e o crescimento económico sustentável e resiliente: o caso do projeto NEXUS

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Abstract. Título:Redes de inovação e o crescimento econômico sustentável e resiliente: o caso do projeto NEXUSA formação de redes de colaboração para projetos que demandam a atuação conjunta de perfis diferenciados de atores exige uma capacidade especial de orquestração das múltiplas dinâmicas necessárias para atingir os resultados almejados. No caso específico das redes de inovação, onde fatores como competitividade e adaptabilidade orientam suas ações, deparamo-nos com momentos de tomada de decisão e ciclos de recondução ainda mais frequentes e desafiadores. Esta pesquisa tem como objetivo analisar as dinâmicas de gestão da comunicação e das partes interessadas presentes na rede de inovação do projeto NEXUS, selecionado dentro das Agendas Mobilizadoras para a Inovação Empresarial, integrantes do Plano de Recuperação e Resiliência (PRR) de Portugal. Comprometido com metas de sustentabilidade e resiliência socioeconômica em seu território de influência, o projeto concentra-se na digitalização e descarbonização da cadeia logística associada ao corredor do Porto de Sines. A escolha desse domínio de análise justifica-se pelo papel fundamental que fatores como simetria da informação, entendimento comum de objetivos e alinhamento semântico dos conceitos desempenham no sucesso dessas redes. Esta pesquisa empregará uma abordagem metodológica mista sequencial e exploratória, desenvolvendo-se como um estudo de caso, utilizando fontes primárias e secundárias. A metodologia compreende uma análise de rede social quantitativa, seguida por uma análise qualitativa das perceções provenientes de entrevistas semiestruturadas com as partes interessadas. Os questionamentos que se busca responder são: quais são os desafios e oportunidades encontrados nas dinâmicas de governança e coordenação inerentes ao projeto NEXUS, que podem facilitar ou restringir a capacidade da rede de atingir seus objetivos? De que forma essas dinâmicas de rede promovem a geração de resultados sustentáveis e resilientes? Como uma abordagem na gestão da comunicação e das partes interessadas pode apoiar a governança de redes de colaboração particularmente voltadas para a implementação de políticas de desenvolvimento sustentável e resiliente? Além disso, visa-se desenvolver e avaliar uma abordagem processual que apoie as lideranças das redes de colaboração na governança da comunicação e das partes interessadas em projetos comprometidos com o desenvolvimento sustentável e resiliente.

Keywords: *ciência de dados; políticas públicas; métodos de apoio à decisão*

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A descentralização de competências no domínio da saúde para as autarquias locais

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Abstract. A descentralização tem sido amplamente debatida e promovida por diversas instituições e colocada em prática inclusive em diversos países unitários, enquanto fator alavancador de desenvolvimento. Englobando a transferência de poderes para níveis subnacionais, esta reforma advoga que assim se obtém melhor conhecimento das necessidades locais e das preferências dos cidadãos, um maior envolvimento das comunidades locais, uma coordenação intersectorial mais capaz e uma maior eficiência na prestação de serviços. Este debate ganhou uma preponderância recente com a da pandemia Covid-19, com os poderes locais e regionais na linha da frente de combate à crise sanitária e os seus efeitos socioeconómicos.

Apesar de constitucionalmente prevista, a descentralização administrativa em Portugal tem sido implementada paulatinamente, sendo vários os estudos que referem que Portugal ainda possui uma estrutura de governação centralizada. O processo de descentralização administrativa adquire um novo impulso com a publicação da Lei nº50/2018, que define o quadro legal de transferência de competências para as autarquias locais, a que se seguem diversos diplomas setoriais que permitem que o processo de descentralização se inicie em 2019 de forma gradual.

Pouco se sabe como este processo decorre, como será aceite e operacionalizado por parte das autarquias e quais as potencias consequências, designadamente, no que respeita à qualidade, garantia da universalidade e igualdade de oportunidades no acesso aos serviços públicos, à promoção da coesão territorial, à eficiência da gestão pública e à garantia das transferências para as autarquias de recursos financeiros, humanos e patrimoniais adequados.

As caraterísticas do contexto português, o facto de ser um processo legislativo recente, bem como os efeitos da pandemia Covid-19, colocam desafios a uma efetiva descentralização, e justificam a necessidade de aumentar o conhecimento neste domínio e criam horizontes inovadores de pesquisa e ação capazes de auxiliar os processos de tomada de decisão de política pública de base territorial num contexto nacional de descentralização.

Este estudo pretende contribuir para o conhecimento das características que sustentam o processo de descentralização na saúde em Portugal, compreender melhor as dinâmicas territoriais e os mecanismos de governação, e avançar com recomendações sólidas para a sua implementação. Para tal, será utilizada uma metodologia mista, incluindo a realização de questionários, entrevistas e grupos focais a atores-chave.

Keywords: *Descentralização; Governança; Autarquias Locais; Políticas Públicas; Saúde*

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A influência das políticas europeias no ensino superior em Portugal: Implicações para a diversidade do sistema

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Abstract. As políticas europeias de educação têm exercido pressão sobre as Instituições de Ensino Superior (IES) para que atendam às necessidades da sociedade, tornando-se um elemento fundamental na sociedade e economia. Embora essas políticas não sejam diretamente coercivas, tendem a redefinir as missões e o papel das Instituições de Ensino Superior (IES) na academia e na sociedade, o que resulta em mudanças intrínsecas nos papéis, comportamentos e modus operandi, visando a sua adaptação. A missão das Instituições de Ensino Superior (IES) na sociedade, tradicionalmente configurada pela perspetiva influenciada por Humboldt na universidade moderna, difere entre as instituições universitárias e politécnicas nos sistemas binários, como o português. Portanto, é importante refletir sobre como as narrativas europeias da sociedade do conhecimento promovem mudanças nas conceções dominantes sobre as missões das IES e quais implicações essas mudanças potenciais podem ter para a diversidade do sistema, usando o sistema nacional como estudo de caso.

Keywords: *Ensino Superior; Sistema Binário; Sistema Unificado; Diversidade; Portugal; Reino Unido*

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Liderança ética na Administração Pública e Valor Pública: Relações e interdependências

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Abstract. Pretendemos investigar e contribuir para a compreensão do fator "liderança" na Administração Pública Portuguesa, em particular a Liderança Ética, assim como as relações e interinfluências entre Liderança Ética na Administração Pública e Valor Público. Partimos do pressuposto de que é necessário e pertinente continuar a ser investigada a liderança (Crosby ; Bryson, 2018) e de uma conceção de valor público enquanto benefícios que governo e Administração Pública no geral fornecem à sociedade (Stoker, 2006). A partir da definição e delimitação dos nossos construtos teóricos, procuraremos recolher dados empíricos através da aplicação de escalas que avaliem o construto "liderança", utilizando duas escalas, a versão portuguesa da Escala de Liderança Ética (ELS), cujas propriedades psicométricas foram recentemente aferidas e validadas (V. H. Silva ; Duarte, 2022) e a escala de Perceção de Liderança Ética (PLIS), que avalia a integridade do líder percecionada e cuja versão portuguesa também já mereceu algumas investigações (Lurdes, Neves, Jordão, Pina, ; Aguiar, 2016). Procuraremos assim clarificar as interações entre Liderança Ética na AP e Valor Público e explicitar os fatores mediadores nesta relação.
Palavras-chave: liderança ética, valor público, administração pública.

Keywords: *liderança ética, valor público, administração pública*

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A Avaliação do Desempenho na Administração Pública Portuguesa

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Abstract. A avaliação do desempenho é uma ferramenta que permite estimar o nível e a qualidade do desempenho dos trabalhadores num determinado organismo, seja público ou privado. Através deste processo, é possível medir e comparar as avaliações, bem como analisar as atividades nas quais o trabalhador teve um melhor ou pior desempenho durante o período de avaliação, podendo, no último caso, serem sinalizadas necessidades de formação, por forma a reverter o problema identificado no ciclo avaliativo seguinte.

A avaliação do desempenho, enquanto instrumento de gestão, é reconhecida como sendo essencial para que os organismos atinjam os seus objetivos estratégicos, uma vez que tende a estimular nos trabalhadores elevados níveis de desempenho durante a execução das suas funções. Contudo, este processo não está isento de fragilidades.

No caso da Administração Pública Portuguesa (APP), e de acordo com a literatura científica existente, a avaliação do desempenho evidencia fragilidades e limitações.

Partindo da relevância do sistema de avaliação do desempenho enquanto instrumento de política pública de recursos humanos, esta investigação pretende propor a melhoria ou a criação de um novo sistema de avaliação capaz de promover o reconhecimento do mérito e do bom desempenho dos trabalhadores, bem como de estimular o desenvolvimento de uma cultura de excelência e de qualidade na prestação do serviço público.

A metodologia utilizada será qualitativa, uma vez que permite uma análise mais profunda dos fenómenos estudados. Para aferição dos pontos fortes e fracos do sistema de avaliação atualmente em vigor e a discussão das características que um bom sistema de avaliação do desempenho deveria ter, considera-se importante obter as perceções dos atores envolvidos no processo de avaliação da APP (sejam eles trabalhadores em funções públicas, dirigentes ou decisores políticos).

A recolha de dados, no âmbito do estudo empírico, será efetuada de acordo com os seguintes métodos:

• Análise documental – análise de legislação e de outros documentos técnicos para estudo e reflexão do enquadramento legal que estabelece o sistema de avaliação do desempenho na APP e em alguns países europeus identificados.

• Entrevistas semiestruturadas – entrevistas a Dirigentes Intermédios da Área de Recursos Humanos dos serviços da APP, que transmitirão a sua perceção sobre a avaliação de desempenho, baseada na sua experiência.

• Focus groups – realização de dois focus groups, com Dirigentes e Trabalhadores; e Decisores Políticos, respetivamente, para apresentação da primeira versão do novo modelo de avaliação (ou um modelo de avaliação alterado), desenhado com base na análise documental e da análise dos resultados das entrevistas.

Keywords: *Sistema de Avaliação, Desempenho, Administração Pública, Trabalhadores*

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Migration Policies and Asian Immigrants in Portugal; Cases of Bangladesh,Iran, and Nepal

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Abstract. This research aims to investigate the influence of Portuguese migration policies on the integration status of Bangladeshi, Iranian, and Nepalese immigrants. For this, a set of criteria will be derived from the existing models of integration to be used in the field work of the research and formulating a general view of the historical trend of migration to Portugal and the government's approach to it as clear as possible in order to identify the specific subjects to be addressed in the analyses. First, a brief historical review of the approaches towards migration policy-making and a general definition of migration policy will be provided. Then, the dependency of migration policy on the theories of international migration and the necessity of a theory-driven outlook on the subject that is more based on "mid-range" theories than on "grand" theories will be explored. The second part deals with the question of regulation or integration? Policy-making will be classified into two approaches of regulating the flow of immigrants and providing the proper grounds for their integration into the host community and the Portuguese historical trend of migration policy-making and regulation will be addressed in terms of the mentioned classification. The third part is dedicated to the multiple levels of immigration policy, introducing the national, regional, and global levels of migration policy in a multi-level states point of view. Then, the status of the Portuguese migration policy will be discussed in terms of the government's national view, in relation to the EU regulations, and its position in the global mobility picture. The last section is dedicated to the dimensions of immigration policy and includes these subjects: (a) discussing the necessity of going beyond mere economic theories of migration and incorporating the social and political perspectives into the subject and (b) reviewing and categorizing specifically the Portuguese legal documents on the subject of migration in the mentioned perspectives.
According to the used theories, the conceptual model of the research will be extracted and based on this model, a prototype questionnaire will be designed for the field work. To correct the weak points of the prototype questionnaire, it will be filled in a test form by several immigrants. Next, the final questionnaire will be prepared with the approval of the supervisor and the field activity will begin.

Keywords: *Migration, Portugal, Public Policy, Integration.*

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A Qualidade institucional e o desenvolvimento económico e social: Evidências dos países em desenvolvimento.

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Abstract. As políticas públicas destinadas ao desenvolvimento económico e social nos países em desenvolvimento são enfraquecidas pela fraca qualidade das instituições. As ajudas internacionais destinadas ao combate a doenças, fome e redução da pobreza e a desigualdade (rendimento e género) têm sido desviadas em favor de um pequeno grupo de interesse. Isto ocorre, certamente pela grande fraqueza nos fatores institucionais como controlo da corrupção, instabilidade política, estado de direito, voz e responsabilização, qualidade regulamentar e a eficácia da governação. Pretendemos de uma forma geral, investigar a relação entre as políticas públicas voltadas para o desenvolvimento económico e social e a qualidade institucional. Especificamente, 1) analisar a relação e efeito dos fatores institucionais como a corrupção, estado de direito, estabilidade política, voz e responsabilização, qualidade regulamentar e eficácia dos governos e as políticas públicas para promoção do crescimento económico, redução da pobreza e desigualdade de rendimento e a promoção da igualdade do género; 2) Realizar um estudo comparativo entre as diferentes regiões geográficas a considerar no estudo. Para o efeito, planeamos realizar uma tese composta por quatros ensaios/artigos, onde o primeiro será destinado a revisão sistemática da literatura, e os três restantes serão artigos empíricos.Relativamente aos aspetos metodológicos, os dados serão extraídos das bases de dados amplamente reconhecidas no meio académico como por exemplo, o Banco Mundial, Fundo Monetário Internacional e Organização para a Cooperação e Desenvolvimento Económico. Os países em desenvolvimento a incluir no estudo e período da análise serão determinados pela disponibilidade dos dados. Os dados serão alvo de uma análise quantitativa, através de vários modelos econométricos, que serão desenvolvidos atendendo aos objetivos específicos de cada ensaio. De uma forma geral, a tese proposta encaixa em cinco objetivos de desenvolvimento sustentável, nomeadamente os objetivos 1º Erradicação da pobreza; 5º Igualdade de género; 8ª Emprego e crescimento económico; 10º Redução das desigualdades; 16º Paz, justiça e instituições fortes.

Keywords: *Instituições, Crescimento económico, Pobreza, Desigualdades*

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Análise do Modelo de Inovação da Tripla Hélice numa Perspetiva Governamental. Trajetória do Setor de Inovação em Portugal: Realidades e Desafios

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Abstract. TÍTULO: ANÁLISE DO MODELO DE INOVAÇÃO DA TRIPLA HÉLICE NUMA PERSPETIVA GOVERNAMENTAL. TRAJETÓRIA DO SETOR DE INOVAÇÃO EM PORTUGAL: REALIDADES E DESAFIOS
ABSTRACT:
Este estudo baseia-se numa abordagem dos diversos programas levados a cabo pelo Governo português para estimular a produção de inovação no território. O modelo de tripla hélice prevê a introdução de uma economia baseada no conhecimento, sustentada nos pilares governativos, académicos e empresariais. Neste estudo, focar-nos-emos no primeiro pilar e em variados pontos de inflexão, como os ciclos económicos, a influência universitária e a promoção da inovação regional, pelo que foi definido como objetivo geral compreender o processo evolutivo das políticas públicas de inovação das spin-offs em Portugal.
A escolha deste tema prende-se com o facto de o setor da inovação ser considerado um dos que mais fortifica o desenvolvimento socioeconómico de um país. Tendo em conta a realidade europeia e as estratégias que fomentam a participação deste setor, justifica-se uma análise às políticas públicas de inovação que Portugal tem vindo a desenvolver.
Este estudo tem como questão norteadora "Qual o processo evolutivo das políticas públicas de inovação de spin-offs desenvolvidas em Portugal?". Metodologicamente trata-se de um estudo de características descritivas, com recurso à análise documental de um conjunto representativo de documentos originais e com possibilidade da realização de entrevistas (semiestruturadas) a figuras de destaque no panorama de inovação português.
O acervo bibliográfico referente às políticas de inovação existentes em Portugal, foca-se sobretudo em estudos de caso ou em análises de dimensão temporal relativamente pequena. Espera-se que os resultados deste trabalho permitam conhecer, aprofundar e divulgar as políticas públicas de inovação, a importância do modelo de inovação da tripla hélice, o sistema de inovação nacional e a sua influência no crescimento sustentado do país.
Keywords: Inovação; Modelo de inovação da tripla hélice; Políticas públicas; Sistema de inovação nacional; Portugal

Keywords: *Inovação, Modelo de hélices, Políticas públicas, Portugal*

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Implementação da política pública ao nível local: a importância da clarificação do objetivo político como fator preponderante para o seu sucesso.

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Abstract. Tema: Clarificação do objetivo político como fator crítico de sucesso da implementação das Políticas Públicas ao nível local.
Resumo: O estudo pretende compreender se a clarificação do objetivo político influencia o sucesso da implementação da política pública ao nível local.
Os estudos dedicados à implementação, enquanto etapa (do ciclo político) que concretiza a formulação da política pública e a tomada de decisão, têm vindo a ganhar uma nova perspetiva. Entendida inicialmente, como referem deLeon and deLeon (2012), como a execução, por parte dos administradores, dos objetivos definidos pelos decisores políticos, num processo simples e direto, é, atualmente, reconhecida como uma etapa complexa, que requer planeamento e estratégia, e que representa um ponto importante no quadro do desenvolvimento das políticas públicas e, por conseguinte, sobre a qual deverá ser dada maior importância, em termos de investigação académica e perceção política.
Perspetiva-se estudar, ao nível local, qual a importância da clarificação do objetivo político para o sucesso da Implementação das Políticas Públicas. De que forma o discurso mais claro do objetivo de uma política pública, pelos decisores políticos e/ou implementadores, aos seus cidadãos, resulta num maior sentido de pertença [apropriação] e compromisso [mobilização e cooperação] por parte destes às normas, iniciativas e programas. A metodologia a observar para o projeto de investigação, baseada no plano de pesquisa que objetiva dar resposta à questão colocada, será realizada através de pesquisa experimental, com recurso a questionários como principal tipo de recolha de dados, que permitam estabelecer resultados e conclusões sobre a importância de um discurso claro por parte dos decisores políticos e/ou implementadores aos seus cidadãos na concretização da política pública.
Palavras-chave: politicas públicas, implementação, nível local e clarificação.

Keywords: *Politicas públicas, implementação, comunicação e divulgação.*

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Os movimentos sociais de bairro em defesa da mobilidade urbana ativa e justa

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Abstract. Apresentar-se-á movimentos sociais de bairro que reivindicam para o seu território infraestruturas e políticas públicas para a mobilidade ciclável e como estas podem possibilitar a promoção da coesão socioterritorial em contextos que apresentam desigualdades urbanas e socioeconómicas. Pretende-se compreender discursos sobre o bairro e lógicas de comunicação bairro/poder local no sentido de perceber como afetam as reivindicações destes movimentos sociais. Espera-se contribuir para o conhecimento sobre o planeamento territorial participado para a sustentabilidade ambiental ao nível do bairro e como os movimentos sociais de bairro influenciam uma nova agenda para políticas públicas de mobilidade urbana ativa e justa.

Keywords: *bicicleta; desenvolvimento comunitário; mobilidade ciclável; movimentos sociais urbanos; políticas públicas locais; sustentabilidade ambiental.*

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A Cooperação Transfronteiriça e a Política Regional da União Europeia

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Abstract. A cooperação transfronteiriça é um elemento fulcral da política regional da União Europeia (UE), de forma a fomentar desenvolvimento, coesão e integração entre os estados-membros. Os desafios advindos do desfasamento entre as divisões territoriais e as instituições dos estados-membros podem constituir um entrave à cooperação, sendo necessária uma política da UE que estabeleça uma plataforma comum que inclua todos os actores e as redes formais e informais, propiciando a cooperação transfronteiriça. Contudo, a UE tem uma política de cooperação transfronteiriça inconsistente, sem uma estrutura central e com a sobreposição de meios e organizações no nível regional. Nesta investigação iremos olhar para as dinâmicas de cooperação transfronteiriça na UE, o impacto do desfasamento entre os estados-membros e tentar perceber qual a estratégia que maximize a promoção de desenvolvimento e integração preconizadas pela UE. Nesse sentido, iremos olhar para estruturas, tais como as Euro-regiões, para poder observar as políticas públicas da UE em contexto de cooperação transfronteiriça e assim analisar as estruturas regionais de cooperação transfronteiriça da UE.

Keywords: *Cooperação transfronteiriça, Política regional, União Europeia, Euro-regiões, Integração europeia*

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Políticas Públicas de Apoio ao Empreendedorismo no Ensino Superior em Portugal: Uma Análise das Medidas e Estratégias Adotadas e os seus Efeitos na Formação de Empreendedores

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Abstract. As políticas públicas influenciam de forma determinante a cultura empreendedora de uma sociedade. Com este projeto de investigação pretende-se analisar o papel que os diferentes stakeholders tem no desenvolvimento do ecossistema empreendedor em Portugal, analisando o contexto atual e identificando os principais fatores que contribuem para o sucesso ou insucesso das empresas. A questão de investigação é: De que modo é que a colaboração entre as instituições de ensino superior, empresas, governo e organizações não governamentais pode ser fortalecida para criar um ecossistema empreendedor mais robusto em Portugal?

Para responder a estas questões, far-se-á a revisão da literatura sobre políticas públicas de empreendedorismo, a identificação de políticas existentes e a análise das perceções dos Stakeholders sobre o empreendedorismo bem como a formação empreendedora. Assim serão identificados os fatores que influenciam o sucesso ou fracasso das políticas públicas de criação das sinergias entre os diferentes atores. A metodologia adotada será de investigação qualitativa. Entrevistas em profundidade com estudantes, professores, especialistas e formuladores de políticas públicas, servirão como instrumento para a recolha de dados qualitativos. A análise qualitativa dos dados será realizada através de técnicas de análise de conteúdo. O enquadramento conceptual deste projeto abrange variáveis como políticas públicas de empreendedorismo, formação empreendedora e capital social, entre outras. Este projeto de investigação contribuirá para a compreensão do atual cenário das políticas públicas de apoio ao empreendedorismo bem como a articulação existente entre os diferentes stakeholders. Os resultados desta investigação constituirão uma base fundamentada em dados empíricos, com o intuito de contribuir para uma formulação de políticas públicas mais rigorosa e eficaz de promoção do empreendedorismo bem como de criar um ecossistema empreendedor mais dinâmico e resiliente.

Palavras-chave: políticas públicas, empreendedorismo, ensino superior, Portugal, ecossistema empreendedor, Partes Interessadas, Modelo de quadrupla hélice

Keywords: *políticas públicas, empreendedorismo, ensino superior, Portugal, investigação mista*

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Justiça Social no Acesso às Políticas Públicas de Habitação Sustentável: Portugal e República Popular da China

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Abstract. Justiça Social no Acesso às Políticas Públicas de Habitação Sustentável: Portugal e República Popular da China
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Resumo. As políticas públicas de habitação sustentável são essenciais para garantir um acesso justo e equitativo à habitação [1]–[3], especialmente para os grupos mais vulneráveis [4]–[6]. No entanto, implementar políticas públicas de habitação sustentável equitativas é um desafio complexo, que envolve múltiplos agentes[7]–[10]. Esta investigação pretende analisar as políticas públicas mais recentes de habitação sustentável em Portugal e na China, comparando como é que estes países integram os princípios de justiça social nas mesmas[11]–[14]. Para tal serão analisados os programas e os regulamentos que diretamente impactam nesta área. Para que se possa realizar esta análise documental será construído um referencial analítico com métricas a avaliar. Por fim recorrer-se-á ao método comparativo para que se possa contribuir para o debate de como é que as políticas públicas de habitação sustentável podem promover a justiça social. A comparação entre as políticas públicas de habitação sustentável em Portugal e China pode fornecer visões e perspetivas importantes de como é que estes países tentam enfrentar estes desafios e melhorar a qualidade de vida dos seus cidadãos mais vulneráveis [15]–[17].
Palavras-chave: Justiça Social; Políticas Públicas; Habitação Sustentável; Portugal; República Popular da China

Keywords: *Justiça Social; Políticas Públicas; Habitação Sustentável; Portugal; República Popular da China*

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A Relação entre as Políticas Públicas Desportivas e a Performance Olímpica: os casos de Portugal e Espanha

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Abstract. O desporto é um fenómeno com cada vez mais influência na sociedade, gerando um forte interesse numa grande franja da população mundial. A sua máxima expressão global ocorre a cada quatro anos, com a realização dos Jogos Olímpicos. Nesta investigação procuramos olhar para a realidade Olímpica, analisando a evolução dos Jogos ao longo da sua era moderna e o envolvimento que os Estados tiveram neles. Iremos focar-nos em dissecar os casos de Portugal e de Espanha para responder à pergunta essencial que fazemos: qual o papel das políticas públicas nas performances Olímpicas de Portugal e Espanha?
Optaremos por uma abordagem mista, efetuando a análise de fontes documentais acerca dos Jogos, olhando para relatórios oficiais, notícias relevantes e para os resultados das provas. Procuraremos, também, conhecer as posições dos atores relevantes (atletas, treinadores e dirigentes), nomeadamente através de contactos a efetuar via entrevista semiestruturada e através da criação de focus groups. Os resultados obtidos serão processados com a ajuda do método SPLISS.
Pretendemos com este projeto conhecer, com a maior profundidade possível, a situação dos vizinhos ibéricos, para compreender se e de que forma as políticas públicas estão a influenciar a performance desportiva, para as caracterizar e criar caminhos para as potenciar na direção do sucesso desportivo.

Keywords: *Políticas Públicas Desportivas, Jogos Olímpicos, Performance Desportiva, Portugal, Espanha.*

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Políticas Públicas com foco no plano de Gestão da Qualidade nos níveis terciários de cuidados de saúde em Angola

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Abstract. Houve algumas modificações consideráveis na reflexão sobre a gestão quanto aos papéis de uma organização e responsabilidades sociais (Mellat-Parast, 2014). Logo, a qualidade dos cuidados de saúde é um desafio temível desde a década de 1990. Recentemente, um interesse emergente em gestão da qualidade tem sido impulsionado pela necessidade de controlar a eficiência e a eficácia no atendimento (Lin, B., ; Clousing, J. 1995).
No entanto, o conceito de Gestão de Qualidade é continuamente o foco dos executivos em unidades de saúde no Mundo. The Joint Commission on the Accreditation of Healthcare Organizations (JCAHO), por exemplo, tem incorporado conceitos de Gestão de Qualidade na sua agenda para a mudança. A American Hospital Association, por meio de sua Research Hospital e Educational Trust, publicou um relatório para ajudar os hospitais a projetar e implementar o sistema de Gestão da Qualidade (Lin ; Clousing, 1995).
Logo, o objeto deste estudo é tentar perceber como a gestão de processos nos níveis terciários de cuidados de saúde influência na prevenção de riscos relacionado aos pacientes.
O objetivo geral é avaliar o grau de satisfação profissional dos gestores no apoio do executivo para o plano de Gestão da Qualidade nos níveis terciários de cuidados de saúde em Angola.
A palavra metodologia utiliza-se frequentemente com distintos sentidos, quer na expressão do dia-a-dia, quer no mundo académico. Fala-se assim, de metodologia de investigação para fazer referência às fases e aos procederes que se seguem numa determinada investigação. Porém, será realizado um estudo descritivo, correlacionais e dedutivo, de abordagem quantitativa. Quanto ao instrumento de colheita de dados, utilizaremos um questionário (Pocinho, 2012).

Keywords: *Qualidade; Gestão; Unidades de Saúde; Sistema Nacional de Saúde*

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Cidadania Urbana e Emergências Climáticas: o papel da participação cidadã na construção da ecoconsciencialização e na ação coletiva através das cidades

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Abstract. Os recentes relatórios ambientais confirmam um cenário preocupante sobre o clima do planeta – o aumento de 1,5 graus na temperatura média global poderá chegar já em 2040. Num quadro de crescente emergência climática, emergem também movimentos cívicos organizados de protesto e alerta. Nesse enquadramento, o objeto desta investigação é a ecoconsciencialização, tendo como objetivos compreender a natureza, atividade e impacto do ativismo ambiental-urbano para a ecoconsciencialização; identificar, sistematizar e discutir políticas públicas (PP) voltadas à ecoconsciencialização; propor a articulação de PP voltadas à ecoconsciencialização a partir de metodologias que promovam a participação ativa dos cidadãos. Com a investigação pretende-se demonstrar a importância da articulação da participação ativa como ação eficaz na aplicação de PP voltadas à ecoconsciencialização. Para alcançar esses objetivos optou-se por uma abordagem qualitativa e descritiva, utilizando-se como procedimentos de coletas de dados pesquisas bibliográfica, documental e levantamento – onde a coleta será feita por meio de entrevistas semiestruturadas.

Keywords: *participação cidadã; emergências climáticas; ecoconsciencialização; políticas públicas; ativismo climático; Portugal;*

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Sistema de partilha de cadeiras de rodas – um lugar para as pessoas que têm dificuldades a andar nas políticas de mobilidade em Portugal

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Abstract. Sistema de partilha de cadeiras de rodas – um lugar para pessoas com dificuldades a andar nas políticas de mobilidade em Portuga
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Palavras-chave: políticas de mobilidade, plano de mobilidade, mobilidade inclusiva, cadeira-de-rodas
Resumo:
De acordo com os últimos censos, realizados no ano de 2021, cerca de 19% da população portuguesa sente dificuldades a andar. Este problema afeta pessoas de todos os géneros e idades, recaindo sobretudo sobre pessoas idosas (INE, 2021). Com o envelhecimento da população, existem mais probabilidades de se ter de lidar com estas dificuldades durante mais tempo de vida, perdendo qualidade de vida (Apolo, 2010), caso não se encontrem estratégias adequadas a nível individual ou coletivo. A política pública de mobilidade em Portugal oferece soluções que correspondem às necessidades de maioria da população, no entanto, parecem não auferir resposta para as deslocações das pessoas que sentem dificuldades a andar. Para estas pessoas, poderá ser doloroso ou cansativo andar em distâncias que normalmente consideramos curtas. Este trabalho propõe uma análise às políticas públicas de mobilidade em Portugal e a hipótese de se integrar um sistema de partilha de cadeiras de rodas para uso, dentro de diferentes zonas, em diferentes territórios. O objetivo será alcançar, por via das políticas públicas de mobilidade, uma estratégia que permita o cidadão nas circunstâncias acima descritas ter um melhor usufruto do espaço, sendo o direito à mobilidade um desígnio de vários países da União Europeia (Gallez, 2017). Será dado seguimento à investigação desenvolvida em mestrado onde defendi o projeto Reinventar a roda: sistema de reutilização e partilha de cadeiras de rodas em Aveiro (Coimbra, J. et al., 2019), optando agora por não incidir a investigação apenas neste território. A metodologia definida para o desenvolvimento da investigação está assente em métodos de análise quantitativos e qualitativos, envolvendo tarefas tais como: construir instrumentos de pesquisa, recolha de dados e de análise; pesquisar em diferentes bases de dados, entre as quais, bases de dados científicos; recolher dados; analisar e refletir; realizar contactos formais e informais com diferentes stakeholders; partilhar dados obtidos durante a investigação; discutir resultados; identificar futuras oportunidades de investigação ;extrair conclusões. O cronograma de trabalhos está programado para 27 meses, incluindo 13 categorias de tarefas e 36 tarefas.

Keywords: *políticas de mobilidade, mobilidade inclusiva, cadeira-de-rodas*

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O Papel de Empresas Emblemáticas no apoio à Implementação de Políticas Transformadoras no Território onde atuam - Um estudo de caso

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Abstract. Narrativas de "grandes transformações" fazem parte desde sempre do imaginário coletivo (mítico) em diferentes civilizações e períodos históricos do desenvolvimento humano. Nas Ciências Sociais e Políticas, o tema transformação (sustentável) retorna ao centro das discussões como tema fundamental nas políticas públicas em escala global. Desde as duas últimas décadas deste século, discursos políticos e científicos apresentam forte apelo à necessidade de uma "grande transformação" da política, da economia e da sociedade para a solução de problemas sociais e ecológicos complexos em escala planetária. No atual debate sobre o papel do Estado no período pós-pandêmico (COVIDE-19), e com o objetivo de legitimação de medidas econômicas restritivas, tornou-se mais evidente a dominação de uma "semântica de transformação de processos". Essa semântica atenua o papel fundamental do contexto territorial na construção de práticas comunicativas, de narrativas e histórias informais, semelhantemente ao observado em discursos sobre globalização. Entretanto, considerando-se a importância da dimensão espacial / meio (escala) e sua influência sobre a forma de intereção entre os diferentes atores e (sub)sistemas sociais (política, economia, sociedade, religião, arte) na construção de textos políticos e padrões sociais, defendemos a seguinte tese: i) empresas emblemáticas, enquanto atores institucionais de forte representação local, constroem ativamente as "histórias" e as narrativas de "grandes transformações", agindo como plataforma de comunicação (acoplamento) nas interações internas e externas entre os diferentes atores e (sub)sistemas sociais locais, assim como contribuem para o fomento da capacidade institucional e para mudanças estruturais (transformações) na região onde atuam; ii) processos de transformação / processos transformativos ocorrem de forma significativa (apenas) localmente, em determinado território ou região; iii) processos de transição / transformação são identificados pela mudança da função da política. Este trabalho tem por objetivo analisar o papel de empresas emblemáticas no apoio à implementação de políticas transformadoras no território onde atuam, a partir de um estudo de caso na região do Alto Alentejo, Campo Maior. Trata-se do Grupo Nabeiro – Delta Café. Essa empresa fundada nas décadas de 1961, caracteriza-se por forte ligação à região, liderança no mercado ibérico e representação internacional em quarenta (40) países, entre eles Angola, Brasil e China. Sua escolha como objeto de análise deve-se, de um lado, a sua relevância às economias regional e nacional, a seu forte engajamento social, mas também a sua localização em uma região de baixa densidade demográfica em Portugal, pouco explorada na literatura especializada. De outro, essa escolha oferece-nos um exemplo concreto para uma análise, que busca perceber a interação complexa entre uma empresa emblemática e outros atores institucionais e (sub)sistemas sociais no âmbito das políticas públicas em determinada região, assim como ajude-nos a identificar pontos de tensão e de oportunidades para a implementação de políticas públicas, que venham a promover mudanças positivas à sociedade e / ou manter relações de poder e interesses já existentes. A análise tem como bases teórica e metodológica a teoria dos sistemas sociais e a análise crítica do discurso.

Keywords: *Capacidade institucional, governança, transformação, teoria dos sistemas sociais, análise crítica do discurso, políticas públicas*

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Immigration and Migration Policy in Angola

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Abstract. Due to the growth of the Angolan economy in the regional context, Lopes (2015) verified in Angola a complexification regarding the migration flows with the massive arrival of immigrants with different origins. According to the National Institute of Statistics of Angola-INE, in 2014, there would be about 586,480 foreign residents, a figure that increases to 795,936 in 2019. From the population point of view it meant that the resident foreigners increased their representativity from 2.3% to 2.6%.(report 2016 ; 2022).
In Lee (1966), one perceives the power of attraction of the economic conditions offered by the destination areas and the desire of the individual agent to improve his economic condition in the essence of the push-pull model, Ravenstein (1889), and theories considered micro-sociological of migration (Peixoto, 2004). Studies by Chappell ; Sriskandarajah (2007), reveal that migration can influence social and economic development in origin and destination areas. Lopes(2015). However, the possibility of immigration to contribute to the development of destination areas, depends on government actions emanating in Public Policies, Jenkins (1978). In particular, the aim is to understand whether or not the Public Policies aimed at migration congregate measures that stimulate the action of immigrants in order to contribute to local development. For this study we will use the data provided by INE and Serviço de Migração e Estrangeiros - SME. It is planned to conduct interviews with immigrants residing in the city of Luanda who perform income generating activities, using the snowball sampling technique. This will be a mixed methodology of a qualitative and quantitative nature. In terms of public policies, the government needs to develop more measures aimed at: Boosting immigration for the economic development of the Country; Documenting every income-generating immigrant. In this light, the main focus of this work is to analyze with what measures public policies on migration can contribute to the development of the Country.

Keywords: *immigration, public policies, migration policy and economic development, Immigration in Angola.*

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The role of Academic Engagement in a Knowledge Society: a comparative analysis on aims, trends, and policy implications

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Abstract. Under the Knowledge Society narratives, European policy emphasizes the role of knowledge production and transfer in fostering economic competitiveness and addressing complex societal challenges (Ulnicane 2015). The universities play a key role in this context, encouraging academics to engage with non-academic partners (Carayannis and Campbell 2018; Perkmann et al. 2013).
At the same time, Education Institutions (HEIs) have been introducing market-oriented reforms that impact the modes of knowledge production and academic work, challenging academics to comply with diverse and complex demands (Coucher and Lacy 2022).
Taking this into account, this study aims to contribute to the discussion on the role of academic engagement in a Knowledge-based Society, attempting to answer the following research question:
How does the political and institutional framework shape academic engagement with society? What are the engagement practices developed by Portuguese academics, and what are the main drivers of these practices? How does Portuguese Academia compare with other European Systems subject to similar policy narratives and expectations?
To answer these questions, we follow a quantitative approach based on the APIKS survey that provides comparable data regarding the attitudes and practices of academics.
The findings suggest the influence of individual and institutional determinants on academic engagement with society by considering different practices, partners, purposes, and orientations (Peksen et al. 2021; Queirós et al. 2022). The data also reveal country differences in the way academics engage with society and how HE reforms influence the involvement of different sub-groups of academics.
With this study, we aim to characterize academic engagement in Portugal from a comparative perspective with other European systems, discussing how different practices, namely more socially oriented knowledge-based activities, may involve the academic community for this purpose.

Keywords: *Higher Education Policy, Knowledge Society, Academic Engagement, Knowledge Production, Academic Profession*

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Cross-Border Higher Education: an overview of quality assurance policies

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Abstract. Internationalisation has long been a goal for higher education systems and institutions. However, nowadays there is an increasing emphasis in different ways of becoming international, one of them being the offer of education through Cross-Border Higher Education (CBHE) models. CBHE can be understood as a process in which a higher education institution (HEI) offers and guarantees a study program in a country different from the one where the HEI is located (UNESCO 2005). For Yelland (2010), CBHE presents opportunities and challenges related to issues of implementation, access, and quality assurance (QA). Field (2009) shows great concern with the quality of teaching and learning that is offered under CBHE models. Amaral (2016) highlights some precautions with Rouge Providers and the offer of degree mills that appear to emerge when there is a lack of regulation. Because of these concerns, several organizations have sought mechanisms and tools to ensure the quality of CBHE. This proposal aims to share some of the results already obtained under a PhD Project entitled "Cross-Border Higher Education: an overview of quality assurance policies". In this project the aim is to understand the main challenges the quality assurance of CBHE faces in Europe, both at the system and institutional level. The project is characterized as qualitative research and methodologically it relies on a systematic literature review on CBHE and quality assurance, complemented with documents' analysis and a set of interviews with key actors from: i) the national QA agencies of European Countries; and ii) international organizations with a role in quality assurance, such the EUA, ENQA, EURASHE, ESU, EQAR, ECA, INQAAHE, UNESCO and OECD, as identified by Cardoso ; Rosa (2018). So far, based on the results achieved it is possible to highlight the lack of cooperation between different stakeholders, such as international organisations, governments, quality assurance agencies and HEI, as one of the main challenges for the QA of CBHE. Also, the diversity of legal frameworks at HE and QA levels, and the tensions between home and host countries appear as important aspects challenging the quality assurance of this type of provision. In general, the existence of a common mechanism to guarantee the quality of CBHE between all stakeholders may contribute to reduce these challenges.

Keywords: *Cross-Border Higher Education; Quality Assurance; European Higher Education Area.*

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Reabilitação Urbana e Cultura

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Abstract. Resumo
As Políticas Públicas ocupam, cada vez mais, um papel preponderante na evolução e inovação da sociedade. Existe uma grande necessidade de Políticas Urbanas eficazes em diversos níveis, como por exemplo, na adequação dos espaços construídos de acordo com a função que exercem ao meio em que se inserem, a sua articulação e respectiva acessibilidade com as outras partes da cidade, a reabilitação do património construído, a reabilitação do espaço público, daí a reabilitação urbana ser de máxima necessidade, visto que o que está degradado tem tendência a ser abandonado e esquecido, levando depois a outros problemas de vertente social. A existência de mais políticas públicas urbanas (efectivamente eficazes) no âmbito da reabilitação (no seu todo) podem levar a um crescimento das próprias cidades, mesmo que o crescimento não seja no sentido físico. Reabilitar o espaço urbano atrai investimento, proporciona desenvolvimento económico e, também mais qualidade de vida.
As leituras, a investigação, a observação com lente, neste caso, de arquitecta levou-me ao tema das cidades, concretamente as CEC e tudo o que se desenrolou e desenvolveu devido a essa categoria. E, aqui, surgiu a ideia de que a urgência da reabilitação urbana poderia ser complementada e impulsionada com políticas culturais. A cultura atrai pessoas, e, as pessoas procuram cultura e há necessidade de ter espaços devidamente reabilitados para o acolhimento (exterior ou interior) destas mesmas pessoas. E por mais volátil que seja um evento cultural, o espaço fica sempre lá. Fica o espaço e ficam as memórias. Fica o espaço e vão e vêm eventos culturais. É necessário apostar numa mobilidade eficaz, em espaços urbanos reabilitados e acessíveis, em edifícios reabilitados e enquadrados e, até, em novos edifícios quando assim se justifique. Porque ficam no espaço e no tempo. E o caso das CEC é um óptimo caso em que estas duas políticas juntas podem melhorar uma cidade nos mais diversos aspectos, em que partindo da reabilitação urbana e da oferta cultural vai existir, por consequência, mais vida social e desenvolvimento económico, a mobilidade vai ser maior, a sociedade vai interagir mais e todos estes factores podem levar a um grande desenvolvimento da cidade. Portanto, uma candidatura a CEC pode ser uma excelente oportunidade de desenvolvimento.

Keywords: *Políticas culturais, Reabiltação urbana, Sustentabilidade, Resiliência*

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Well-being at work: From public policies to the perspectives of employers and workers/employees in the Aveiro Region

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Abstract. The thesis' subject is well-being at work (WBW), especially its dimensions and subdimensions.
Its main objective is to know, in the perspectives of Portuguese public policies and of employees/workers and employers in the Region of Aveiro, which dimensions (or aspects) and subdimensions they consider to confer WBW.
Other objectives are: to understand how public policies, employees/workers and employers define or understand the concept of WBW; to understand to what extent there is convergence or divergence in the perspectives of public policies, employees/workers, and employers on the dimensions/subdimensions that confer WBW and how they define or understand this concept; and to know the practices that confer WBW in organizations, to understand whether organizations implement more practices beyond those foreseen in the legislation, and whether workers/employees are satisfied with them, whether they consider the practices sufficient, and whether the organizations could adopt more practices.
The research question is "What are the dimensions and subdimensions that public policies and employees/workers and employers in the Aveiro Region understand to confer WBW?"
In fact, the research problem relates to the fact that work can have negative consequences for workers' well-being, both on and off the job. The market has changed over the years, being extremely competitive, generating stress, illness, and deaths, making WBW central (Livro Verde Sobre o Futuro do Trabalho, 2021), particularly after Covid-19 (Eurofound, 2021). The solution is to increase knowledge about what confer WBW and keep workers healthy, being very important to retain employees (Agapito et al., 2015; EU-OSHA, 2013).
Regarding the methodology, this will be essentially qualitative, using surveys by semi-structured interviews to employers; and by questionnaire to employees/workers, being content analysis the technique of data analysis. About public policies, the techniques will be document analysis (of the legislation) and content analysis. The sample will include private companies in the Aveiro Region (NUTS III), with the limitations being the possibility of respondents being defensive in their answers and the number of answers being scarce.
Finally, it is expected that the results of the study will show that distinct dimensions and sub-dimensions conferring WBW can be referred to, even in the same group. So far, from the literature review, examples are: individual well-being (feeling positive emotions); contractual issues (fair salary); and growth/development (feeling self-realized) (CIPD, 2016; Cvenkel, 2018; Warr, 2013; Zheng et al., 2015). The results should provide clues to organizations and public policies about how they can improve workers' well-being.

Keywords: *Well-being at work, Well-being at work policies, Well-being and happiness, Well-being and quality of life*

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Reabilitation Sciences

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Alterações globais associadas à Disfunção da Articulação Sacroilíaca e a sua normalização por manipulação

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Abstract. Introdução- A disfunção da articulação sacroilíaca refere-se a um estado de biomecânica alterada dessa articulação (Wong et al, 2021). Apesar da multiplicidade de estudos abordando esta disfunção e consequências a vários níveis localizados, não encontramos nenhum que estudasse as consequências a nível global do corpo humano, como pretendemos estudar.
Objetivos- Mapeamento das alterações sintomatológicas mais evidentes, quando a disfunção da articulação sacroilíaca está presente, em termos de dor e tônus muscular (estudo 1); estudar o efeito imediato e médio prazo da terapia e sua voz com as alterações registradas, a nível da dor, tónus muscular, percepção de mudança e satisfação com o tratamento (estudo 2).
Metodologia- Estudo 1: Para o estudo transversal, o tamanho da amostra calculada foi de 128 participantes, dado que se estima uma percentagem de 30,5 % da população, mesmo assintomática, apresenta disfunção da sacroilíaca (Eno et al., 2015). A amostra do estudo será selecionada de forma aleatória no universo de estudantes da Universidade de Aveiro, inscritos para participar no estudo. Critérios de inclusão: jovens adultos, de ambos os sexos, com idades entre os 18 e os 30 anos, com disfunção sacroilíaca. Critérios de exclusão: estudantes da Licenciatura em Fisioterapia, portadores de lesão neurológica, sujeitos a outro tipo de intervenção terapêutica durante o período do estudo. Variáveis: Dor, Tónus muscular; Instrumentos: Escala Visual Analógica da Dor, Algómetro de pressão, MyotonPro. Estudo 2: Estudo randomizado controlado, realizado no Laboratório de Movimento Humano da Universidade de Aveiro, com uma amostra de 39 alunos, divididos aleatoriamente em 3 grupos: experimental, sham e controle, onde testaremos as mesmas variáveis do estudo1, adicionando a percepção da mudança e satisfeita com o tratamento, com a Escala de Mudança de Melhoria Global do Paciente. Resultados- Mapeamento da semiologia associada à disfunção da sacroilíaca, assim como a sua normalização com a manipulação e aferimento da satisfação com a intervenção.
Palavras-Chave – intervenção manipulativa, dor, tónus muscular, semiologia da disfunção sacroilíaca.

Keywords: *intervenção manipulativa, dor, tónus muscular, semiologia da disfunção sacroilíaca.*

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Effects of a Cardio-Oncology Rehabilitation program among high cardiovascular risk cancer survivors: results from the CORE trial

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Abstract. Introduction: The increased burden of cardiovascular risk factors, in association with aging and systemic cancer-related therapies, makes cardiovascular disease a leading cause of death and disability in cancer survivors
Objective: To assess if a center-based cardiac rehabilitation (CBCR) framework, as compared to community-based exercise training (CBET), is superior regarding peak oxygen consumption (VO2peak) and cardiovascular risk factor control among cancer survivors at high cardiovascular risk.
Design: The CORE trial is a prospective, single-center, randomized clinical trial performed from March 2021 to March 2022.
Setting: Medical and community centers.
Participants: A total of 80 adult cancer survivors exposed to cardiotoxic cancer treatment and/or with previous cardiovascular disease.
Interventions: Participants were randomly assigned in a 1:1 ratio to an 8-week CBCR or CBET. The combined aerobic and resistance exercise sessions were performed twice a week.
Main Outcomes and Measures: The powered primary efficacy measure was cardiorespiratory fitness (VO2peak). Secondary outcomes included handgrip maximal strength, functional performance, blood pressure, body composition, lipid profile, plasma biomarkers, physical activity (PA) levels, psychological distress, quality of life (QoL) and health literacy.
Results: A total of 75 participants completed the study (CBCR N=38; CBET N=37). Exercise adherence was significantly higher in CBCR in comparison to CBET (90.3±11.8% vs 68.4±22.1%, p<0.001). Compared to CBET, the VO2peak was increased by 1.3 mL.kg-1.min-1 (95%CI, 0.1 to 2.6; p=0.03), among those in CBCR. When adjusted for exercise adherence, the between-group differences in VO2peak became non-significant (1.48 mL.kg-1.min-1; 95%CI, -0.01 to 2.96 ; p=0.052). Systolic (-10.4 mm Hg; 95%CI, -16.1 to -4.7; p<0.01) and diastolic (-4.5 mm Hg; 95%CI, -7.5 to -1.6; p<0.01) blood pressure, body mass index (1.4 kg.m-2; 95%CI, -1.7 to -1.0; p<0.01), PA levels (1001.1 METs/Min/Week; 95%CI, 719.8 to 1282.8; p<0.01), QoL (13.6 points; 95%CI, 8.3 to 18.9; p<0.01), and health literacy (2.6 points; 95%CI, 1.9 to 3.3; p<0.01) improved in the CBCR group, as compared with the CBET group.
Conclusion and Relevance: The CORE study showed superior results of a cardio-oncology rehabilitation model among high cardiovascular risk cancer survivors in exercise adherence, cardiorespiratory fitness, cardiovascular risk factor control, quality of life and health literacy. The increase in VO2peak seems to be influenced by exercise adherence.
Trial Registration: ClinicalTrials.gov Identifier: NCT05132998

Keywords: *Cancer survivors, Cardiac rehabilitation, Cardiorespiratory fitness, Cardiovascular risk factors, Exercise training*

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Brain energy-Neural dysfunction interplay in mild brain injury, and therapeutic efficacy of brain stimulation on neural recovery

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Abstract. Mild brain injuries are often seen as transient conditions, reflecting the belief that they are fully recoverable neural disturbances. After the injury, that hampers neuronal circuits, affected neurons and brain circuits must be reactivated or they can degenerate from long-term inactivation. Most reactivations are successful but, in a significant number of cases, incomplete, giving rise to persistent brain impairment. Depleted circuitry energy can influence the activation/inactivation balance. An energy shift from neuronal activity to neuroinflammation events, for example, may promote brain circuitry dysfunction and further neurodegeneration. Compensatory energy transduction should help to prevent neurodegeneration and can be delivered by non-invasive brain stimulation (NIBS). NIBS has already demonstrated potential for neuronal reactivation in patients with mild cognitive impairment.

The main aims of this work are to characterize brain (dys)function in mild traumatic brain injury (mTBI) patients and understand the potential of NIBS stimulation to improve post-mTBI recovery, preventing neural degeneration. Secondary aim is to understand the influence of brain energy dynamics on brain circuitry function.

To accomplish that, several studies were planned. First, a scoping review will be conducted, compiling the theory framework on brain energy dynamics, and a theoretical hypothesis of energy allostatic allocation and its consequences to neuronal function. Second, a retrospective case-control study will be performed using MRI findings from the UK Biobank, to characterize time-dependent evolution of brain dysfunction in mTBI patients that present pre- and post-event MRI. Third, a cross-sectional study on mTBI patients followed at CHVNG/E and enrolled at various post-lesion time periods, and analyzed at a given moment using MRI, psychometric tests, and inflammation fluid biomarkers. Finally, a longitudinal study on mTBI patients enrolled since day one of lesion, with a first monitoring phase, and a second interventional phase using NIBS stimulation, via transcranial ultra-sounds (TPS), aiming to assess its efficacy on brain functional rehabilitation.

Keywords: *Mild Traumatic Brain Injury; Non-Invasive Brain Stimulation; Neuroinflammation; Brain Energy*

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The Bobath Concept (NDT) in adult neurorehabilitation: conceptual literature - a scoping review.

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Abstract. Bobath concept/Neurodevelopmental Treatment (NDT) is an inclusive, individualized, problem-solving approach, informed by current knowledge on movement and Neuroscience, for individuals with neurological conditions, with particular emphasis on movement performance and quality. The aim of this study was to perform a scoping review to describe how the Bobath concept is conceptualized, operationalized and studied in adult-onset neurological rehabilitation over the past decade.
This scoping review adopted methods from the Joanna Briggs Institute (JBI) manual for evidence synthesis and preferred reporting items for systematic reviews and meta-analyses extension for scoping reviews (PRISMA-ScR) guidelines. The electronic databases MEDLINE via PUBMED, CINAHL via EBSCO, Scopus, Web of Science, ScienceDirect, and PEDro were searched as well as reference lists and the search engine Google Scholar. The keywords "Bobath" or "Neurodevelopmental treatment" were employed in the search of non-scientific and research articles in adult neurorehabilitation, published between 2013 till 2022, in English, Spanish and Portuguese language literature.
Of the 89 publications identified, 60 were intervention studies and 29 articles (7 theoretical papers, 7 Delphi/surveys/mixed methods studies, 3 qualitative studies, 1 scoping review, 9 letters to the editor and 2 editorials) addressed the conceptual underpinnings of Bobath concept. This article explores the conceptual papers, comprising 5 themes: (a) Theoretical principles; (b) Clinical principles; (c) Clinical reasoning; (d) Conceptualizing movement; and, current (e) Evidence debate. The revised definition and the Model of Bobath Clinical Practice provides a clarification of the unique aspects of Bobath concept. A new clinical skill was identified beyond facilitation – visuospatial kinesthetic perception – as well as how Bobath experts conceptualize movement, which are all integral to Bobath clinicians clinical reasoning.
This review provides an updated Bobath clinical framework that gathers the theoretical foundations and clinical practice principles, that require careful consideration in the design of future intervention studies.
Implications for rehabilitation:
• The publication and illustration of a Model of Bobath Clinical Practice and the redefined Bobath concept through empirical methods provides a basis for clinical practice, education and research.
• The clarification of movement concepts that underpins the clinical reasoning process and the clinical skills of facilitation and visuospatial kinesthetic perception distinguishes the Bobath assessment and intervention from other approaches in neurorehabilitation.
• All of the above require consideration in the development of Bobath effectiveness studies.
Keywords: Bobath concept, Neurodevelopmental treatment (NDT), rehabilitation, physiotherapy, clinical practice, clinical reasoning, movement.

Keywords: *Bobath concept, Neuro-developmental treatment (NDT), rehabilitation, physiotherapy, clinical practice, clinical reasoning, movement.*

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Neural mobilization techniques help decrease pain and improve function in people with musculoskeletal pain: a systematic review with meta-analysis

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Abstract. INTRODUCTION:Musculoskeletal conditions are the most prevalent conditions requiring physical therapy1. Neural mobilization (NM) is a manual therapy technique that can be used to manage musculoskeletal pain, but previous systematic reviews have primarily included trials on conditions directly related to nervous system involvement (e.g., tunnel syndromes, radiculopathies) (Papacharalambous et al., 2022; Peacock et al., 2023; Varangot-Reille et al., 2022). Thus, the aim of this systematic review was to synthesize up-to-date evidence on the effectiveness of using NM to treat pain in adults with musculoskeletal conditions without neurological deficits. METHODS: A systematic review with meta-analysis of randomized, quasi-randomized, and crossover trials of studies involving adults with musculoskeletal pain was performed. Articles were searched in: Web of Science, PubMed, MEDLINE, CINAHL, Cochrane Central Register of Controlled Trials, Scopus and PEDro database, as well as clinical trial registries and Open Access Scientific Repositories in Portugal. Bibliography of included studies and previous reviews were also consulted. Primary outcomes were pain and function. Secondary outcomes were aspects of physical performance (e.g., muscle strength, flexibility, range of motion) and pressure pain threshold (PPT). Risk of bias was assessed by the RoB 2 tool. Certainty of the evidence was evaluated using the GRADE approach. Study protocol was registered in PROSPERO (CRD42021288387) and published elsewhere (Baptista et al., 2022). RESULTS: Thirty-seven studies were found including ten different musculoskeletal conditions. There was a significant effect favouring the NM as part of a multimodal intervention for pain (ES = -2.03 [95%-CI -2.89; -1.18) and function (ES = -1.85 [95%-CI -2.36; -1.35) in people with low back pain and for pain in people with neck pain (ES = -0.76 [95%-CI -1.39; -0.12]). Aggregated analyses of different musculoskeletal conditions (lateral epicondylitis, rheumatoid arthritis, ankle sprain, shoulder impingement syndrome, and plantar heel pain syndrome) revealed a significant effect favouring NM for function (ES = -0.79 [95%-CI -1.50; -0.08]), PPT (ES = 0.95 [95%-CI 0.24; 1.67]), and grip strength (ES = 0.47 [95%-CI 0.08; 0.86]). However, there is very low confidence in all effect estimates. CONCLUSIONS: NM appears to have positive effects on pain, function, grip strength and PPT in patients with musculoskeletal pain, but results may vary depending on the musculoskeletal condition in question. More studies are needed.

Keywords: *physical therapy modalities, neurodynamics, musculoskeletal pain, pain measurement, functional status, physical functional performance.*

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Pain neuroscience education, exercise, and cognitive training in individuals with idiopathic chronic low back pain: an intervention study

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Abstract. Chronic low back pain (LBP) is one of the most common clinical conditions worldwide[1]. Chronic pain has been associated with cognitive dysfunction with different theories, including a cognitive load triggered by pain that could difficult the processing of cognitive information at the central nervous system[2]. A recent systematic review with meta-analysis published by our group[3] showed decreased problem-solving abilities, speed of information processing, working memory, and delayed memory performance for individuals with low back pain when compared to asymptomatic individuals. Nonpharmacological interventions recommended by recent guidelines for individuals with LBP include exercise and pain neuroscience education[4]. However, the effects of these are moderate at best and these interventions have never been combined with cognitive training. Thus, it is important to investigate whether targeting cognitive function would increase the probability of treatment success. Therefore, a three-arm randomized control trial has been designed, in line with CONSORT, to investigate whether adding cognitive training to exercise and pain education is more effective that exercise and education alone.

A total sample size of 84 individuals was estimated. Participants will be randomly allocated to one of the three intervention groups and will be assessed 3 times (T1 – baseline; T2 – end of intervention; T3 – three months follow-up). Participants will be assessed for pain characteristics (the Numeric Pain Rating Scale, disability, Central Sensitization, Kinesiophobia, Catastrophizing), sleep, anxiety, depression, and cortical reorganization. This will be assessed using two-point discrimination and for cognitive function using an online software. In addition, in the last assessment (T3), participants will answer the Patient's Global Impression of Change.

Group 1 will receive exercise and pain neuroscience education plus cognitive training, group 2 will receive exercise and pain neuroscience education only and group 3 will receive cognitive training only. The intervention will consist of sixteen face-to-face group sessions (two sessions per week for 8 weeks).

This study might elucidate the impact of cognitive training in pain outcomes and provide recommendations for the assessment and management of patients with LBP in the future.

Keywords: *chronic pain, cognitive function, low back pain, cognition.*

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Artificial Intelligence and Machine learning in Asthma and COPD: A Narrative Review for Clinicians

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Abstract. Asthma and chronic obstructive pulmonary disease (COPD) are prevalent chronic airway diseases and leading causes of morbidity and mortality worldwide, imposing a significant individual, economic, and social burdens. Artificial intelligence holds great promise in overcoming some of the challenges associated with the diagnosis and management of these complex diseases by its ability to analyse large amounts of data, identify complex patterns and model linear and non-linear relationships. It can support clinicians by providing prompt and precise diagnoses and patients improving their outcomes and quality of care. Despite its advantages, the knowledge gap between respiratory clinicians and data scientists represents a significant barrier to the widespread adoption of artificial intelligence in healthcare.

This narrative review aimed to bridge the knowledge gap and promote AI deployment by offering a comprehensive understanding of the key concepts of artificial intelligence and machine learning and to demonstrate their potential applications in improving the care in asthma and COPD through real-life examples.

Artificial intelligence includes all systems that perform tasks autonomously. Machine learning is a subfield of artificial intelligence and consists of algorithms that learn from data. There are three main branches of machine learning: supervised learning, unsupervised learning, and reinforcement learning. Supervised learning uses models trained on data to predict response values based on independent variables. It has been highly successful in discriminating patients with asthma or COPD from healthy subjects, identifying patients at high risk of hospitalization, predicting their response to treatment, and their chances of survival. Unsupervised learning, which focuses on finding patterns in data, has shown to be invaluable in identifying subtypes of asthma and COPD, clustering patients based on similar features. This approach enables deeper insights into disease heterogeneity. Reinforcement learning has had a limited use in the respiratory field, nevertheless, it holds promises in guiding healthcare decision-making, namely supporting the management of chronic respiratory diseases where treatment needs to be constantly adjusted to improve patients' outcomes. This technique involves training an algorithm to make decisions by interacting with an environment and receiving feedback in the form of rewards or punishments.

The application of artificial intelligence and machine learning have the potential to revolutionize clinical decision-making, leading to personalized therapy and improved outcomes. However, the need for larger sample sizes and external validation has been identified as a critical requirement for developing clinically relevant and generalizable models.

Keywords: *artificial intelligence; asthma; chronic obstructive pulmonary disease; diagnosis; machine learning; management*

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Effects of home-based pulmonary rehabilitation on the functional status of patients with exacerbations of COPD: a randomized controlled trial

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Abstract. Exacerbations of chronic obstructive pulmonary disease (ECOPD), which are defined as an acute worsening of respiratory symptoms that result in additional therapy, have a negative impact on patients' functional status and disease progression. Pulmonary rehabilitation (PR) is a well-established intervention for the management of patients with stable disease, however uncertainty exists about the safety and beneficial effects of delivering PR for patients with ECOPD. This study aimed to explore the safety and effects of a home-based PR programme on the functional status of outpatients with ECOPD.

A randomized controlled trial was conducted (NCT03751670). Patients with ECOPD were randomly assigned to the control (CG, i.e., standard medication) or experimental (EG, i.e., standard medication plus 3-weeks [2 times/week] of PR) group within 48h of the diagnosis (baseline). The PR programme was composed of breathing control exercises, airway clearance techniques, exercise training and psychoeducational support. Functional status was assessed at baseline and after 3 weeks (post) through the London chest activities of daily living scale (LCADL), short physical performance battery (SPPB), quadriceps muscle strength (QMS) and 1-minute sit-to-stand test (1-minSTS). Comparisons within and between groups were explored with (non-)parametric mixed ANOVAs.

Fifty outpatients with ECOPD (78% male, 69.7±10.7 years, FEV1 47.4±16.4%predicted) were included. Between groups comparisons showed a significant group*time interaction for LCADL (CG: baseline 24.5 [19; 39] vs. post 27 [16; 39], EG: 23 [17.5; 39] vs. post 18.5 [13; 30], p=0.006), SPPB (CG: baseline 9 [8; 11] vs. post 10 [8; 11], EG: 9 [7.5; 10] vs. post 10 [9; 11.5], p=0.049) and QMS (CG: baseline 23.4±7.3 vs. post 23.1±7.8 kgf, EG: baseline 22±6 vs. post 26±6.8 kgf, p<0.001), but not for the 1-minSTS (CG: baseline 17 [14; 25] vs. post 18 [14; 26] repetitions, EG: baseline 16.5 [12.5; 22] vs. post 22 [17.5; 25] repetitions, p=0.061). The EG presented significant improvements, after PR, on all functional status measures (p<0.05). No significant within group differences were found for the CG (p>0.05). No adverse events were reported.

A 3-weeks home-based PR programme is safe and more effective than only standard medication in improving the functional status of outpatients with ECOPD. This highlights the potential role of PR in improving the recovery process during ECOPD and might contribute to improved prognosis in these patients. Future larger studies are needed to confirm these findings and assess the mid- and long-term effectiveness of PR in outpatients with ECOPD.

Keywords: *pulmonary rehabilitation; exacerbations of COPD; functional status; outpatients*

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Effectiveness of PersonalIsed CommUnity-based Physical activities (PICk UP) on functional exercise capacity of people with chronic obstructive pulmonary disease

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Abstract. Pulmonary rehabilitation (PR) is a non-pharmacological, evidence-based and cost-effective intervention for the management of people with chronic obstructive pulmonary disease (COPD).1 Improving functional capacity is one of the most widely recognised benefits of this intervention.1 Nevertheless, PR is a time-limited intervention (six to 12 weeks) and benefits tend to disappear within six to 12 months.2 Personalized community-based physical activity (PA) programmes may promote long-term adherence to PA and therefore prolong PR benefits.3 PICk-UP (NCT04223362) aimed to assess the effectiveness of personalized community-based PAs on the functional capacity of people with COPD.

PICk UP was a multicentre, assessor-blinded, randomized controlled trial. People with COPD were recruited from community-based PR programmes and randomly assigned to either the experimental (EG: enrolment for 6-months on the preferred community-based PAs [e.g., senior or aquatic gymnastics]) or control group (CG: standard care). Functional capacity was measured with the six-minute walk test (6MWT) and the 1-minute sit-to-stand test (1STS) at baseline (post PR), 3 and 6 months after PR completion. Effectiveness of the PICk-UP trial was evaluated according to the intention-to-treat principle using linear mixed models with subsequent post-hoc multiple comparisons (Sidak adjustment).

61 people with COPD (EG: n=32, 84%, 70.1±9.2 years, FEV1 60±17 %predicted; CG: n=29, 83%, 69.1±7.7 years, FEV1 54±17 %predicted) were included. There was a significant time-group interaction for the 1STS (P=0.01) but not for the 6MWT (P=0.90). At the 6-month follow-up, there was a significant decrease in the number of repetitions of the 1STS in the CG (= 2.4 [0.3; 4.5] repetitions; P<0.05), but not in the EG (= -0.2 [-2.2; 1.8]). When comparing changes after 6-months between the two groups, the CG performed 2.6 [0.3; 4.9] fewer repetitions than the EG (P<0.05). The 6MWT remained unchanged over time in both groups (CG: = 11.9 [-16.4; 40.1] metres; EG: = 12.1 [-16.4; 40.7] metres).

People with COPD appear to experience a more rapid decline in sit-to-stand activities than in walking activities. Engaging them in personalised community-based PAs seems to be an effective strategy to prevent functional decline, particularly for sit-to-stand activities. Further studies with longer follow-up periods (1 or 2 years) are needed to confirm that these results hold in the long term.

Keywords: *Physical activity; community; COPD; pulmonary rehabilitation*

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The needs of informal caregivers of people with ILD

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Abstract. Interstitial lung disease (ILD) is a highly disabling chronic respiratory disease characterised by significant morbidity and mortality. People with ILD experience severe symptoms (e.g., dyspnea, fatigue, cough) which impair their ability to perform everyday tasks and maintain independence. Informal caregivers play a key role providing them support and assistance, especially at advanced stages. Nevertheless, knowledge about the support needs of caregivers of this population is lacking. This study aimed to characterise the needs of informal caregivers of people with ILD.

An exploratory cross-sectional study was conducted. Informal caregivers were identified from participants with ILD from iLiFE study (NCT04224233). Information about the care provision, i.e., relationship with the patient and if she/he lived with the patient, number of people involved in the care and duration and type of care was collected. The carers' support needs were assessed with the Carers Support Needs Assessment Tool (CSNAT). The CSNAT is a comprehensive, but brief and practical tool, which comprises 14 questions assessing the need for more support. It is scored as: 0-no, 1-little more, 2-quite a bit more and 3-very much more. For the purpose of this study, a need was considered if any score other than "no" was registered. Descriptive statistics were used to analyse data.

Sixteen informal caregivers (62.5% female, 61±15 years) were included. Most were partners (75%), lived with the patient (87.5%) and were the only ones involved in the care (70%). 44% of informal caregivers had been providing care from more than 4 years. The main types of care provided included: housework (75%), accompaniment to medical appointments (75%), transportation (56.3%), personal care (50%), shopping (50%) and drug management (43.8%). Most informal caregivers need more support to know what to expect in the future when caring for the relative (62.5%), who to contact if concerned about the relative (56.2%) and to understand the disease of their relatives/managing relative's symptoms (43.8%). Informal caregivers also wanted more support with dealing with their feelings and worries (50%).

The findings from our study may help to personalise interventions to support informal caregivers of people with ILD, ultimately contributing to improve their well-being and care experience. Based on our results, these interventions should include information about the disease trajectory and emergency contacts, but also support for caregivers' direct needs (e.g., feelings and concerns). A study with a larger sample size is needed to confirm our results.

Keywords: *Lung disease, Care assessment, Caregivers*

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Breastfeeding Interventions in Migrants: a Systematic Review

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Abstract. Breastfeeding is one of the most effective ways to ensure children's health and subsistence. The World Health Organization recommends exclusive breastfeeding for the first six months of life. However, humanitarian emergencies or forced migrations can lead to early weaning, putting children at greater morbidity and mortality risk. Therefore, interventions promoting breastfeeding in these contexts are crucial. A systematic review of the literature is necessary to examine the effectiveness of breastfeeding interventions in humanitarian contexts. Our aim is to conduct a systematic review to analyse the effects of interventions on breastfeeding with the refugee, migrant, and asylum seeker populations, following the PRISMA structure. Literature research was conducted in four electronic indexing databases: PubMed, the Cochrane Library, Web of Science, and Scopus. Two researchers independently analysed methodological quality through Quality Assessment Tool for Quantitative Studies. Six studies published between 2012 and 2022 met the eligibility criteria and therefore were included. The results showed that breastfeeding interventions for refugee and migrant women may be individual or group-based, and results may include increased breastfeeding and associated outcomes. Breastfeeding intervention indicators like intention to breastfeed, exclusively breastfeeding until six months, self-perception of efficacy and efficiency regarding breastfeeding, dietary diversity, meal amount, and acceptable diet can rise. Therefore, the general health of mothers, children, and entire communities may improve. However, these results should be carefully analysed. Studies about breastfeeding interventions for migrants, refugees, and asylum seekers are scarce, and none report adequate methodological quality. Due to the small number of studies and their methodological quality, it is not possible to draw clear conclusions about the effectiveness of the interventions to guide clinical practice. Consequently, future studies should improve their methodological quality to ensure evidence-based practice.

Keywords: *humanitarian emergency situation; breastfeeding intervention; refugees; migrants; asylum seeker*

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Assistance for people with stroke in Angola

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Abstract. Background: According to the World Health Organization, 17 million people have a stroke per year, mainly, which represents a global health problem, with an increasing burden in associated developing countries. Alongside the increase in the incidence of stroke, these countries propose the intervention point of view. In Angola, the current epidemiological data of the country are scarce and an epidemiological characterization of the reality.Objectives: This project has two main objectives, specifically designated, to characterize health care for people with stroke in the national system of Angola and to develop a strategic plan to sensitize the luandense community on the emergence of stroke identification for rapid intervention.
Methods: Two different methods will be chosen. The exploratory, descriptive and longitudinal study (E1) to characterize health care for people with stroke, housed in 2 hospitals in Luanda; the quality and transverse study (E2) concerning on the development and evaluation of a strategic early intervention plan for a stroke patient. Ethical and deontological principles for an investigation will be proposed.
Results: Contributor to the knowledge of the reality of providing care to the person after a stroke, in Angola; Propose and develop an early action plan. Contribute to integration to influence policy makers on the need for assistance with stroke, aiming at their functional, family and social rehabilitation, particularly in the labor market.

Keywords: *stroke; Functional recovery; Quality of life; Health policies*

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Tutoriais de apoio à construção de Ambientes Web Imersivos

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Abstract. As tecnologias têm evoluído de forma exponencial e a grande velocidade, onde a ficção clássica no cinema se torna uma realidade nos dias de hoje. Contrastando, os métodos de ensino, apesar de terem sido desafiados pela pandemia do covid 19, surgindo o Ensino Emergencial Remoto, estagnaram a sua evolução mantendo em si as mesmas metodologias do ensino tradicional. Porque não aliar as novas tecnologias a novas formas de aprendizagem? E como poderá ser este processo facilitado? Os Ambientes Web Imersivos (AWI) são o assunto do momento, e por esse motivo, e pela versatilidade que estes proporcionam, devem ser testados em contexto de sala de aula, onde será possível os estudantes interagirem com os assuntos lecionados e também eles próprios acrescentarem novos conteúdos de multimédia ao AWI. O passo seguinte será a construção desses ambientes pelos estudantes, com base nos conteúdos curriculares proposta pelos professores.
Neste sentido, elaboramos tutorias de apoio para demonstrar as ferramentas da plataforma Spoke, que permite criar os AWIs 3D, de uma forma intuitiva e simples.
Após definir o público-alvo e os objetivos a alcançar, começamos por elaborar um brainstorming, no site Miro, sobre as plataformas existentes na Web assim como das suas principais ferramentas. A opção final foi o Spoke, pelo facto de apresentar uma interface intuitiva, ou seja, prática para qualquer circunstância, em que os estudantes sejam submetidos. Escrevemos três guiões para três tutoriais diferentes, o primeiro tutorial é sobre a plataforma Spoke, o segundo aborda o AWI Mozilla Hubs, que é a plataforma que permite navegar pelo ambiente criado, e o terceiro é um tutorial passo a passo da construção de um modelo 3D exemplo, e a exploração do mesmo através do Hubs. Os tutoriais têm como principal objetivo, auxiliar os estudantes e os professores a criarem salas Web Imersivas, quer em contexto presencial ou remoto, de forma a tornar o ensino mais apelativo e atualizado. De seguida, gravamos o ecrã enquanto navegamos pelo site e passamos para à captura de áudio da narração do tutorial. Para tornar o vídeo mais apelativo recorremos a um site de inteligência artificial para animar uma imagem, de um avatar, com base no áudio da narração.
O próximo passo consiste em disponibilizar os tutoriais junto do público-alvo, verificar a sua eficácia na construção de AWI, para esse efeito iremos elaborar um questionário de forma a recolher os dados.

Keywords: *nan*

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InfoVis: comunicação de dados de projetos no contexto do Observatório de Media Digitais

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Abstract. A visualização de grandes quantidades de dados através de representações visuais permite que o utilizador tenha um melhor entendimento das informações e é reconhecida como essencial para apoiar decisões informadas. Conforme Manuel Lima (2011), o mapeamento de informação é fulcral para responder a objetivos de simplificação, clarificação, comunicação, exploração e registo.
Este estudo foi desenvolvido no âmbito do Observatório dos Media Digitais, cujo objetivo é criar um sistema de recolha e visualização de dados para compreender a complexidade da comunicação digital, utilizando o Power BI como ferramenta de apoio.
O objetivo do projeto proposto para Students@DigiMedia foi a criação dashboards interativos que permitem a visualização dos resultados - com recurso à InfoVis - dos projetos desenvolvidos pelo Centro de Investigação DigiMedia.
Realizou-se uma pesquisa inicial das metodologias e estilos de visualização de informação, recorrendo a autores como Manuel Lima (2023). Posteriormente, realizou-se um levantamento das ferramentas digitais, gratuitas, para a criação, compreendendo que opções disponíveis melhor se adequam ao nosso projeto. Na fase inicial foi utilizada a ferramenta Genially, que é um software de criação de conteúdos interativos. Este software permitiu desenhar um primeiro esboço para inserir os dados pretendidos, contudo este software na versão gratuita tem muitas limitações de funções. Daí optou-se por outro software: Figma. É um editor gráfico de vectorização e prototipagem de projetos de design baseado principalmente no navegador web. Neste editor foram criados dashboards interativos dos 4 projetos DigiMedia (Seduce 2.0, Locus, HiLives, CeNTER) todos com a mesma identidade visual, para uma compreensão mais rápida e eficaz.
Com os conhecimentos adquiridos nesta proposta conclui-se que as ferramentas de InfoVis contribuem para uma coesão apelativa e para a valorização e proliferação do trabalho de investigação do DigiMedia, tendo, como produto final, um modelo de visualização de informação aplicável aos futuros projetos, que será incorporado no futuro website do Observatório.

Keywords: *Media Digitais; Observatório; Visualização de Informação; Dados*

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Cres(SER): recriando a identidade visual de um projeto de apoio à primeira infância

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Abstract. Promovido pelo Centro de Saúde de Águeda, o projeto Cres(SER) tem como objetivo a valorização das interações, emoções e afetos desde o começo da vida (gestação e 1ª infância). O projeto tem como público-alvo as crianças dos zero aos três anos de idade e respetivas famílias, bem como o setor da saúde e da educação. A equipa do projeto Cres(SER) pretende desenvolver vários materiais/recursos destinados à sensibilização da família/comunidade para a importância da primeira infância, divulgando-os por diversas entidades públicas. Assim, tendo como objetivo final a criação de uma campanha de comunicação para o projeto Cres(SER), numa dinâmica de cooperação com a equipa do projeto e pais, desenvolveu-se um conjunto de atividades de investigação para criação da identidade visual do projeto. A identidade visual é essencial para os projetos na área da saúde, uma vez que contribui para o reconhecimento, a credibilidade, a comunicação eficaz e o envolvimento do público (Sillence et al., 2006; Sousa, 2017).

A equipa começou por realizar uma revisão da literatura em bases de dados Scopus e Web of Science, reunindo artigos científicos relevantes para a análise da presença online e identidade visual de websites na área da saúde. Esta etapa foi essencial para fazer um levantamento do conhecimento existente, bem como para a criação de uma grelha para análise da presença online e identidade visual de projetos "concorrentes". Com recurso a essa grelha, a equipa realizou um benchmarking de websites de projetos dedicados à promoção do desenvolvimento das crianças na primeira infância, comparando estratégias e práticas de presença online e identidade visual, reunindo referências para aprimorar a comunicação do projeto Cres(SER). Verificou-se quais as áreas de conteúdos que habitualmente surgem nesses websites e também novas tendências, como a gamificação ou possibilidade de conversas pais-pais e pais-profissionais de saúde, bem como as redes sociais mais utilizadas por estes projetos e estratégias de utilização. Em termos de identidade visual, identificaram-se boas práticas relacionadas com o logótipo, paleta de cores, tipografia e integração do sítio web com as redes sociais. Após algumas reuniões com os representantes do projeto e depois de perceber os aspetos mais prioritários e pertinentes para o projeto, procedeu-se ao desenvolvimento de uma identidade visual coerente que transmita uma imagem de credibilidade e confiança, ajudando a comunicar os valores, os objetivos e a finalidade do projeto de saúde de uma forma visualmente impactante.

Keywords: *Identidade Visual, Saúde; Primeira infância; Estudo de benchmarking*

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Proposal of a mobile application for the promotion of early childhood development

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Abstract. Pregnancy and the beginning of parenthood are moments of enormous psychological vulnerability with possible repercussions on the relationship with the baby and his/her development. In this context, it is of utmost importance to promote "better cooperation among services or further integration of them for families and children, most importantly with social and health services as well as schools, at national, regional and local levels"(CEU, 2019). Seeking a new way of looking at early childhood, the Cres(SER) project was conceived and has been supported by the Regional Health Administration of the Centre, presenting an intervention that advocates child's emotional, social, cognitive and cultural development and stable growth since prenatal life, especially during the first three years.Digital media can play a crucial role in lowering barriers that families might find when accessing and using early childhood education/care services. In this context, one part of the Project Cres(SER) intervention is to provide a mobile application that aims to provide parents with guidance on the development of babies and children and address their questions and concerns through feedback from healthcare professionals. The research conducted aimed to design and prototype a potential solution, following a user-centered design process (IDF, 2019). To achieve this, we conducted benchmarking of related apps by creating an analysis grid based on a literature review. A focus group was also conducted, comprising parents who could be potential users of the Cres(SER) app.Through benchmarking, we obtained important findings such as the apps with the best and worst Mobile Application Rating Scale (MARS) ratings, the features more common in competitor apps or some problems identified in the visual design of the apps analyzed. In the focus group, participants' experiences and reflections were valuable to identify they value a mobile application that provides all the important information in one place, highlighting the importance of including videos from recognized healthcare professionals. Additionally, parents mentioned the complexity of other applications, emphasizing the importance of a simple interface and quick access to the desired information.The results supported an initial design proposal for a mobile application that facilitates the development of programs to promote parenting skills in the pre and postpartum periods and the child's first years.

Keywords: *parenting app, benchmarking sudy, user-centered design*

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'Tourism and Technologies... the Future?': A Critical Analysis of Mobile Technologies in Portuguese Cultural Tourism

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Abstract. Nowadays, it is estimated that about 47% of travellers are directly or indirectly motivated by culture (UNWTO, 2018), making cultural tourism particularly relevant. The growth of tourism in Portugal has become imperative for the recovery of old city centres, playing a key role in improving the quality of life of society, impacting positively on culture and the national economy and the enhancement of the country's interior villages (Correia ; Homem, 2018). In turn, the use of information and communication technologies enables innovation in the way heritage is experienced, positively reinforcing the touristic experience and sustainably increasing the flow of tourists in the location (Di Pietro et al., 2018). However, despite the existence of statistical data associated with tourism in Portugal and the Portuguese, it seems to exist scarce information regarding the use of information and communication technologies, namely mobile applications developed to promote cultural visits and stimulate the learning of local information, whether historical, mythical, gastronomic, or others. Therefore, with this study, we intend to identify the activities that visitors perform or would like to perform during a cultural visit, namely using mobile applications. For this, we built an online questionnaire where we intend to understand whether cultural tourism is practised by the Portuguese, if when practised they use or would like to use mobile applications and what are their preferences regarding the features of these same applications. From the 196 answers obtained, it was found that 84% of respondents practice cultural tourism, but only 34% use mobile applications during their visits. Nevertheless, 72% of those who do not use mobile applications during their visits would like to use them, and the main reason mentioned for not using them is the lack of knowledge about the existence of this type of mobile app. Regarding functionalities, there is a clear prevalence in the preference for digital informative guides, including, for example, old photographs, videos, sound, text, and stories of the place. Lastly, although 89% of those who use mobile applications during their visits consider relevant the investment and the promotion of this genre of applications, it is important not to consider the use of mobile technologies in the context of cultural tourism as a "utopia", but as a way to promote a mutualistic and weighted relationship between the physical place of the visit and the enriching complement of the digital.

Keywords: *Cultural Tourism; Mobile Applications; Portuguese Tourism.*

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Understanding the Role of Hardware on Sense of Presence in Virtual Reality Environments

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Abstract. The technological inability to present virtual worlds capable of being understood as verisimilar led to the loss of interest in virtual reality over several decades (Gutiérrez et al., 2008). Years later, technological advancements made possible the popularization and mainstreaming of virtual reality through the introduction of head-mounted displays that were portable and affordable, yet technologically robust as well (LaValle, 2019). The purpose of this research, as part of the Students@DigiMedia#02 initiative, is to understand whether the hardware used while we are immersed in a virtual world can shape our feeling sense of presence. To this end, the researchers defined a research question – Can the visualization technology influence the sense of presence in virtual reality? – and proceeded to select four head-mounted displays – Google Cardboard, Oculus Go, HTC Vive, and Meta Quest 2 – and one content to be viewed across all HMDs – a 360º video related to the Festivities of S. Gonçalinho, an annual religious celebration in Aveiro, Northern Portugal. To define the indicators that would be used to compare each HMD, we started by reviewing the core concepts of immersion and presence according to several authors, allowing us to have a clear distinction of what each concept implies. Subsequently, our next step was to select a questionnaire that would allow us to measure the feeling of presence in virtual environments, having chosen the Igroup Presence Questionnaire (IPQ), validated for the Portuguese population (Vasconcelos-Raposo et al., 2016). To complement this instrument, some indicators belonging to the User Experience Questionnaire+ (Schrepp ; Thomaschewski, 2019) – attractiveness, perspicuity, dependability, and aesthetics – were also selected. Lastly, as the exposition to virtual reality can provoke cybersickness, we decided that the Simulator Sickness Questionnaire (Kennedy et al., 1993) would also be applied to measure side effects. At the moment, the research team is carrying out the tests and expect to share the results in a timely manner.

Keywords: *nan*

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"Not too cold, Not too hot": Exploring UX Design in Water Heating Systems for the SENSINGHOME project

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Abstract. Over the past years, the proliferation of connected home devices and appliances have posed a myriad of challenges concerning communication standards, energy-saving costs, security, and ease of use that are likely to affect the whole user experience (Ribeiro Serrenho, ; Bertoldi, 2019). Although extensive research has been carried out on human interaction within the context of a home environment, the considerations in the design of home appliance interfaces for HVAC/R (Heating, Ventilation, Air Conditioning, and Refrigeration) systems such as heat pumps, air conditioners, or systems for heating water have been quite unexplored.The purpose of this research is to establish the guidelines for designing and evaluating tactile panels installed in different home appliances as the main scenario, serving different interaction purposes and integrating sensor functionalities to gather data about its operations.To attain this goal the work carried out entailed: (1) Analysis of current interfaces on the market relative to HVAC/R (Heating, Ventilation, Air Conditioning, and Refrigeration) systems such as heat pumps, air conditioners or systems for heating water; (2) Identification of task requirements and personas; and (3) Conceptualization of novel approaches to support evaluation and co-design of interaction for these appliances using Mixed Reality (with paper publication in an international conference – Marques et al. 2023). To have a first understanding regarding how users interact with these kinds of devices and inform building an evaluation framework for a systematic approach to tackle these analyses, a pilot testing is being conducted. With 20 participants, so far, data is being collected regarding the user's visual attention and usability relative to the tasks, i.e., adjustment of the temperature, activation of the economic mode, check of the water flow, and consultation of the monthly costs in a thermoaccumulator. As a result of the work being carried out, the outcomes are: Report on the interaction difficulties and proposal of the interface; Commentary on the use of data collection and Mixed Reality (MR) for industrial product co-design; and A set of requirements for evaluating interfaces for HVAC/R systems.

Keywords: *nan*

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'Does the content matter?': Exploring Content Genre's Influence on Sense of Presence in Virtual Reality Environments

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Abstract. This research, conducted as part of the Students@DigiMedia#02 initiative, aimed to investigate the impact of different virtual reality content genres - games, simulators, cultural environments, and 360º videos - on the sense of presence experienced while exposed to the technology, based on the following research question: "Can the content genre influence the sense of presence in virtual reality?" To achieve our objective, we began with an in-depth literature review to establish a clear understanding of immersion and presence concepts, which formed the foundation of our investigation. Following the literature review, the research team selected appropriate instruments to measure the sense of presence in virtual reality. After careful analysis, the Igroup Presence Questionnaire (IPQ) was chosen for its alignment with our theoretical understanding and validation for the Portuguese population (Vasconcelos-Raposo et al., 2016). Additionally, to assess potential side effects of virtual reality exposure, the Simulator Sickness Questionnaire (SSQ) (Kennedy et al., 1993) was included to measure the degree of cybersickness experienced by participants. Once the data collection methods had been decided, the research team commenced the evaluation phase. A total of 20 participants were involved in the study and, with each session lasting around 45 minutes, they were asked to explore four different content genres, in a random order, using the Meta Quest 2: (i) a digital game (Beat Saber), lasting up to 15 minutes, (ii) a simulator (Mission: ISS), lasting up to 10 minutes, (iii) a synthetic cultural environment (Talasnal House VR), lasting up to 10 minutes, and (iv) a 360º video, (Festivities of S. Gonçalinho), lasting up to 5 minutes. Participants completed the IPQ after each content exposure, while the SSQ was administered only at the end of the session. The analysis of the collected data exposed interesting insights into the participants' sense of presence across different virtual reality content genres. Specifically, the simulator content emerged as the one eliciting the highest sense of global presence, whereas the game content scored the lowest in this particular dimension. As for the reported spatial presence, involvement and experienced realism, the game, simulator, and 360º video have respectively obtained the highest scores.

Keywords: *nan*

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Collaborative Design of Narratives and Games to Enhance Immersion in Virtual Reality Exposure Therapy for Animal Phobias

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Abstract. Virtual Reality Exposure Therapy (VRET) has proven to be an effective tool for treating phobias, including those related to animals (Meyerbröker ; Emmelkamp, 2010; Morina et al., 2015; Opriş et al., 2012). Key to the success of this therapy lies in the patient's motivation and willingness to confront and overcome increasing levels of fear and anxiety (Öst, 2012). The medium of virtual reality (VR) has opened up new opportunities for patient engagement within anxiety-inducing scenarios. Incorporating storytelling and interactive gameplay in therapeutic contexts, while leveraging the immersive qualities of the digital medium (Murray, 1997; Ryan, 2015), holds great potential for significantly amplifying patient motivation and enhancing the overall treatment experience.

By involving individuals with phobias in co-design activities, our goal is to ensure that the design of VR experiences aligns with their genuine needs and motivations. In this project, we employed a focus group methodology to gather valuable insights from individuals with various types of phobias. The primary objective of our first session was to gather insights into the features that individuals would find comfortable in a game that addresses their fears. Through a series of activities, we aimed to explore their preferences regarding game aesthetics, mechanics, and challenges. Furthermore, participants engaged in a collaborative exercise, where they collectively contributed to the design of narratives centered around a specific phobia.

Preliminary findings from the focus group indicate that participants expressed a preference for narratives in which the feared animals were not portrayed as enemies. Instead, they were drawn to game mechanics that promoted empathy and encouraged a sense of identification with the animals. Proposed mechanics included collaborative interactions, the ability to switch perspectives and engaging in dialog with the animals. Additionally, the inclusion of comedic elements and the integration of magic or superpowers were identified as effective strategies to alleviate the fearful elements and enhance motivation within the virtual experience.

The next focus group sessions will build upon the key findings gathered thus far and delve deeper into the design process of a game narrative tailored for individuals with spider phobia. Participants will engage in brainstorming activities, collectively generating ideas for various scenarios, characters, and plotlines that can effectively contextualize the phobic stimuli within the game. Through this collaborative approach, our aim is to create a game narrative that not only addresses the specific therapeutic goals but also provides an engaging and enjoyable experience for individuals undergoing therapy.

Keywords: *Serious game, Storytelling, Virtual Reality, Spider Phobia*

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Senior cyclotourism with Jizo: An app and website development

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Abstract. By harnessing the power of social connections and gamification, a social networking and gamified app becomes a catalyst for increased physical activity, transforming exercise into an engaging and motivating journey (Edney et al., 2020). Although ongoing efforts have been made to develop digital skills among senior citizens, including how to use websites and apps, and how to create content tailored to this population segment, there is still a need for dedicated accessibility research to address this challenge.

The goal of this project, in the scope of students@digimedia program, is to implement the Jizo app and develop its website to motivate and change senior citizens' behavior for a sustainable active and healthy aging through cyclotourism (Ortet et al., 2019). To enhance the user experience and engagement of the website and app, the study focused on coding and implementing user-friendly features and functionalities.

Between January and June 2023, the app and website were developed to ensure scalability and modularity of the code for future maintenance and improvements, where the primary focus was on providing a positive user experience. The products feature customizable user profiles, social networking capabilities, and gamification elements (e.g., challenges, rewards, friendly competitions, and achievement sharing). Moreover the social component enables the user to connect with fellow cyclists, participate in events, save routes, access informative blogs, among others.

Since scalability and maintainability were key factors in the design of these products, it was developed a distributed system using microservice architectures and message-oriented middleware, based on RabbitMQ. To organize data before sending to the client, it was implemented a Backend for Frontend GraphQL API that aggregates information from different microservices publishing messages and consuming responses.

In May 2023, 12 participants aged between 65 and 78 years old evaluated the high fidelity prototype of Jizo app and website with the purpose of testing the main functionalities of the devices and issues related to usability and accessibility. Data was collected through a questionnaire, observant participation and field notes. Furthermore, the test results allowed the implementation of improvements that allow a better use of the target audience.

It is believed that a user-friendly app and website were developed to enhance cyclotourism experiences among senior citizens, inspiring and motivating users to be active and healthy as they age. Moreover, by incorporating social connections and gamification, an interactive environment was created, providing a positive user experience and lay the foundation for future improvements and advancements.

Keywords: *active and healthy ageing, cyclotourism, app, website*

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Mapping the Landscape of Digital Media Doctoral Theses at the University of Aveiro: a global overview

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Abstract. This study was part of the Digital Media Observatory, an initiative of the DigiMedia Research Centre that aims at creating digital data collection, compilation, processing, and a visualization system to understand the complexity, disseminate information, and promote studies on digital media in Portugal and other countries. This study aimed to create an overview of the themes, objectives, methodologies, and results of the doctoral theses developed in Digital Media studies in the last five years. For this purpose, the project team considered the two Doctoral Programs (Doctorate) linked to the Digital Media ; Interaction Centre: Doctorate in Multimedia in Education (University of Aveiro) and Doctorate in Information and Communication in Digital Platforms (a consortium between the University of Aveiro and the University of Porto).

To achieve this goal, these theses were collected from the institutional Repository of the University of Aveiro (RIA) and the information system SIGARRA of the University of Porto. We collected about 50 theses that were analyzed considering the title, abstract, keywords, methodology adopted as the instruments, approach, target audience, and territorial scope of the research. Besides this, we analyzed the objectives of each project and the type of funding for each thesis. Finally, we have analyzed the scientific publications and dissemination actions that each doctoral student has been doing along their path.

The most used methodologies are case studies and research-based design; and the most used instruments are observation, surveys, interviews, and focus groups. We conclude that in the scope of the analyzed theses, several final products were built, namely digital platforms, mobile applications, models, and prototypes in several fields of study. This information was systematized and recorded in a spreadsheet and loaded into the Microsoft Power BI software to display the results and interactive visualization of the data on the website of the Digital Media Observatory. With these results, we hope to contribute to generating knowledge and an overview of the themes, objectives, methodologies, and results of the research carried out by doctoral students and to contribute to enhancing the postgraduate offer of the Department of Communication and Art.

Keywords: *Ph.D. Theses, Digital Media, Multimedia in Education, Information and Communication in Digital Platforms.*

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"Let's talk about... students@DigiMedia: promoting students' participation in scientific research activities through mentoring programs

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Abstract. DigiMedia is the research unit (IU) of the scientific area of Communication Science and Technology (CTC) of the Department of Communication and Art (DeCA). In order to stimulate student participation in scientific research activities, the UI implemented - from the 2021/22 academic year - the "students@DigiMedia"initiative.
The project dynamics focus on involving the students (from all study cycles – 1st, 2nd, and 3rd from the Technologies and Communication Sciences) in research activities such as data collection, development of apps, audio-visual content production, project management tasks, and other activities proposed by the several research projects. The participation in these activities is totally voluntary, with the participants (students and researchers) receiving a certificate of participation and appearing if the research team determines the relevance of the scientific publication as co-authors of a scientific article.
The first edition occurred in the academic year of 2021/22, with 31 students from all study cycles participating in the 13 projects proposed by 24 DigiMedia researchers. The second edition, now in progress, aims to bring more work topics and research lines to work. In total, 21 proposals were presented by 34 researchers, with 20 projects being selected. 51 students from all study cycles – 1st, 2nd, and 3rd from the CTC area – are involved in this edition.
In this abstract, we present the "let's talk about... students@DigiMedia", one of the research projects being developed. This project aims to collect data from the students and researchers that participated in the event's first edition to evaluate the impact and assess participants' perception regarding i) motivation, ii) expectations, and iii) experience participating in this initiative.This project has as main objectives: to characterize the initiative, framing it in the scope of the challenge launched to the Research Units; to evaluate the impact of the first edition (academic year 2021-2022);
and to propose guidelines to be considered in future editions.
The information will be collected through the application of a questionnaire to participants in the first edition, researchers and students; and through individual interviews with two representatives of the DigiMedia Coordination. The data collected will be used to characterize the impact of the first edition and to establish guidelines (improvements) for the next editions.
The information collected will allow not only to assess the impact of the first edition, but also to structure a set of best practices that can be adopted by other IU in the organization of similar initiatives.

Keywords: *Mentoring Program, Higher Education, Communication Science and Technologies, Scientific Research Program*

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Estou escutando: plano de comunicação para a promoção de podcasts junto da comunidade escolar

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Abstract. No âmbito de uma investigação de pós-doutoramento foram desenvolvidos 20 "short" podcasts com temas relevantes para debate nas escolas do ensino secundário (violência sobre as mulheres e intertextualidade). Os podcasts foram disponibilizados nas principais plataformas de distribuição deste tipo de conteúdos. O trabalho aborda o plano de comunicação, assente no Instagram, para a divulgação dos podcasts junto da comunidade escolar (docentes e estudantes), nas suas diversas fases: investigação, planeamento, execução e avaliação.

Keywords: *Plano de comunicação, podcasts, comunidade escolar*

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Promoção audiovisual da ferramenta de design thinking "The Impact Plan".

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Abstract. A ferramenta The Impact Plan sustenta-se em princípios de design thinking e na antecipação de impacto através de técnicas de design foresight e theory of change. Pretende precisamente simplificar e promover, desde o momento de receção de brief de um projeto, uma reflexão para determinar o efeito que esse projeto terá a curto e médio prazo na experiência e nas oportunidades de futuro de quem nele se vê envolvido, e a longo prazo, no impacto que dito projeto poderá ter na humanidade e no planeta.

Dada a pertinência do contributo positivo que este tipo de reflexão pode trazer para a academia, tanto para alunos, como para docentes e investigadores, o presente trabalho tem como objetivo a idealização e produção de um objeto audiovisual para promoção da ferramenta The Impact Plan. Este conteúdo visa cristalizar e promover, junto do seu público-alvo, as vantagens da utilização deste recurso no momento de definição das bases para um projeto estável e de sucesso, que beneficie todos os intervenientes e partes interessadas.
Após uma análise das características principais da ferramenta, foram definidas as "Personas" e desenhados os respetivos Users Journeys, no sentido de identificar qual o público-alvo e o ecossistema de representações visuais a utilizar.
Terminado o processo de caracterização da ferramenta, deu-se início à fase de pré-produção audiovisual. Esta consistiu na escolha e desenvolvimento da narrativa a ser utilizada, culminando no guião com o corpo e principal estrutura do vídeo. Ao passar para a produção do vídeo, foram realizadas sessões para as quais contribuíram alunos e docentes a usar a ferramenta, e a partir das quais se realizou o registo de vídeo. Na última fase de pós-produção, em curso, é feito um levantamento de todo o registo vídeo obtido, para filtrar e editar as partes que melhor se adaptam à narrativa identificada no guião do conteúdo promocional. São ainda realizadas sessões de registo áudio para voz-off e de entrevistas com os alunos para estes relatarem a sua experiência na utilização da ferramenta e partilharem o seu testemunho.
Terminada a produção do vídeo, e finalizada a edição, será desenvolvido um master audiovisual para ser apresentado como resultado do projeto. Nele deverão ser claras as vantagens na utilização da ferramenta em contexto de sala de aula e o potencial da mesma como meio para determinar e promover, individualmente e nas mais diversas equipas, o projeto com maior potencial de impacto no futuro de todos os envolvidos.

Keywords: *Audiovisual, Vídeo Promocional, The Impact Plan, Sustentabilidade, Projeto, Antecipação de Impacto*

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Audiovisual contents for cyclotourism

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Abstract. The rapid development of Virtual Reality (VR) technologies in recent years has promoted substantial growth in the society usage of this tool for various purposes (Howard, 2017; Bermejo-Berros ; Gil Martínez, 2021). However, the development of digital skills among senior citizens for the use of these technologies and the creation of VR content specifically targeted at this population segment are areas that still require further research. In order to overcome such issue, this project, conducted within the scope of the students@digimedia program, aimed at finding ways to contribute to the production of 360º VR audiovisual content for the Jizo app, that has the goal of motivating and transforming the behaviour of senior citizens for a sustainable active and healthy ageing through cyclotourism (Ortet et al., 2019). From january to june of 2023, a research was conducted on the best practices and appropriate equipment for recording 360º videos of cyclotourism routes, whereas tests using the Vuze+ 3D Stereoscopic 360º camera were also carried out. Simultaneously, informative and motivating audiovisual content on cyclotourism for seniors was also produced, such as interviews with bicycle workshop mechanics who shared information on bicycle maintenance for the practice of the modality. The development of this project presented various challenges that led to the confirmation of the necessary technical elements for producing 360º VR audiovisual content of cyclotourism routes, as well as the planning of a second phase of testing to be conducted in the second half of 2023.

Keywords: *Audiovisual contents, Cyclotourism, Video production, Video edition*

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Proactive Assistant for TV as a promoter of interactions between older adults and other generations: a demo video

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Abstract. Television is the most frequently used device by the senior audience (Coelho, Rito, ; Duarte, 2017) due to factors such as familiarity with the interface, usage history, and its role as a companion in moments of solitude. During the period of social isolation caused by the Covid-19 pandemic, for example, the consumption of television content increased among the older adults, as well as the adoption of other technological resources for entertainment or social interaction (Seifert, 2020).
On the other hand, using such devices requires a greater set of skills, and since this knowledge is often lower among older individuals, there is an increased risk of skepticism towards the use of new technologies (Vaportzis, Martin, ; Gow, 2017).
In this sense, voice features have the potential to make interactions between humans and systems more user-friendly and anthropomorphic (Bahlenberg ; Yan, 2019). This is mainly because speech is the primary means of social communication. By using voice interaction systems, individuals envision an active and fluid path instead of navigation obstacles (Fernandes, Abreu, Almeida, ; Santos, 2019). And the fewer barriers there are, the better the interaction of the senior audience with the systems.
Activities that require digital skills, such as managing emails, using social networks, or playing games online, can be performed more easily when the elderly rely on voice assistants (Reis et al., 2018). The same applies to household tasks, such as watching television and adjusting lighting intensity in the environment (Sun, 2020). The tendency is for each activity to be performed more quickly and accessibly. In other words, as it does not require the need to use hands or get up, the use tends to be faster and more satisfying.
In the aforementioned context, the present doctoral project aims to identify whether the integration of a proactive and multimodal assistant in Interactive TV (iTV) will be able to reduce the social isolation of the elderly by promoting a more dynamic, frequent, and consistent interaction with family members, caregivers, and friends.
Therefore, within the scope of students@digimedia, an explanatory video was created to showcase the functionality of the proposed system, demonstrating all the existing steps and the involvement of senior citizens. The material includes recordings made at the uX lab of Social iTV, a research group of the Digimedia Research Center at the University of Aveiro, and animations developed by the students who participated in all stages of the project.

Keywords: *iTV, TV, intelligent assistants, proactivity, older adults, intergenerational communication, voice commands*

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Sustainable Chemistry

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Potential of the macroalga Ulva sp. for the recovery of Yttrium obtained from fluorescent lamp waste

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Abstract. The Rare-Earth Elements (REE) are a group of elements essential in the development and production of many modern technologies such as electronic devices, renewable energies and hybrid cars. However, their availability is heavily limited since their extraction and refinement is exclusive to very few countries. Secondary sourcing of Rare-Earth elements (REE) from electronic waste can compensate for supply bottlenecks as well as environmental and health issues associated with ore mining. However, the available technologies for the recovery of REE from wastes is still severely underdeveloped, and new sustainable approaches are required to achieve a sustainable and circular economy. In this study, recovery of yttrium (Y) from real fluorescent lamp waste (FLW) was achieved through biosorption onto the macroalga Ulva sp. This was achieved through sorption batch experiment conducted in 1 L flasks and a Box-Behnken design was applied to optimize parameters such as initial Y concentration, sorbent mass and solution salinity. Surface response methodology was used to provide 3D surfaces of the optimized results. The initial waste was composed mainly of yttrium oxides (49%) and calcium hydroxides/phosphates (23%). Response surfaces revealed lower salinities (10) and higher sorbent mass (9 g/L) improved sorption efficiency (maximum removal of 52% and 32% for initial concentrations of 20 and 120 mg/L). Higher concentrations of Y accelerated the sorption kinetics, achieving equilibrium after 3 h. The amount of Y accumulated on the algal tissue (maximum of 22 mg/g) was not affected by algae dosage. Results show that algal-based sorbents are efficient when applied to real wastes under optimal conditions. While leachate purity still requires optimization, fast kinetics and high concentrations in the biomass indicate that Ulva sp. may constitute a viable material for the biosorption of Y obtained from FLW. Incorporating Ulva sp. biosorption into an Y recovery process will thus contribute to a green and circular economy, compensating the negative effects associating with primary ore mining, mostly through carbon capture during the cultivation process.

Keywords: *Circular economy, Waste valorisation, Environmental biotechnology, Rare-earth elements, Sorption*

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Active polymeric filtration membranes with siderophore for iron(iii) removal from aqueous systems

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Abstract. The excess of iron(III) in industrial effluents and in the blood is an issue. Not only the iron catalyzes the oxidation of organic compounds from living beings, but also forms highly insoluble precipitates of iron(III) oxyhydroxides [1]. Then, that solid's deposits interfere with the fluidic systems' normal flow.
One way to solve this problem is to dop filtration membranes with active agents such as siderophores to enable the chemisorption of the iron(III) present in the samples during the filtration process. It was chosen compounds of the hydroxamic acid family, with long alkyl chains for that purpose. They are known to have very high complex formation constants [2]. The addition of an alkyl chain to the hydroxamic acid was the strategy found to improve the lipophilicity of the siderophore, avoiding it leaching from the polymeric membrane structure during the nonsolvent-induced phase inversion process.
Those membranes, with the siderophore included, were prepared by spin-coating. They were then characterized in respect to their siderophore contents, porosities, and maxima water flows. Their specific iron(III) absorptions were analyzed in static and dynamic conditions.
The results suggests an excellent inclusion of the siderophore in the membrane structure. Under batch conditions, the iron(III) absorption was superior to the 1:1 iron/ligand proportion.

Keywords: *membrane, hydroxamic acid, iron(III), chemisorption*

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Effect of the macrocyclic host on the CO-release from inclusion compounds with CpMo(CO)3Me

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Abstract. Carbon monoxide (CO) is usually associated with its negative side due to its responsibility for intoxication cases. However, CO is endogenously produced in the human body, during heme oxidation catalysed by heme-oxygenase, which is known for its cytoprotective and restorative processes, where CO is endogenously produced. This leads to the positive side of CO as a therapeutic agent. In this context, CO-releasing molecules (CORMs) have emerged as potential CO-prodrugs, with the most common ones having transition metals in their constitution, including molybdenum (Mo) (Varon et al. 1999).
Mo-based CORMs can be used as antimicrobial and bactericidal agents (e.g., [NEt4][Mo(CO)5Br]) (Nobre et al. 2007), with good pharmacological effects in the treatment of bacterial agents, but these compounds have some limitations, namely, poor water solubility and low stability. Supramolecular chemistry provides solutions to overcome these drawbacks. In this context, macrocyclic hosts such as cucurbiturils (CBs) and cyclodextrins (CDs) have frequently been used as hosts in the synthesis of inclusion compounds with drug molecules. Encapsulation of CORMs in these hosts could enhance the pharmacokinetic properties of the molecules and lead to a more controlled CO-release rate, to prevent hypoxia.
In the present work, the cyclopentadienyl molybdenum tricarbonyl complex CpMo(CO)3Meand its 1:1 inclusion complexes with -CD and CB[7] were prepared and characterized. The free complex CpMo(CO)3Me and the inclusion complexes were studied in relation to their CO-release capacity through the myoglobin (Mb) assay, where absorption spectroscopy (in the Q-band region) is used to monitor the conversion of deoxy-Mb into carbonmonoxy-Mb. These studies were performed in the presence of PBS buffer (pH 7.4) and DMSO as co-solvent, at 37 ºC. Both inclusion compounds displayed slower CO-release rates in relation to the free complex CpMo(CO)3Me, which may be desirable for optimal CO-based therapies.

Keywords: *Carbon monoxide, CO-releasing molecules, Molybdenum, Supramolecular chemistry, Cucurbiturils, Cyclodextrins*

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Comparation of Tricarbonyl-Pyrazine-Molybdenum(0) Metal-Organic Frameworks as CO-Releasing Materials

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Abstract. A high exposure to carbon monoxide (CO) is considered harmful and can be lethal to mammals. However, in the last decades, the understanding of the biological and physiological roles of CO as a gasotransmitter molecule led to the study of its pharmacological features. Metal-Organic Frameworks (MOFs) have been studied as nanomaterials for the storage and delivery of gas-releasing molecules. This study intended to investigate the capacity of tricarbonyl-pyrazine-molybdenum(0) MOFs to act as viable CO-releasing materials (CORMAs).
The reaction of Mo(CO)6 with excess pyrazine (pyz) in a sealed ampoule at 150 ºC gives a MOF formulated as fac-Mo(CO)3(pyz)3/2·1/2pyz as the major (triclinic) phase (containing pyz-occupied hexagonal channels, denoted as Mo-hex), while performing the reaction in refluxing toluene gives a dense cubic phase formulated as fac-Mo(CO)3(pyz)3/2 (Mo-cub).The crystalline solids Mo-hex and Mo-cub were characterized by powder X-ray diffraction, scanning electron microscopy, thermogravimetric analysis, FT-IR and FT-Raman spectroscopies, and 13C{1H} CP MAS NMR spectroscopy. The CO-release rates from both MOFs were studied by the standard myoglobin assay using UV-Vis spectroscopy. Mo-hex and Mo-cub release CO upon contact with a physiological buffer in the dark, delivering 0.35 and 0.22 equiv. (based on Mo), respectively, after 24 h, with half-lives of 34 h. Both materials display high photostability such that the CO-releasing kinetics is not affected by irradiation with UV light. The materials are attractive as potential CORMAs due to the slow release of a high CO payload. (Silva et al., 2023)

Keywords: *Molybdenum, Pyrazine, Carbon monoxide, Metalorganic frameworks, CO-releasing materials*

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Evaluating raspberry seeds composition and potential novel food applications

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Abstract. Raspberries are easily perishable, so a significant part of their harvest is fueled to the production of raspberry-derived products like jams, juices, sauces, among others (Milala et al., 2018). During raspberries industrial processing to obtain these pulp-rich products, their seeds are often discarded. Raspberry seeds oil (RSO) is highly appreciated due to its richness in polyunsaturated fatty acids (PUFAs)2 known as healthy fats for the human body. Despite that, commercial RSO application has been channeled to cosmetic fields (Ispiryan et al., 2021), with no food-related applications known for this oil. Furthermore, the information on the remaining composition of raspberry seeds (RS) is scarce, including its polymeric material such as polysaccharides and proteins. As such, both RS biopolymers and oil could fit novel applications in the food industry. In this work, RSO was recovered from RS by Soxhlet while the polymeric material was recovered by microwave-assisted extraction (MAE) (Passos ; Coimbra, 2013). The chemical characterization confirmed the RSO status as a specialty oil (rich in PUFAs) with antioxidant effects. Furthermore, the recovered RS biopolymers from the defatted seeds revealed that RS are rich in xyloglucans and arabinoxylans. Furthermore, MAE also allowed to enrich soluble extracts by up to 4 times the original RS protein content. These biomolecules revealed to have potential in the preparation of solid support for vegetable oils, combining RSO healthier properties with the texture of animal fat. Thus, both RS biopolymers and RSO can have the potential to be repurposed as a renewable source of biomolecules for food applications, adding value and sustainability to this agri-food byproduct.

Keywords: *Raspberry Byproducts, Bioactivity, Circular Economy, Functional Food, Sustainability*

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A molybdenum(VI) complex of 5-(2-pyridyl-1-oxide)tetrazole: synthesis, structure, and transformation into a MoO3-based hybrid catalyst for the epoxidation of bio-olefins

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Abstract. Numerous products, e.g., flavors, fragrances, resins, are derived from the epoxidation of olefins. Sourcing from biomass-related raw materials, like agricultural crops and waste from the forest and citrus industries and waste cooking oil, would veer production toward better sustainability. Homogeneous or heterogeneous catalysts have contributed effectively to predominantly generate epoxide-type products from biobased olefins, namely methyl oleate, methyl linoleate and limonene. Here, an organic–inorganic polymeric hybrid, [MoO3(Hpto).H2O (1), where Hpto = 5-(2-pyridyl-1-oxide)tetrazole, was synthesized by a hydrolysis–condensation reaction of the complex [MoO2Cl2(Hpto)].THF. Complementary spectroscopic characterization techniques detected a common six-membered chelate ring from the bidentate N,O-coordination of Hpto to MoVI centers in both 1 and [MoO2Cl2(Hpto)].THF. The two compounds were compared as olefin epoxidation catalysts, being very active and selective toward the formation of epoxide products. The mononuclear complex acts as a homogeneous catalyst, unlike hybrid 1, which is one of the rare examples among molybdenum oxide/organic catalysts that acts as a solid catalyst. Hybrid 1 effectively catalyzed the reaction of biobased olefins with tert-butyl hydroperoxide, namely fatty acid methyl esters (methyl oleate, methyl linoleate, methyl linolenate, and methyl ricinoleate) and the terpene limonene, leading predominantly to the corresponding epoxide products with yields in the range of 85–100 % after 24 h at 70 °C. Catalyst 1 also proved to be versatile by effectively catalyzing the oxidation of sulfides into sulfoxides and sulfones, at 35 °C (quantitative yield of sulfoxide plus sulfone, at 24 h; sulfone yields in the range of 77–86 %). To the best of our knowledge, 1 is the first molybdenum catalyst reported for methyl linolenate epoxidation, and the first of the family [MoO3(L)x] studied for methyl ricinoleate epoxidation.

Keywords: *Dioxomolybdenum (VI) complexes, Organic–inorganic hybrid materials, 5-(2-Pyridyl-1-oxide)tetrazole, Epoxidation, Bio-olefins, Sulfoxidation*

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Art, Science, Environment and Society as a landscape-language and research-creation approach applied to: "The viability of living macroalgae-based technologies as a sustainable alternative supply for critical raw materials"

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Abstract. Through the process of starting to implement the scientific experimental design of this doctoral thesis, different research lines started to vascularize from the branch of sustainability. These are now two distinct research pathways that use different methodologies to fulfill specific research gaps. The first research line is the scientific approach: - Although living macroalgae have been proposed as a more sustainable sorbent for the removal and recovery of Critical Raw Materials (CRMs) [1], among them are the Rare Earth Elements (REEs), their application at an industrial level requires further knowledge about the sorption process under relevant close to industrial conditions. There is also the need to apply certified methodologies, such as Life Cycle Analysis (LCA)[2], to measure the environmental burden that this technology would represent. The second research line is the artistic approach: - how artistic practices can give rise to scientific questions, what is the space for creativity, identity, language and error as alternative ways of exploring scientific concepts, while reflecting on how the scientific community is giving form to the knowledge it is generating and how science can contribute for inclusion, reducing inequity and increasing literacy.

A comparison between the efficiency in the simultaneous uptake of Y (Yttrium), La (Lanthanum), Nd (Neodymium), Eu (Europium), Gd (Gadolinium), and Dy (Dysprosium) (which are REEs) from an equimolar mixture also containing Hg (Mercury), Cd (Cadmium), Pb (Lead), and As (Arsenic) by Ulva lactuca and Gracilaria gracilis applied as living and non-living biomass was evaluated. Batch sorption experiments run for 72 h, at optimized values of salinity (10) and pH (7.8 - 8.0) by contacting 5 g of living macroalgae and the respective mass in its dried (non-living) form with natural seawater spiked with the metals under study, under constant stirring (800 rpm). The elements As and Cd were less removed from the solution, while REEs and the elements Hg and Pb were removed by the living biomass above 80%. However, for non-living biomass, the removal percentages for REEs were significantly lower, in general, under 40%. Implications for upscaling the proposed technology to a real contamination scenario are the sequential application, in the first step, of the non-living biomass for the removal of classical contaminants, followed by a second step in which the living biomass bioaccumulates REEs since the uptake of these metals with high economic and technological value is still efficient under the presence of other contaminants for living biomass.

Keywords: *macroalgae, biosorption, complex mixtures, Rare Earth Elements (REEs), Potentially toxic elements (PTEs)*

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Carbon-based nanomaterials from renewable sources for water treatment applications

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Abstract. Emerging pollutants such as pesticides and pharmaceuticals are an increasing environmental and health concern, with wastewater treatment plants being unable to completely remove most of these compounds. There is also an interest in developing novel fluorescent probes to monitor the presence of various species, such as contaminants and metal ions, in water.
This research project aims to develop porous carbon-based nanomaterials, as alternative sorbents for water treatment, or as fluorescent probes for the detection of aqueous contaminants. Novel synthesis routes and comprehensive characterization of nanomaterials constitute the core components of the proposed research.
Carrageenan based bio-silica hybrid nanomaterials have been prepared and used as sacrificial templates to prepare porous functionalized carbon nanomaterials using hydrothermal carbonization. (Nogueira et al., 2018) The materials were fully characterized and preliminary adsorption tests of pharmaceuticals contaminants from aqueous solutions were performed. This process has been optimized for microwave hydrothermal treatment.
The same process also led to the formation, in the supernatant, of fluorescent hybrid nanoparticles. (De Yro et al., 2016; Li et al., 2019) A thorough characterization process was undertaken to study their potential as probes. These hybrid nanoparticles were found to have a distinct and more sensitive excitation-dependent photoluminescence profile than counterparts prepared directly from carrageenan. The nanoparticles were tested for the detection of metal ions in aqueous solution (Wang et al., 2021) and were found to be sensitive to Fe(III) ions, with a concentration-dependent linear range of fluorescent intensity that makes them suitable to detect the presence of the ion within the recommended concentrations for drinking water.
Also of note is a magnetite-carrageenan composite nanomaterial, prepared with a one-step microwave hydrothermal treatment. (Wu et al., 2014) Preliminary ciprofloxacin adsorption trials resulted in a 65% removal, which combined with the simplicity of synthesis and ease of removal from water using magnetic fields, makes the material highly promising. Further optimizations are ongoing, using different concentrations of carrageenan and using hybrid bio-silica nanomaterials instead of polymer.
Future work will include utilization of raw carrageenan-rich algae material for the hydrothermal processes instead of the purified polymer, to further simplify and make more sustainable the production of the useful nanomaterials.

Keywords: *Nanomaterials, Adsorption, Fluorescence, Carrageenan, Microwave, Magnetic*

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FEC-Enabled PAM4 400G PON Architecture for Access Networks

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Abstract. The past few years has presented an ongoing discussion and research around the exploitation of higher architectures due to the anticipated demand for high bandwidth such as required for Next Generation of Passive Optical Networks (NG-PONs). Currently, the industry at this stage of development is still constrained to using 10G/25G NRZ modulations as well as host-side FEC for implementation to enable it transit from 40G to 100G (100Gemergence) and 200G, mainly due to the use of digital signal processing (DSP) and forward error correction (FEC) in conjunction with non-return to zero (NRZ) modulation to achieve long transmission distances, which is not cost effective. The design and realization of these ultra-high bandwidth network topology demands that optical networks must transit to from traditional NRZ to level 4 Pulse Amplitude Modulation (PAM-4). More so, at same bitrate, channel loss is lower with PAM-4 because its baud rate is half that of the NRZ signal. Even more, PAM4 has three distinct eye openings, as a result of the presence of four different voltage levels which create 12 distinct signal transitions (Trowbridge, 2015).

This work presents a different 400Gbps Ethernet architecture that implements a PAM-4 modulation scheme having pre and post Forward Error Correction (FEC) at transmitter and receiver respectively, with wavelengths all operating at the O-band. It shows a four-lane system with individual wavelengths according to the IEEE 802.3cu standard (IEEE. 2021), over single mode fiber for short reach. The use of a non-linear electro-absorption modulator (EAM) for the 4X100Gbps PON design with intensity modulation and direct detection (IM-DD) alongside optimized system parameters impacts on the system functionality. But the PAM-4 signal tolerance to crosstalk and reflection is reduced, because of the 33% smaller eye-opening resulting in a higher bit error rate. It is evident that using pre- and post-FEC has helped the setup achieve the required BER better than the standard.

The result of BER against ROP shown indicates the possibility of using the 4X100Gbps (4 lane 100Gbps) using minimal set transmitter constraints to achieve positive results having performed better than standard FEC threshold to recover errors with an improvement of 1dB. However, it is recommended that electrical and (or) optical compensation may be needed to further improve system's performance.

Keywords: *Four lane 100G architecture, Intensity Modulation/Direct Detection, Forward Error Correction, level 4 Pulse Amplitude Modulation, Access Networks.*

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Machine Learning for Radio Resource Allocation in Physical-Layer Network Coding-Enabled Mobile Networks

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Abstract. Relay communications is an effective technique to boost the performance of wireless networks. Generally, two types of relay communication networks exist: one-way relay channel (OWRC) and two-way-relay channel (TWRC). OWRC needs four time slots for exchanging information between a pair of user equipment (UEs). In contrast, TWRC needs only two time slots for completing the same information exchange. In the first time slot, known as the multiple access phase, both UEs simultaneously transmit their signals to the relay. In the second time slot, which is called the broadcast phase, the relay broadcasts the physical layer network-coded (PNC) signal to the UEs. Each UE uses this PNC signal to extract their peer's data. Radio resource allocation (RRA) schemes are crucial in the performance optimization of wireless networks, and they are used to optimize an objective function, e.g., spectral/energy efficiency, under some constraints (fairness, transmit power, and so on). However, many RRA algorithms lead to a non-convex mixed integer nonlinear programming (MINLP) problem, which is NP hard. Therefore, conventional optimization solvers end up in suboptimal solutions and fail to achieve globally optimal solutions in a realistic time frame, if they achieve any. In some scenarios, where the RRA problem may not be well-defined mathematically (e.g., due to the nonstationary and dynamic nature of the propagation environment and the mobility of the users), we may not be able to solve the underlaying optimization problem with the desired accuracy. In addition, the computational complexity of well-known global optimization algorithms, e.g., the branch-and-bound algorithm, is exponential. Consequently, most of the existing solutions are limited to sub-optimal or heuristic algorithms. Nevertheless, the performance gap of these sub-optimal or heuristic algorithms to the optimal solution is usually difficult to quantify and control.Furthermore, mobile system is becoming increasingly complex with different technological advancements, e.g., hyperdense small cell deployment, network slicing, and the adoption of massive MIMO and reconfigurable intelligent surfaces to offer heterogeneous services with extreme and sometimes conflicting requirements (e.g., URLLC and Metaverse). This adds further challenge to RRA algorithms.Therefore, 6G networks call for new models and solutions for RRA and network management. To this end, machine learning is a promising tool that can extract knowledge from the system by gradual learning in the presence of inherent uncertainties. This PhD thesis aims to develop novel deep learning models to continuously learn and optimize resource allocation strategies in a dynamic environment in B5G/6G scenarios.

Keywords: *6G, Relay networks, Physical layer network coding, Radio resource allocation, Artificial intelligence, Machine Learning.*

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Realization of Programmable Chessboard Mushroom-Type Metasurface for Beamforming Applications

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Abstract. In this work, we report on a prototype realization of a reconfigurable reflectarray-type metasurface and investigate its potential for beamforming applications.The studied programmable metasurface (PMS) comprises a chessboard-like array of metallic patches placed over a groundeddielectric slab with metallic vias connecting the patches to a network of x- and y-controlling lines. Tunability is achievedwith nonlinear capacitive loads -varactor diodes - inserted between the corners of the metallic patches that form the chessboard structure. The direction of the reflected beam is changed byapplying differential voltages necessary to create a given reflection phase gradient on the metasurface.The analytical model of such a chessboard Sievenpiper mushroom-type PMS with memory was developed by us previously [1,2, 3, 4]. Byusing this analytical model and the SIMULIA CST Studio Suite software we have investigated several variants of the proposed PMS concept. Based on these studies, the design parameters and dimensions have been optimized for the frequency range from 3 to6 GHz for potential 5G+ applications. A prototype PMS that operatesin this range has been built. With this prototype, we have realizedand tested experimentally a few simple one-dimensional beamformingscenarios, in which we have used a resistor chain-based voltage divider to create differential voltages. The performance of the prototype has been tested in an anechoic chamber in a bistatic configuration with a pair of horn antennas communicating through the reflecting PMS. Experimental results have demonstrated that a PMS prototype with just 3 by 10 controllable elements is already sufficient to redirect the beam in different directions.In the next series of experiments, we aim to control the PMS with acustom-built FPGA-based controller. By using such a controller we willbe able to create arbitrary voltage distributions among the full setof PMS control lines. Such a setup will allow us to realize morecomplex beamforming scenarios. Moreover, the current results haveshown that a PMS with a larger size might be needed in order todecrease the influence of parasitic scattering effects. Developingthe new experimental setup is underway. The complete system willinclude a digitally-controlled multichannel voltage driver board, an FPGA board to produce a set of Pulse Width Modulated (PWM) input signals for the bias voltage drivers and a laptop PC converting thephase gradient data to the PWM control data given to the FPGA by aUSB serial link.

Keywords: *Programmable Metasurface (PMS), Future Telecomunications, Beamforming, Memory Capacitor*

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Carrier synchronization in m-CAP modulation for VLC-based IoT systems

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Abstract. In recent years, wireless communication capabilities have become a common built-in feature on consumer electronics. From household appliances and wearable technology to entertainment systems, these devices are now able to connect to the Internet, leading to the real implementation of the Internet of Things concept (Ding et al., 2020). Cisco predicts that by 2023, 14.7 billion internet-connected devices are machine-to-machine connections, representing half of all internet connections ("The Internet of Things (IoT)," 2021). Such devices are required to have smaller sizes, low cost, and consume progressively less power (Akyildiz et al., 2002; Portilla et al., 2019). Visible light communications (VLC) technology has been proposed as a complementary technology for a vast number of scenarios, in particular for IoT, where it can relief the communication channel in high device density scenarios by enabling spectrum reuse within few meters (Ding et al., 2020). In 2019 m-CAP modulation was suggested as a frequency-domain multiple access scheme to address multiple user capability (Merah et al., 2019). However, practical implementation of the Rx would demand digital receivers with powerful DSPs. The proposed system uses a digital m-CAP modulator embedded in a ceiling LED light fixture and analog homodyne receivers, aiming at low-cost, low-power, and small-sized IoT devices. Such analogue devices can be easily implemented with integrated circuits with less transistors than the digital equivalent, effectively decreasing its cost and power consumption. Nevertheless, the carrier synchronization of homodyne receivers is a critical aspect in real-world implementations because of imperfections of devices, and the channel delays and interferences. Using the MatLab Simulink, a simulation model for the Costas Loop is presented, along with performance results, which demonstrate the system's ability to synchronize with pull-in and lock ranges of +/-800 Hz and +/-900 Hz, respectively. The loop requires 1.194 ms to be in the locked state, allowing the system to lock within 6 symbols period. In addition, we measured the performance of the system in the presence of noise and interference from other modulated bands. When compared to the ideal synchronization scenario, the results showed that noise and interference did not degrade the system's performance. Although the system was unable to lock when energy was present in adjacent bands, alternative options such as high order phase-locked loop and hybrid frequency-division multiple access and time-division multiple access, can improve system performance without significantly increasing the cost and complexity of the devices.

Keywords: *visible light communications, Internet of Things, Costas loop*

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Comparing Trajectory Approach to Holistic Approach for End-to-End Response Time Analysis in RT-MQTT

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Abstract. Nowadays, custom components are increasingly being replaced by commercially available off-the-shelf hardware and standard protocols. Additionally, emerging industrial paradigms like Industry 4.0 and IoT place new demands on requirements like scalability, transparency, adaptability, and efficiency. Accordingly, application layer protocols like the Message Queuing Telemetry Transport Protocol (MQTT)(MQTTV5.0, 2019) have gained popularity in these fields due to their simplicity, scalability, low resource usage, and decoupling between end nodes. MQTT is typically used over TCP/IP networks, which provide ordered and lossless bi-directional channels. MQTT offers three levels of Quality-of-Service (QoS), although these are related to handling transmission errors and lack support for real-time requirements. To address this limitation, the authors recently proposed an architecture called RT- MQTT that extends MQTT with real-time services (Shahri, Pedreiras, ; Almeida, 2022),(Shahri, Pedreiras, ; Almeida, 2023). RT-MQTT enables applications to define real-time requirements over MQTT that are translated into network reservations and enforced by Software Defined Networking (SDN)(Xia, Wen, Foh, Niyato, ; Xie, 2014), specifically using the OpenFlow(OpenFlow, 2018). This paper extends the work by refining the formal system model, complementing the analytic approach based on the Holistic Approach (HA)(Tindell, Ken and Clark, ; John, 1994) with the more efficient Trajectory Approach (TA)(Martin, Steven, ; Minet, 2006) to improve the tightness of the results, and, finally, verifying the correctness and relative performance of both analyses by means of extensive experiments.

Keywords: *Real-Time Systems, MQTT, FP Non-preemptive Scheduling, Trajectory Approach, Holistic Approach*

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Photonic beamformers for large-scale satellite communications

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Abstract. Satellite-based telecommunications are fundamental for the democratization of digital access (Duarte et al., 2019). However, to truly achieve that goal, the economics of satellite access need to be comparable to land-based systems. With satellite payloads at their size, weight, and power consumption (SWAP) limits, improving the economies of scale in this area requires solutions capable of increasing capacity, whilst having a SWAP-friendly footprint. A contender to provide such a solution is photonics-backed spatial-division multiplexing (SDM), in the shape of photonic beamformers (PBFs) for high-scale phased array antennas (PAAs) (Inigo et al., 2014).To achieve a SWAP-friendly PBF we looked at the most successful application of optics: optical telecommunications. Here, we identified the key enabling technologies behind this success: wavelength-division multiplexing (WDM), coherent detection, and programmable photonic processors (PPPs). We then translated these technologies in an architecture for a PBF. With this architecture, we have proposed, and demonstrated, with a full suite of analytical derivations, numerical simulations, and experimental demonstrations, PBFs for receiving (Oliveira, Nogueira, and Drummond, 2022; Oliveira et al., 2021) and transmitting-side applications (Oliveira, Nogueira, and Drummond, 2022). The proposed architectures are capable of fully software-defined, dynamic, multibeam beamforming, and include accompanying features like frequency conversion. All of these capabilities have been analyzed in the published work. The proposed architectures are suitable for optical integration, namely in the form of photonic integrated circuits (PICs).The work realized presents a clear advance in the state-of-the-art in photonic beamforming. From the solid architectural foundations developed, future work should move towards integration and miniaturization, by resorting to PICs, and thus raising the technology readiness level

Keywords: *Microwave photonics, Beamforming, WDM*

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Territory, Risk and Public Policies

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Assessment of the awareness of municipal forestry services regarding post-fire soil erosion and its mitigation – Case study of Central Portugal Region

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Abstract. Several environmental scenarios forecast a global temperature increase until 2100, affecting generally the European territory, and particularly, the Mediterranean Region (IPCC, 2023). In the meanwhile, changes are already being felt through the increasing trend of wildfires occurrence (number, recurrence and intensity) (Fernandez-Anez et al., 2021). Driving the identification of post-fire erosion risk areas in Portugal (Parente et al., 2022), and in the European Union (Vieira et al., 2023), in which emergency targets, and local action, is crucial to mitigate on- and off-site impacts (García-Girona, 2023). Adding up to national legislation on post-fire soil erosion, which assigns responsibilities to local entities, on where and how to act for burned forest soil conservation.Based on historical wildfire recurrence, and modelled post-fire soil erosion risk level, the central region of Portugal was selected as a case study to assess local technical forestry awareness on soil erosion after wildfire. A questionnaire survey was conducted between 14 September and 14 October, in which 100 municipalities were invited to participate, through their Forestry Technical Offices. Such questionnaire was structured by: i) entity general characterization; ii) wildfires concerns; iii) relation to forest soil management and erosion mitigation after wildfires. Questionnaire draft combined closed and open questions. Of 78 responses, 49 were considered valid for analysis.Results of this study reveal that local technical activity is focused on wildfires prevention and awareness, despite observing a general concern among respondents generated by an increase in soil erosion. Wildfire indirect impacts (e.g. water pollution, human health) are those that generate less concern level. In around half of valid answers, respondents identify that, at some point, implemented, or have knowledge on the implementation, of mitigation measures against post-fire soil erosion, mainly represented by organic barriers application and rows following the contour lines. According to respondents' perspectives, two key inferences can be taken on how promote local soil conservation: i) local empowerment to act on emergency stabilization/rehabilitation and support forest owners, and ii) strengthening awareness to local stakeholders.

Keywords: *local perception; technical perspectives; post-fire soil erosion; emergency soil stabilization*

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Tourism

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Islands in human imagination: A review of cultural and social representations

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Abstract. Typically romanticised as ideal places of escape from ordinary life, islands have always inspired human imagination, being associated with heroic journeys, myths, mysteries, and holy quests. These places have attracted the attention of scholars and writers from several disciplines. Not only geographers, biologists, ecologists, anthropologists, historians and economists, but also many poets and painters have been inspired by the singular island atmosphere, with each island naturally having its own personality. Many studies have assessed island destination image, even though little attention has been paid to the social and cultural representations of islands and their contribution to the development of island destination image. Therefore, the purpose of this paper is to conduct an extensive content analysis of articles, books and chapters on island destinations revealing categories of social and cultural meanings assigned to islands over the centuries, and to discuss practical implications for destination marketing. Islands are generally perceived as unique places, marked by a pristine environment, exotic wildlife, and remoteness, being often associated with a romantic idyll. Nevertheless, islands also face challenges, with several negative image elements, namely associated with isolation, scarce resources, and difficult weather conditions. Both attractive dimensions and those revealing islands' vulnerability, visible in social representations, should be considered in destination image assessment, reflecting destination marketing potential as well as challenges.

Keywords: *Destination image, Destination marketing, Imagery, Island studies*

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Citizen science of astrophotographers in leveraging the promotion of sustainable development of astrotourism destinations

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Abstract. ABSTRACT
Since the industrial revolution and with the vertiginous evolution of technology, tourism has become a dynamic and fast-paced activity, exponentially increasing opportunities for the sector. However, the COVID 19 pandemic forced society to reformulate its relationship with the world at various levels, including the tourism sector. Currently, and in opposition to the rapid development of mass tourism, new forms of leisure are emerging, characterized by unique experiences, environmental awareness, reflection on the interaction we have with the world, a philosophy based on authenticity, slowness and quality. Today, astrotourism presents itself as a tourist movement resulting from a repressed society that yearns for a connection with the simple things in life, away from crowds, pollution and the urban, all of which are features of low-density territories.
These territories are frequently connected with numerous challenges. However, they are also usually classified as places with great environmental quality, rich cultural and natural heritage, and, in the specific case of astrotourism, low light pollution. These characteristics, seen in an innovative perspective, can and should be used and leveraged for the development of these territories, increasing their visibility, helping them to reach new markets, attracting investments, and consequently improving the resident population's quality of life. Today, tourists want genuine and exotic experiences combined with sustainability concerns and, in this sense, astrotourism is a type of tourism that can satisfy the new needs and curiosities inherent to these new tourists. Astrotourists, in particular astro/nightscape photographers, through the dissemination of their inspiring images of the night sky, strongly contribute to the promotion of scientific knowledge, human capital formation and environmental awareness among visitors and the host community.
This research adopts a positivist paradigm. It intends to identify characteristics and behaviours of a specific tourist segment and find relationships and interactions between this segment and the sustainable development of astrotourism destinations. The production of knowledge in this area, as pointed out in the Tourism Research Agenda, becomes a fundamental instrument in the decision-making, planning, promotion and definition of sustainable development strategies and the creation of products/services that meet the needs of these new tourists and local communities.

Keywords: *Astrotourism; Astrophotographers; Sustainable development; Low density territories; Citizen science.*

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De que forma é que o turismo gastronómico contribui para a preservação e autenticidade do património gastronómico dos destinos?

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Abstract. Inspirada pela literatura, pela agenda da investigação em turismo e pelo interesse no turismo gastronómico e autenticidade do património gastronómico, o objetivo da investigação consiste em compreender como é que o turismo gastronómico contribui para a preservação e autenticidade do património gastronómico.
A literatura corrobora o papel central da autenticidade no turismo gastronómico, revelando a tendência da procura e elencando escalas e variáveis que condicionam a memorabilidade e intenção de revisita dos destinos. Identifica conexões temáticas como a cocriação, alinhada com a perspetiva construtivista e existencial (Wang, 1999) e com o construtivismo social (Park ; Widyanta, 2022); a crescente procura de experiências; o potencial da gastronomia no marketing; e o caráter distintivo da gastronomia, enquanto ativo cultural enraizado nos lugares e nas comunidades.
O turismo gastronómico oferece valor cultural ao turismo e cria impactos económica e socialmente positivos (Berbel-Pineda et al., 2019), afirmando-se como fator de desenvolvimento regional e elo entre a alimentação, a terra e as comunidades (Fusté-Forné, 2016). O turismo gastronómico contribui para a construção do orgulho da comunidade (Zhang et al., 2019); para o incremento de novos produtos (Seyitoğlu ; Ivanov, 2020); e para o desenvolvimento sustentável dos destinos (du Rand et al., 2003), apresentando-se como alternativa para áreas sem "sol, mar e areia"(Sánchez-Cañizares ; López-Guzmán, 2012). No entanto, importa redesenhar as experiências e sistemas alimentares (Hall, 2020), enfatizando a participação ativa do turista e a inspiração de práticas alimentares e estilos sustentáveis que desafiam a visão do turista passivo (Leer, 2020). A gastronomia enquanto produto turístico reforça a dinamização das economias locais; incrementa a relação entre a agricultura e o turismo, aumentando a produção biológica e favorecendo as cadeias curtas e beneficia a preservação das tradições e valores de autenticidade da comunidade de acolhimento (Jiménez-Beltrán et al., 2016).
O turismo gastronómico leva ao desenvolvimento dos destinos, mas a literatura não explica como contribui para a preservação e autenticidade do património gastronómico, nem como é que a oferta se posiciona para afirmar a identidade gastronómica.
Recorrendo ao método misto de investigação, e concretizando-se em duas fases, a investigação parte dos conceitos de turismo gastronómico, autenticidade, experiência gastronómica e patrimónios gastronómicos, desenvolvendo um estudo que posiciona a autenticidade como conceito nevrálgico. Ancorada na expansão do horizonte gastronómico, esta abordagem identifica novas questões de preservação dos territórios; existência de redes alimentares, éticas e sustentáveis; e o papel estratégico da gastronomia na autenticidade dos destinos.

Keywords: *Turismo gastronómico; Autenticidade; Produtos gastronómicos; Património gastronómico; Experiências gastronómicas; Método misto de investigação*

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O papel da educação e formação no desenvolvimento de um turismo regenerativo

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Abstract. O Turismo é hoje uma das indústrias mais dinâmicas do mundo, liderando a criação de emprego e o desenvolvimento económico local. Nos últimos anos este mesmo crescimento tem sido considerado excessivo em algumas regiões ou locais devido aos seus impactos negativos a nível social e ambiental e ao nível da perda de identidade dos territórios e da destruição dos ecossistemas. Este aparente paradoxo tem motivado a investigação sobre novos modelos de organização da atividade turística que assegurem a regeneração dos territórios naturais através de abordagens holísticas que incorporem os sistemas naturais e humanos e a ética da responsabilidade para a regeneração. A educação e a formação para o turismo têm um papel fundamental na modelação destas novas abordagens, contribuindo para o desenvolvimento de competências que garantam a conexão dos sistemas sociais e naturais, através da preparação de profissionais com um posicionamento ético e responsável capaz de atender à urgente mudança das condições de habitabilidade do nosso planeta.
A investigação pretende responder à seguinte questão: Que modelos de educação e formação devem ser implementados para garantir o desenvolvimento de um turismo regenerativo? E que competências essenciais devem ter os futuros profissionais do setor?
Partindo de uma revisão da bibliografia sobre os conceitos de turismo sustentável, turismo regenerativo, literacia regenerativa e competências para a sustentabilidade, a investigação fará uma análise sobre os principais modelos de educação e formação no turismo, analisando em particular o sistema de formação profissional em turismo em Portugal, procurando identificar as lacunas existentes como base para a definição de novos modelos e para a identificação das competências (transversais e específicas) que garantam o desenvolvimento de um turismo regenerativo. Em termos de objetivos investigação destacam-se os seguintes:
1. Aprofundar o conceito de turismo regenerativo;
2. Identificar um novo modelo de educação e formação para o turismo que contribua para posicionar o turismo como ancora de um desenvolvimento sustentável de longo prazo
3. Identificar as competências que devem ter os futuros profissionais do turismo por forma a garantirem o desenvolvimento de um turismo regenerativo.
Através do desenvolvimento de uma metodologia mista, combinando a realização de entrevistas aos atores do sistema de educação e formação com a realização de questionários aos profissionais do setor, a investigação contribuirá ainda para (re)definir o sistema de educação e formação em turismo, identificando novos caminhos de suporte a uma educação para a preservação das comunidades e do planeta.

Keywords: *Turismo regenerativo; literacia regenerativa; modelos de educação e formação; competências ambientais; competências sociais.*

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Employer branding em turismo

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Abstract. Os recursos humanos, na indústria do turismo e da hospitalidade, são determinantes, tal como defendido de forma geral (Singh et al., 2022; Baum et al., 2016) - as organizações dependem dos recursos humanos, vistos como conhecimento, experiência, capacidades e compromisso dos funcionários (Jimad et al., 2022).

O employer branding, área de estudo cada vez mais relevante, é definido como uma estratégia a longo prazo de construir uma imagem identificável e única no que diz respeito à entidade empregadora, construindo e mantendo uma imagem positiva e atrativa para os colaboradores atuais e potenciais, diferenciando-a (Ek Styvén et al., 2022). Estudos mostram que as imagens negativas como positivas influenciam o comportamento dos indivíduos no que diz respeito a candidaturas a empregos específicos (Innerhofer et al., 2022).

Os gestores de turismo e hospitalidade sentem a necessidade de identificar elementos que criam impacto sobre a marca do empregador nas suas tentativas de formular e implementar estratégias de employer branding (Bagheri et al., 2022), estando a exigir mão-de-obra especializada, e a lidar com inúmeros constrangimentos na sua obtenção (Innerhofer et al., 2022) - fatores tais como mão-de-obra jovem e transitória, baixos níveis de remuneração, horários de trabalho pouco atrativos e imagem negativa da indústria (Ek Styvén et al., 2022). Para atrair e reter empregados para a indústria, é importante melhorar a sua imagem, num trabalho de toda a organização (Gehrels ; de Looij, 2011).

A literatura atual tem-se concentrado sobre a compreensão da rotação do pessoal em vez de estudar fatores que contribuam para a retenção (Ek Styvén et al., 2022). Bagheri et al. (2022) identificam este é um tema ignorado pelos investigadores, apontando uma lacuna óbvia na literatura. Esta investigação pretende, assim, trazer contributos para o setor do turismo, baseando-se no conceito de employer branding

Keywords: *EMPLOYER BRANDING, TURISMO, RECURSOS HUMANOS,RECRUTAMENTO E FIDELIZAÇÃO DE TALENTO, COMUNICAÇÃO*

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Public Governance as mediated coopetition for tourism development

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Abstract. Coopetition is a concept that unites two normally opposite behaviors: competition and cooperation. The applicability of this concept is usually associated with the constitution of stakeholders' networks that can benefit from joint action. In tourism, the establishment of coopetitive relationships intrinsic and emergent, either by the complementary nature of the various services provided by stakeholders, or by the shared goal of tourism destination development, which will benefit both firms and society.
This study will analyze how coopetition can be mediated by governance at a supra-municipal level. The context of the analysis will be the public governance organizations in Portugal, namely at the level of the administrative NUT III, which comprise the Intermunicipal Communities and the Metropolitan Areas. The methodological design will have two phases. Firstly, a qualitative methodology of case analysis based on Content analysis with data collected from in deep interviews with public managers. Second, a quantitative methodology based on partial least squares structural equation modelling (PLS-SEM) with data collection through questionnaires with residents.
In order to carry out this research, it is necessary, through a literature review, to conceptualize the concepts of governance, tourism coopetition, and tourism competitiveness from the perspective of society and local tourism development, to propose a model to understand if regional governance is a mediate coopetition that positively impacts on the tourism destination development.
This research, despite being based on a positivist paradigm, will also use the qualitative paradigm in order to understand and interpret the meaning of human interactions or perspectives.

Keywords: *Governance; tourism governance; tourism coopetition; coopetition strategy; tourism competitiveness from the perspective of society; local tourism development; tourism destination competitiveness; social management; destination management.*

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The virtuous circle of the Circular Economy in Tourism: The case of Rural Tourism

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Abstract. The economic relevance of the tourism industry, combined with its environmental impact, makes the sector a relevant contributor for achieving the European environmental targets. Simultaneously, 21st century consumers look towards being ecologically conscious, adopting new behaviours. The transition towards the experience economy is interconnected with the development of smart, environmentally sustainable destinations, that promote memorable experiences. There is also a growing demand for rural destinations, a phenomenon multiplied by the COVID-19 pandemic. Current consumption trends, combined with this type of destination with a strong nature component, translate into a greater practice of pro-environmental behaviours by visitors.

Extensive literature already explores the relationship between tourism demand and supply. In this scope, studies on factors that determine the adoption of new behaviours by consumers are of particular interest. The influence of new trends on the adoption of consumer habits is not unprecedented Circular economy is an alternative to linear economy, keeping resources in use for as long as possible, extracting the maximum value from them, then recovering and reusing products/materials (Mitchell, 2015). This research aims to analyse the influence that the adoption of circular economy behaviours by visitors can have on the implementation of circularity processes by the tourism supply, and vice-versa.

A conceptual framework of circularity behaviours and processes of visitors and tourism companies will be developed, based on a systematic literature review, determining the factors that influence the adoption of circularity by visitors and enterprises. One factor that will be analysed in detail is the belonging to networks/partnerships, verifying whether cooperation facilitates the implementation of circularity processes in companies. The network of Historical Villages of Portugal will be used as an empirical case study, applied to both visitors and tourism supply agents. Primarily, two exploratory qualitative studies through interviews will be held with both demand and supply, later developing a questionnaire, applied to the same agents.

It is believed that the study will have relevant theoretical contributions, namely at the level of environmental economics in the scope of tourism and contribute to the development of marketing strategies and territorial development. Additionally, this research can give recommendations to consumers, enterprises, and policy makers: being efficient and productive, doing "more with less", increasing the value chain; educating producers and consumers; promoting a more conscious and dynamic community/society involvement; encouraging regional cooperation, synergies, and symbiosis between different sectors of activity, supporting new legislation, tax incentives/green taxation; and fostering more research in this field.

Keywords: *rural tourism, circular economy, visitor behaviour, circularity processes, circular tourism*

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As redes de turismo cultural como fatores de desenvolvimento regional: o caso do produto templário

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Abstract. Portugal is the Templar country par excellence and owns a vast built heritage. The material and immaterial Templar heritage and memory that take us back to the origins of the Nation's identity are present mainly in the Centre of Portugal.
The Templar subject is already an important differentiating tourist product in several regions a component of regional development, as it constitutes a strong pull factor in Tomar. However, the product needs to be operationalized along the territory. Consequently, cooperation between stakeholders is essential for valuing endogenous resources (honey-pots), while the presentation-interpretation of heritage becomes a differentiating element of tourist destinations. In this process, the governance and promotion of destinations are crucial to create value, specially in sparsely populated regions. The current model of "regional innovation systems" (RIS) incorporates increased productivity and competitiveness into regional growth, in which governance, knowledge transfer and the community are keys to ecosystems' innovation. The decision-making processes, in a bottom-up model, involves planning, economics and management of the tourism sector, which must be seen in association with each other, rather than being approached in isolation, for the evolution of the sector.
Regarding the literature, there is a notable gap in what concerns the legacy of the Order of the Temple and its contribution to tourism. Concerning the historical and cultural identity and the role of historical reconstitutions in the diversification of the offer, such as the Templar Festival held in Tomar. Previous studies highlight the need for innovation, the importance of stakeholders' networks, and internationalization. Symbolism and legends must be transformed into tourism initiatives that become pull factors and the theoretical basis for the creation of the product. Thus, this research can be led to future actions that reinforces and qualifies the tourist-cultural visitation to these territories, regarding the environmental, economic, social, scientific, and cultural dimensions.
The main objective of this work is to identify and characterize the relationships established between the stakeholders of the tourism sector in the social, cultural, economic and governance dimensions, in the Centre Region ecosystem.
The methodology will include semi-structured exploratory interviews applied to cultural agents, which will address the dimensions mentioned and will be evaluated by content analysis (webQDA). The questionnaires that will result from a snowball sampling technique will be focused on the same dimensions and will be analyzed based on descriptive statistical analysis (SPSS); a sociometric analysis will disclose the strength of the ties within the network (UCINET).

Keywords: *Tourist destinations, Innovation network, Regional innovation systems, Total tourist experience, Knights Templar product.*

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Implications of Blockchain Technology (BCT) adoption for the tourism sector

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Abstract. Boosting the digitalisation of the tourism sector worldwide, promoting innovation and entrepreneurship in organisations in this industry has been a challenge for associations and companies. There are more and more tools such as artificial intelligence, virtual and augmented reality, IoT, Blockchain, that are present in the strategies of tourism sector companies.
Blockchain technology (BCT) emerged in 2008 with the publication of an article by Satoshi Nakamoto entitled "Bitcoin: A Peer-to-Peer Electronic Cash System". This technology has been progressively changing various industries worldwide, with particular relevance to tourism. Its implementation is seen as a solution for disintermediation, traceability and transparency. It has the potential to drastically change traditional tourism intermediation business activities. The aim of this study is to identify the implications in the adoption of Blockchain Technology for the tourism sector, from the supply side, being aligned with SDG9 and the smart specialization area, the Digital Transition.
A model that contemplates the main implications in the adoption of Blockchain Technology for the tourism sector will be developed, based on the collected literature review. As a result of the literature review, in theoretical terms, the study will try to understand what is being approached in the context of Blockchain in the tourism sector, understanding its main implications in the adoption of this technology for tourism related companies. In a second phase, interviews will be applied to experts and companies in this technology in the tourism sector. The data collected will be the basis for the preparation of questionnaires to entities and associations in the tourism field. In conclusion, this research is expected to be relevant and to contribute to the tourism industry. In practical terms, it is expected that it will be seen as a step forward towards the new reality of tourism, helping tourism sector companies to integrate the Blockchain Technology in their business processes, and an element of awareness for change and the need to bet on hiring people from areas of specialization of the technological area, linked to tourism, since its use and understanding is still at an early stage.

Keywords: *Tourism, Blockchain Technology; Implications; Supply chain*

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A inovação tecnológica enquanto fator promotor da Qualidade dos Serviços em turismo: o caso do setor da restauração

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Abstract. O Turismo é indiscutivelmente uma das indústrias com maior crescimento ao longo dos anos (OCDE, 2020). No que diz respeito à oferta, a indústria do turismo destaca-se pela sua diversidade de serviços, capazes de satisfazer uma grande diversidade de necessidades e contribuir para o bem-estar e qualidade da população. Por este motivo, têm sido realizados grandes investimentos em produtos e serviços inovadores capazes de melhorar a experiência dos participantes, com evidências claras ao nível da competitividade dos negócios (Clark ; Guy, 1998). As empresas ambicionam inovar de modo a atender aos desejos e necessidades dos mercados alvo, e, para isso, é fundamental que estas se adaptem às constantes mudanças do perfil dos consumidores e das suas preferências (García-Sánchez et al., 2019; Pırnar et al., 2012).
A tecnologia surge na literatura como uma das inovações tecnológicas com maior contributo para os negócios e destino, na medida em que está presente em todas as fases da oferta turística (Borowiecki ; Makieła, 2019; Divisekera ; Nguyen, 2018; Hjalager, 2010; Romão ; Nijkamp, 2019), contribuindo para a facilidade de acesso e para o aumento da qualidade da experiência turística (García-Sánchez et al., 2019). O setor da restauração apresenta um vasto potencial para inovar (TriStar, 2022). Este setor é considerado um dos principais eixos de atividade da indústria turística, conforme descrito na CST, em Portugal, além de possuir uma manifestação acentuada no paradigma dos negócios, visto existirem cerca de 32 mil empresas deste setor (Gabinete de Estratégia e Estudos, 2022), o que confirma a sua relevância económica. Neste sentido, esta investigação, desenvolvida no âmbito do Programa Doutoral em Turismo, pretende dar resposta à seguinte questão de investigação: "De que forma pode a tecnologia contribuir para o fornecimento de um serviço de qualidade nas empresas de restauração, aumentando a sua competitividade?" Para dar resposta aos objetivos traçados, irá ser adotada uma abordagem metodológica mista, com recurso ao método dedutivo e indutivo e a métodos de recolha e análise de dados qualitativos e quantitativos. Assim, numa perspetiva metodológica, pretende-se realizar uma revisão de literatura acerca das temáticas Qualidade dos serviços turísticos, Inovação e Tecnologia e como estas se relacionam. Neste sentido, recorrer-se-á à revisão sistemática da literatura com análise de conteúdo e análise bibliométrica. De maneira a completar a enriquecer a informação, as mesmas temáticas serão também alvo de estudo em entrevistas realizadas aos empresários/gestores de empresas da restauração em Portugal e questionários realizados à procura (consumidor).

Keywords: *qualidade dos serviços; serviços inovadores; qualidade interna dos serviços; tecnologia; restauração*

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Impactos das interações turista-residente na formação da imagem dos destinos

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Abstract. A presente investigação tem como objetivo compreender a relevância das interações entre turistas e residentes na formação da imagem dos destinos. Estudos recentes realçam o papel dos residentes na competitividade entre destinos turísticos, mas são escassos os estudos que exploram o impacto das interações turista-residente na formação da imagem do destino, sobretudo em termos de Solidariedade Emocional. O presente estudo procura analisar o impacto das interações entre turistas e residentes na construção da imagem do destino, com ênfase na Solidariedade Emocional.

Para tal, será utilizada uma metodologia mista, que combina uma análise de conteúdo (metodologia qualitativa) para identificar variáveis relacionadas com a interação turista-residente, e um questionário aplicado aos turistas (metodologia quantitativa), com o intuito de analisar questões que avaliem o papel dos residentes e das suas interações com os turistas na imagem do destino.

Objetiva-se oferecer uma compreensão mais aprofundada sobre a importância das interações entre turistas e residentes na formação da imagem dos destinos, destacando a relevância da inclusão dos residentes como um elemento fundamental na gestão e construção da marca do destino. Compreender o papel dos residentes na construção da imagem do destino pode contribuir para a implementação de estratégias mais eficazes de gestão de destinos e branding, que possam melhorar a experiência do turista e aumentar a competitividade do destino turístico.

Keywords: *Interações, Turista, Residente, Imagem*

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Translation and Terminology

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Translation as Variation: Register Variation of Portuguese Translations from an SFL Approach

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Abstract. Title
Translation as Variation: European Portuguese Translations from an SFL Approach
Abstract
This research aims at analysing variation in translations using comparable corpora of translated and original texts, diverse textual registers, and translation methods. It examines linguistic features in translations indicating variation, hinging on Systemic Functional Linguistics, Translation Studies, and Cross-Linguistic Register Variation, by performing quantitative (CA and HCA), along with qualitative analyses. The selected features are drawn according to a set of contrastive-typological features of English, German and Portuguese, and to register-specific features. Contrasts in terms of THEME-SELECTION (marked vs. unmarked) are also considered, as in languages such as Portuguese, where the subject is often elided leaving the predicator as clause initial, this has been seen as more problematic (Gouveia ; Barbara, 2006). Regarding registerial features, in terms of TRANSITIVITY, the preference for process types is under scrutiny (e.g., relational vs. others in popular science). A further criterion concerns VOICE (active vs. passive vs. alternatives). Romance languages have been associated with a more limited use when compared to English (Lavid at al., 2010), exhibiting a lower number of scopes and goals, while German presents more constructions.
The main hypothesis being put forward revolves around basic assumptions about the nature of translations: if translations show features more typical for PT, normalisation is observed; if features are more typical for EN, "shining through"is observed. A further refinement of the hypotheses in terms of the typological and registerial linguistic features and SL or TL prominence (tendency to shining through and/or normalisation) is currently in progress.
To the best of our knowledge, none of the existing corpora completely satisfies our research purposes, as most of them include only one translation method (e.g., EUROPARL (Koehn, 2005), with human-produced translations (Resende 2019); COMPARA (Frankenberg-Garcia, 2001) only one textual type; Per-Fide (Dias et al., 2014) makes gauging the source language of the texts (coming mostly from EU institutions' corpora) difficult. These corpora, with due exceptions (e.g., in Resende 2019, which includes 30 registers), contain only one register. Thus, the corpus created, as well as the results of the analysis, will have applicability in different areas, such as language typology, translation studies, and register variation.
Keywords
Systemic Functional Linguistics, Cross-Linguistic Register Variation, Translation Properties.

Keywords: *Systemic Funtional Linguistics, Cross-Linguistic Register Variation, Translation Properties.*

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Consistency Issues in Localizing Digital Products

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Abstract. Localization appeared as an "industry phenomenon" with the "emergence of personal computing and software" (Jiménez-Crespo, 2018, p.27). It has a commercial purpose and consists of adapting a digital product for a specific target locale, whose costumers should be able to interact with the product as if it had been originally developed for them. It must be performed in a seamless way so that it is invisible to the product's users, otherwise it means errors have occurred during the process (De la Cova, 2016, p. 236). Fulfilling such task implies having accuracy, fluency and consistency as requirements to follow during the localization practice, because problems related to these issues can have adverse outcomes, such as poor usability and bad receptiveness from the public. Translation technologies are promoted as indispensable tools for achieving successful outcomes in localization projects, yet they bear several challenges. "Data driven translation technology is considerably challenged" (Folaron, 2020, p. 312), as it is not just the quantity that is relevant but also the quality of the data.
The main purpose of this study is to analyze how translation technologies can actually affect the quality of localization projects. We aim to address different challenges of localizing digital products and discuss in what way consistency can influence the customer experience. For this purpose, we compiled an ad-hoc monolingual corpus consisting of English Web texts on digital devices, which were then localized into Portuguese using the localization and translation management platform Lokalise (Lokalise, n.d.).

Keywords: *Localization, Translation Technologies, Digital product, User experience, Accuracy, Consistency, Fluency*

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The role of interlingual subtitling in the reception of the message in science documentary films

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Abstract.
This research proposal falls within the field of Audiovisual Translation (AVT), in addition to Reception Studies and Science Communication, from a descriptive, interdisciplinary and multimodal perspective. Indeed, research in AVT has evolved exponentially in the last decades, and several authors, such as Gambier (2023), have emphasized its interdisciplinary nature, placing this discipline at the crossroads of Communication Studies, Semiotics, Accessibility, among others. In this sense, Pettit (2004) corroborates the multidimensional dimension of AVT, reinforcing its interdisciplinarity. On the other hand, Kress and van Leeuwen (2006) underline the importance and the need to develop methods of analysis to verify that semiotic elements present in a "text"participate jointly, but also distinctly, in the construction of social meanings. Moreover, Reception Studies, along with Science Communication, enable us to understand how AVT modes interfere in the perception and comprehension of audiovisual products (Nikolic, 2018;), in particular for the dissemination of scientific knowledge (Ogea, 2020; Vyzas, 2022).Firstly, the problem to be addressed aims to analyse the possible interference subtitling may have in the reception of the message and comprehension of the audiovisual product. Secondly, based on the knowledge of the semiotic codes involved in the comprehension of an audiovisual product (Gambier, 2023), we will verify how these codes interact with the written information on screen, i.e. subtitling, in the case of science dissemination films.
The data resulting from these analyses will then be used to propose possible solutions capable of increasing the degree of comprehension of the message, notably on the basis of already existing subtitling (sub)modalities.
This exploratory-descriptive study will begin by delimiting a corpus of science dissemination films, in the area of nutrition and health and in several foreign languages subtitled in Portuguese, which will allow us to assess, through the submission of questionnaires, the degree of comprehension of this type of product by the target audience. The analysis of the reception of the message will take into account the characteristics of the films chosen (corpus) and the characterization of the population groups surveyed (age range, linguistic profile, literacy level and reception habits).
The aim is to find out whether new subtitling solutions effectively increase the degree of film comprehension in a specialised area of scientific dissemination, either through specific linguistic resources or through different subtitling strategies and techniques.

Keywords: *Audiovisual translation, Interlingual subtitling, Reception studies, Film comprehension, Scientific dissemination*

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Localization: Multidisciplinary requirements and competencies in course design

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Abstract. Localization: Multidisciplinary requirements and competencies in course design
Over the last decades we have witnessed an impressive development in localization, resulting in the emergence of a multi-billion dollar industry. The growing role of localization is linked to a tremendous need to automatically translate user-generated content. Localization has managed to overcome other variants of linguistic, cultural, social, economic, political, or legal adaptation and has therefore gained a growing interest in Academia and Industry. A noticeable impact of globalization on the language industry is reflected on the increasing demand for localization by companies operating globally and/or locally. This growth entails a pressing need for localization professionals, and accordingly, the necessity to train and educate these professionals. Universities are in an urge to react to a constantly changing landscape and implement innovative course design, which aims at enhancing students' performance and motivation from the perspective of the end-product which the market appears to require at the present time. In recent years, there has been a growing attention on localization teaching at higher education level (Tórres del Rey, 2019; Sánchez Ramos et al., 2022; Jiménez-Crespo, 2020), In order to address this pressing need, in our research work we aim to design an innovative module on localization, encompassing a wide range of critical topics and aspects demanded by the industry. The proposed module will adopt a multidisciplinary approach balancing theory and practice to provide students with a holistic understanding of the subject matter. In methodological terms, we will accomplish this objective by conducting internal surveys with students and external surveys with professionals and companies, reviewing job offers on specialized websites, and examining industry reports, conference papers, and dissertations. By synthesizing and cross-referencing these sources of data, it will be possible to gain a more nuanced understanding of the specific training needs that the course should incorporate.
Keywords: Localization, Localization Training and Education, Translation and Localization Competences, Localization Technology, Cultural Adaptation

Keywords: *Localization, Localization Training and Education, Translation and Localization Competences, Locali-zation Technology, Cultural Adaptation*

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