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under the theme "Science, Policy and Impact: from evidence to action"

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Preface

The 2026 Research Summit, which took place from 15—17 July, was themed around "Science, Policy and Impact: from evidence to action". The objectives of the Research Summit 2026 were:

- To strengthen networking among faculty members, researchers, and students from the University of Aveiro;
- To develop research partnerships to make more efficient use of available infrastructure and scientific expertise and skills;
- To reflect on the past and discuss the future of research at the University of Aveiro;
- To showcase the research carried out at the Research Units;
- To provide PhD students with the opportunity to present their work and encourage them to develop their communication and networking skills.

Research Summit 2026 was organised into four stages. The first stage comprised activities organised by and for PhD students, including a pre-course and the AIM Further event, which was a special occasion for discussing the life of PhD students. The second stage included a day on which the research units showcased their research and other activities aligned with theme "Science, Policy and Impact: from evidence to action". This day started with the Plenary Lecture "Align, Act and Accelerate Research and Innovation for Prevention, Preparedness and Readiness in times of increasing uncertainty, AI and misinformation", by Manuel Heitor. The following two days featured presentations by PhD students, as well as first- and second-cycle students. A "Best Communication Award" was presented at the end of the event.

We really thank the participants for their involvement.

This Book of Abstracts and Proceedings, of the Research Summit 2026, is therefore the result of the remarkable contributions of young scientists and PhD students working on the topics of the Doctoral Programmes of the University of Aveiro. Although the Research Summit 2026 is aimed at young researchers, senior researchers also contributed to the conference's success by fostering discussion and collaboration on the research papers included in this book. The presence of senior scientists and PhD supervisors proved very beneficial for all participants, and it is hoped that young researchers and PhD students benefited from this experience.

The organisers hope that Research Summit 2026 provided a valuable opportunity for participants to exchange ideas and that it will be remembered as a milestone in the history of Forums at the University of Aveiro.

Artur M.S. Silva
Mara G. Freire
A. Gil Andrade-Campos

Aveiro, Portugal, July 2026.

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List of Abstracts

[CERIS] Risk Assessment, sustainability and rehabilitation of the built environment

Design for Disassembly in Prefabricated Construction: A Systematic Review of Demountable Connection Systems

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Abstract. The growing shortage of affordable and adequate housing, together with the substantial energy consumption and environmental impact of the building sector, has intensified the need for more efficient and sustainable construction approaches. In this context, demountable connections are central to the performance, constructability, and sustainability of prefabricated and modular construction systems, as they assure load transfer, structural robustness, assembly efficiency, and construction time. This systematic review examines research on connection systems in prefabricated structures, with particular focus on demountable solutions that support disassembly, reuse, and circular construction. A structured search of peer reviewed studies was conducted using the Scopus and Web of Science databases. The selected publications were analysed through bibliometric methods to identify publication trends, influential journals, leading countries, collaboration networks, and keyword co-occurrence patterns. The review also synthesizes current knowledge on structural behaviour, design requirements, and practical implementation challenges. The findings show increasing attention to innovative and reusable connection systems, especially in relation to maintenance, adaptability, and end of life recovery. Overall, the study identifies key research gaps and future directions for improving the resource efficiency and life cycle performance of sustainable prefabricated construction.

Keywords: Demountable connection; prefabrication; disassembly; shear transfer; systematic review

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Physics-informed agentic AI for safe and optimal design of steel frames

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Abstract. Computational design of steel structures, particularly portal frames, is a safety-critical and resource-intensive process relying on iterative physics-based analysis and optimization. While metaheuristic methods such as Genetic Algorithms, Particle Swarm Optimization, and Differential Evolution improve nonlinear structural optimization, they remain computationally expensive and unsuitable for large-scale applications.

Recent advances in large language model (LLM)-based agentic systems show potential for automating structural reasoning and workflows. Multi-agent frameworks for steel design [1], hybrid pipelines improving reliability in LLM-based structural analysis [2], agent-based systems for automating structural engineering workflows [3], and lightweight multi-agent approaches for 2D frame analysis [4] demonstrate emerging capability for reasoning-driven automation in structural engineering. However, these approaches still struggle with physical consistency, robustness, and strict compliance with design codes required in safety-critical contexts.

To address these limitations, a physics-informed human-in-the-loop agentic AI framework is proposed for optimal steel frame design. The framework integrates machine learning surrogate models with goal-driven agentic reasoning to support engineers in generating, evaluating, and refining designs under explicit physics, design code, and safety constraints. Rather than replacing engineers, it augments decision-making through supervision and validation.

The methodology combines surrogate modelling with structured reasoning inspired by engineering heuristics, enabling interpretable and uncertainty-aware outputs. Surrogate architectures including physics-informed neural networks (PINNs), Gaussian Process models, and neural networks will be developed and benchmarked, and validated through steel beam and portal frame case studies.

Expected outcomes include reduced computational cost, improved material efficiency, enhanced safety, and greater transparency while maintaining engineer accountability. The work bridges data-driven intelligence with physics-informed engineering, establishing a collaborative human–AI framework for structural design.

By enabling resource-efficient solutions, this research supports Sustainable Development Goal 12 (Responsible Consumption and Production) through reduced material waste and improved sustainability.

Keywords: *Agentic AI; Steel Portal Frames; Optimization; Resource efficiency; Surrogate models*

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Performance comparison and life cycle assessment of shallow geothermal energy systems for a university building

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Abstract. The increasing vulnerability of conventional energy sources for building heating and cooling, together with the urgent need to reduce greenhouse gas emissions, has accelerated the search and the need for sustainable energy solutions [1]. Among renewable technologies, shallow geothermal energy systems represent a promising alternative for improving building energy efficiency and reducing environmental impacts. This research develops an integrated methodology for building energy simulation by combining soil thermal characterization, geothermal system modeling, building energy simulation, and life cycle assessment (LCA) through a real case study. Soil samples collected from construction sites in Lisbon and Aveiro, Portugal, were experimentally analyzed at the National Laboratory of Civil Engineering (LNEC) to determine their thermal properties using transient line source and transient plane-source thermal sensors [2]. These thermal parameters are of paramount importance for the simulation and design of shallow geothermal systems [3]. The study focuses on the Communication and Image Sciences Complex (CCCI) building at the University of Aveiro, which incorporates a shallow geothermal system. Whole-building energy simulations were conducted using CitySim Pro, while GLHEPRO was used to simulate the operation of a ground heat exchanger. Comparative analyses across different European capitals demonstrated that borehole heat exchanger sizing and operational performance are highly dependent on local climatic and geological conditions. Additionally, a cradle-to-grave LCA compared three HVAC alternatives for the CCCI building: a ground-source heat pump system, an air-source heat pump system and a conventional natural gas boiler combined with an electric chiller. Overall, the research demonstrates the potential of integrating shallow geothermal systems into sustainable building energy planning and provides insights for optimized low-carbon heating and cooling system design.

Keywords. *Whole building energy simulation; Borehole heat exchangers; Climate zones; Ground thermal properties; Life cycle assessment.*

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Behaviour of cold-formed compressed C-profiles with and without web slots: numerical analysis

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Abstract. Cold-formed steel profiles are characterised by the high slenderness of their walls, where the creation of "folds" (stiffeners) increases their strength, resulting in an improvement in the profile's maximum load-bearing capacity, when some of its parts are in compression. This type of profile exhibits good tensile behaviour but, on other hand, poorer compressive behaviour. Due to their slenderness, these sections are more susceptible to instability phenomena, such as global, local, and distortional buckling.

New solutions for cold-formed profiles have recently been developed, such as the introduction of parallel slots in their webs, as exemplified by those developed by the company Perfisa [1]. These slots allow for the breaking of thermal bridges present in these steel profiles when integrated into *Light Steel Framing* (*LSF*) walls. The ultimate load-bearing capacity of these new solutions is still poorly understood.

This study investigates the behaviour of cold-formed C-profiles with and without slotted web under compression, applying numerical modelling with the guidelines in Fpr EN 1993-1-14:2025 [2], using the ANSYS finite element program [3]. It was analysed the influence of different parameters, such as the initial geometric imperfections with the members instability modes shapes and the steel constitutive models proposed in Part 1-14 of the second generation of EC3 [2], on the numerical ultimate load-bearing capacities.

The safety and accuracy of the design methodologies prescribed in EN 1993-1-3:2024 [4] are analysed, being concluded that they provide some unsafe predictions for slotted profiles. The presence of slotted webs leads to a decrease in the strength of cold-formed steel profiles, being the trade-off between thermal performance and load-bearing capacity analysed in the scope of future tasks of the project EcoLSFsystem.

Keywords. *Cold-formed steel; Slots; Compression; Numerical modelling; Eurocode 3*

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Using deep learning for the characterization of the built environment for natural hazards risk assessment

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Abstract. As natural hazards intensify worldwide, rapid and reliable building characterization is becoming essential for disaster risk reduction and multi-hazard risk assessment. In recent years, artificial intelligence and new sources of imagery, such as Google Street View and drone data have created new opportunities to automate this process. Using deep learning and computer vision, relevant building attributes can be extracted directly from images, reducing reliance on large inspection teams and improving the efficiency of data collection.

Accurate building characterization influences the estimation of economic and human losses during natural-hazard events. For instance, the number of stories is often used as a proxy for occupancy, while construction material affects replacement costs and expected damage. In addition, multi-hazard risk assessment requires considering different attributes, since vulnerability drivers vary by hazard type. For example, the lateral load-resisting system is a key attribute for seismic risk, whereas roof shape and roof material are especially relevant for wind-related hazards. Together, these data support disaster-mitigation planning and provide essential inputs for decision-makers developing strategies for safer and more resilient cities.

To realize the potential of automated characterization in practice, a flexible, transparent, and user-oriented workflow is required, through which results can be obtained in a scalable, consistent, and traceable manner. To meet this need, RUBIC-AI was developed as an open-source, AI-powered toolkit and graphical user interface for automated building characterization. Moreover, due to its open-source nature, the platform can be extended by researchers, new features can be incorporated, and feature-specific models can be replaced with user-trained weights, thereby providing a strong foundation for future research and broader scientific adoption.

Keywords. *Exposure modelling; Vulnerability; Deep learning; Computer vision; Seismic risk*

Cognitive and Physiological Impacts of Indoor Environmental Quality in Learning and Workspaces: A systematic review

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Abstract. Indoor Environmental Quality (IEQ) influences occupants' health, comfort and performance, particularly in learning and workspaces. Previous literature reviews have shown associations between IEQ and cognitive functions, although the available evidence remains fragmented by domain, protocols and outcome measure (Fissore et al., 2023; Wang et al., 2021). Workplace studies have also linked environmental conditions to well-being and productivity, while multidomain evidence suggests that IEQ domains do not contribute equally to occupant responses (Felgueiras et al., 2025; Zhang et al., 2023). Therefore, this literature review examines how IEQ parameters affect cognitive and physiological outcomes in these settings. Following the PRISMA 2020 guidelines, peer-reviewed studies from 2015 to 2025 were searched in Scopus, Web of Science and PubMed. A total of 35 studies were included. The analysis covered thermal environment, indoor air quality, acoustics, lighting and physical aspects, mapping cognitive outcomes and physiological indicators including heart rate variability, electroencephalography, electrodermal activity, ocular responses and stress-related biomarkers. Thermal conditions showed the broadest evidence base, with warmer or uncomfortable exposures mainly affecting reaction time, memory and autonomic load. Acoustically adverse conditions were associated with poorer attention, working memory and increased physiological strain. The effects of indoor air quality were more heterogeneous and often linked to vigilance, sleepiness, productivity and autonomic or ocular responses. Lighting effects were generally more favourable when visual quality, daylight access, external views, or dynamic configurations supported comfort and alertness. Overall, the findings highlight the need for multidomain IEQ protocols and more standardized methodological approaches to improve comparability across studies and to support healthier and more effective learning and workspaces.

Keywords. *Indoor Environmental Quality (IEQ); Cognitive Performance; Physiological Responses; Learning spaces; Workspace.*

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Dynamic wall panel with an innovative PCM-Based Heat Exchange System

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Abstract. Dynamic building envelope systems incorporating phase change materials (PCMs) have demonstrated potential for improving thermal regulation and reducing building energy demand. However, limited research has addressed the integration of PCMs into modular dynamic wall panels that combine ventilation-based heat exchange with predictive control under variable weather conditions. This research aims to develop and evaluate a dynamic wall panel compatible with modular construction, designed to precondition outdoor air and improve indoor thermal comfort and energy efficiency. The proposed system will exploit the latent heat storage capacity of PCMs to increase the heat exchanged between the wall panel and the ventilation airflow, enabling the preheating or precooling of incoming fresh air. Initially, the geometry, configuration, and operating parameters of the dynamic wall components will be optimized through parametric design and numerical simulation. An experimental prototype will subsequently be developed and instrumented to monitor indoor and outdoor environmental conditions, PCM thermal behavior, airflow characteristics, and system performance. A predictive control strategy based on artificial neural networks will then be implemented to manage the system in real time, considering monitored conditions and short-term weather forecasts. The predictive model will be trained and validated using experimental and simulation data. The research is expected to provide a scientifically validated framework for integrating latent heat storage, ventilated modular façades, and predictive control, contributing to reductions in building energy demand and operational carbon emissions while supporting the development of adaptable and energy-efficient construction systems.

Keywords. *Dynamic Wall Panel; Phase Change Materials (PCM); Thermal Comfort; Energy Efficiency; Modular Construction; Sustainable Building.*

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Beyond offsite construction: enabling business model innovation through an elementized construction system

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Abstract. The paper examines how business model innovation can advance industrialization in construction by moving beyond offsite construction (OSC) toward an elementized construction paradigm. The purpose of the paper is to develop and empirically validate a comprehensive framework that advances business model innovation in construction, enabling the transition from traditional offsite construction to an industrialized, elementized construction paradigm that supports circularity and systemic value creation. Although Modular Integrated Construction (MiC) and OSC offer benefits in quality, speed, and cost, their global adoption is limited by systemic barriers such as fragmented value chains, skill shortages, high capital demands, and lack of integrated standards [1]. Prior research has focused mainly on technological solutions, leaving business model innovation in MiC and OSC underdeveloped. Building on systemic disruption theories, the paper proposes a framework viewing the shift from project-based construction to industrialized, circular delivery as the co-evolution of five interconnected subsystems: product, process, organization and people, information and digitalization, and value creation [2]. To refine this framework, expert interviews with practitioners in modular and offsite construction explore barriers, enablers, and future business model paths. Within this combined theoretical and empirical lens, "Elementized Construction" is introduced as a next-generation system beyond conventional OSC, based on a standardized element platform, a continuous digital backbone (including 7D BIM, IoT tracking, and configurators), and new lifecycle and circular value logics. The element-based housing concept illustrates a systemic business model architecture for elementized construction ecosystems.

Keywords. Offsite-construction, Business Model Innovation, Elementized Construction

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Numerical modeling of storm events on sandy shores: morphological changes and dune recovery

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Abstract. Coastal areas are continuously shaped by wind, waves, and nearshore currents, leading to constant morphological changes [1]. Climate change may increase the frequency and intensity of storms, amplifying erosion and overtopping events, reinforcing the need for effective coastal protection strategies. While hard engineering structures, such as groins and revetments, have been widely used since the 19th century [2], their maintenance costs and environmental impacts have increased the interest in more sustainable solutions, including sand nourishments. Coastal dunes constitute a natural barrier against overwash and coastal flooding [3], with their growth and recovery being strongly dependent on aeolian sediment transport and sediment availability. This study investigates the interaction between storm-induced erosion and beach-dune recovery at Costa Nova beach, through the combined analysis of maritime and aeolian processes. The analysis of storms and aeolian sediment transport, supported by numerical modelling, allows to improve the understanding of the main drivers of beach-dune morphologic evolution. Several field campaigns were conducted to measure wind conditions, sediment properties, beach morphology and consequent aeolian sediment transport, to better represent these conditions and validate numerical modelling. An analysis of storm events was also performed, to identify the maritime forcing to the study area. Storm events were identified using the ERA5 dataset, considering events with significant wave heights above the 95th percentile, and characterizing storm intensity, according through the maximum significant wave height, wave power, Storm Power Index, and storm energy, while duration was also evaluated. The numerical model XBeach will be applied to simulate hydromorphodynamic processes, overtopping, and beach profile morphological changes under storms events. Field aeolian sediment transport patterns will be considered on numerical modelling, evaluating the dune recovery processes. Finally, different scenarios will be discussed to improve sand nourishment performance under storm events, evaluating erosion mitigation strategies and supporting coastal management and decision-making.

Keywords. *XBeach; Aeolian Sediment Transport; Storms; Costa Nova; Sand Nourishments*

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Real-time hygrothermal characterization and monitoring of built heritage

The preservation of cultural heritage in museums requires careful control of the indoor environment, particularly air temperature and relative humidity, as these factors can cause irreversible damage to highly sensitive materials. A specific case involves panel paintings, which are particularly vulnerable due to their composition of hygroscopic materials, that allow moisture transfer depending on environmental conditions.

This study focuses on the characterization and hygrothermal monitoring of indoor spaces in the National Museum Grão Vasco in Viseu. The museum houses national treasures such as paintings and sculptures, with the central goal of preserving its collection. In this context, the aim of this research is to create a detailed digital twin of the Paço dos Três Escalões building, which will enable the tracking and monitoring of temperature and relative humidity around the various artworks, as well as assess how these parameters, among others, influence conservation strategies and actions over time.

The research has now progressed into a comprehensive monitoring system, which includes an integrated IoT infrastructure that continuously acquires hygrothermal data from several compartments, complemented by an outdoor weather station and by FBG fiber optic sensors tracking the strain field of the São Pedro panel painting. Data are streamed through a Database–InfluxDB–Grafana pipeline, where Python and MQTT routines apply normative criteria in real-time to classify the risk state of each space. Ongoing work addresses the development of the digital twin of Paço dos Três Escalões, integrating HBIM geometry with live sensor data and a risk prediction module combining immediate damage thresholds. Future stages will integrate hygrothermal building simulation calibrated with monitored data, followed by data-driven (ML/DL) forecasting of indoor climate, supporting proactive, evidence-based preventive conservation.

Key-words: Digital Twin, Wooden panel paintings, relative humidity, temperature, fiber optic

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Dynamic PCM-Integrated Shading Systems for Energy-Efficient Buildings: Design, Testing, and Performance Evaluation

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Abstract. The integration of renewable energy sources combined with dynamic construction systems can significantly enhance building efficiency by improving thermal comfort and reducing energy demand and greenhouse gas emissions. Dynamic façades represent a promising approach for decarbonizing the building sector due to their ability to adapt to environmental conditions and occupant behavior. Furthermore, the increasing adoption of thermal energy storage systems based on Phase Change Materials (PCM) highlights the strong potential of these technologies to improve thermal and energy performances. This research focuses on the design, manufacturing, and performance analysis of a Dynamic Shading Device incorporating PCM (DS-PCM). The proposed solution supports the development of a performance-based design tool to facilitate the evaluation and optimization of the dynamic shading device under different operating conditions. The research methodology begins with the design and development of an internal dynamic shading device with PCM, for glazed envelopes, to mitigate indoor overheating. A reference system was developed to serve as a baseline for comparison and control purposes. An experimental campaign was conducted in two comparable real-scale Light Steel Framing (LSF) buildings to evaluate the system's performance through indoor temperature monitoring and thermal discomfort analyses under different operational strategies. The current stage of the research focuses on the dynamic simulation of the system to extend the experimental analyses and achieve a comprehensive characterization of the DS-PCM device through calibrated numerical models. These simulations will investigate the impact of different parameters and operating scenarios on the performance of both the reference and the dynamic solution. Following experimental and simulation analyses, a performance-based design tool will be developed and refined to support the replication and adaptation of the DS-PCM in different scenarios and climate conditions. The tool will aid designers and architects by providing a user-friendly interface for optimizing the design and operation of the proposed system.

Keywords. *Phase change materials; Dynamic façade; Indoor shading device; Whole building dynamic simulation; Thermal comfort; Energy efficiency*

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Valorisation of rubber-based wastes for geotechnical engineering: a systematic literature review

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Abstract. The accumulation of end-of-life tires and other rubber-based wastes presents as a significant environmental challenge, driving the search for sustainable valorisation pathways within the framework of circular economy. Geotechnical engineering offers a promising route for large-volume reuse of this material, transforming a problematic waste into a resource for constructing civil infrastructure. This paper presents a quantitative systematic literature review synthesising the particulate matrix in which the waste is incorporated, the forms of rubber used, the tests conducted, and the applications studied. The review focused on the addition of rubber in unbound granular materials, excluding chemically stabilised composites, bitumen and concrete. Additionally, a bibliometric analysis was conducted to identify the temporal evolution, geographical distribution and conceptual structure of the research field. The search for relevant literature was performed using the Scopus database and the bibliometric analysis was executed using the Vosviewer software. The results indicated that this research topic is relevant nowadays, with worldwide participation from 36 countries. Sand-rubber mixtures have been studied the most when compared to other particulate matrices (ballast, gravel, clay, silt and organic soils). Five different rubber forms have been studied, with granules being more prominent. However, regarding forms nomenclature, a lack of uniformization has been shown as, in some cases, authors refer to the same form with different names or to different forms with the same name. Several tests have been conducted to evaluate the geotechnical properties of the mixtures with rubber, with direct shear tests being the most used. Concurrently, these mixtures have been studied for a variety of geotechnical applications, yet several articles either do not specify a direct application or mention a wide variety of applications.

Keywords. *Waste valorisation; Systematic literature review; Bibliometric analysis; Sustainability; Circular economy*

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Development of an external thermal insulation system for buildings with adjustable fixing and AI-based geometric acquisition

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Abstract. Developing construction solutions that improve thermal comfort and energy efficiency, while promoting efficient resource use, remains a key challenge for both new and existing buildings [1].
In this context, external thermal insulation systems play a crucial role in enhancing the energy performance of buildings, which is essential for meeting global climate goals [2]. However, despite their benefits, these systems still present several limitations and require continuous technological development [3]. One of the main challenges is their limited adaptability to irregular substrates, particularly in existing buildings, characterized by uneven surfaces and geometric deviations [4]. Conventional fixing systems often fail to accommodate such irregularities, leading to installation inaccuracies, reduced thermal performance, and increased installation times [3].
Additionally, thermal bridges, due to the system's installation, significantly compromise the thermal efficiency of the building envelope [3]. Recent studies have sought to improve insulation systems through the development of multilayer panels and off-site manufacturing methods, which can enhance thermal performance, reduce construction time, and minimize waste [5]. Nevertheless, important challenges remain regarding the integration of innovative fastening systems and adaption of these solutions to the complex condition of existing building .
In parallel, digital technologies, including photogrammetry, laser scanning, and artificial intelligence, have significantly improved building geometry acquisition and prefabrication processes. However, their application to external thermal insulation systems remains limited [6].
To address these gaps, this research proposes an innovative off-site manufacturing external thermal insulation system composed of a double-layer panel (rigid and flexible layers) combined with an adjustable mechanical fixing system operating along three-dimensional axes to enhance installation efficiency. Additionally, the study introduces a novel methodology for geometry acquisition using AI-assisted photogrammetry and scanning techniques, enabling a fully integrated workflow from data acquisition to off-site manufacturing and on-site application. By integrating material innovation, mechanical system design, and advanced digital methodologies, this research contributes to advancing the state of the art in sustainable building technologies. The proposed approach offers a scalable solution for improving energy efficiency, reducing construction waste, and supporting the transition toward more sustainable, resilient, and resource-efficient building practices.

Keywords. *Thermal insulation, building envelope, off-site manufacturing system, mechanical fixing system, digital technologies, geometry acquisition*

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On the design of tapered steel members with the 2nd generation of Eurocode 3

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Abstract. The second generation of EN 1993-1-1 introduces relevant changes to the application of the General Method for the out-of-plane stability verification of steel members [1]. These modifications are particularly important for structural components whose behaviour cannot be adequately represented by standard member buckling checks, such as tapered beams and beam-columns. In the previous generation of Eurocode 3, the reduction factor for out-of-plane instability could be evaluated either by adopting the most unfavourable value between the flexural and lateral-torsional buckling reduction factors, or by using an interpolation procedure between them [2]. In the revised formulation, this interpolation procedure is no longer included. Instead, the out-of-plane reduction factor is taken directly as the lower value between the flexural buckling and the lateral-torsional buckling reduction factors [1]. This modification has a direct practical impact on resistance prediction, since it affects the level of conservatism of the design verification.

In parallel, the revised standard introduces an alternative formulation for the lateral-torsional buckling reduction factor of doubly symmetric I/H members with fork supports, in which the bending-moment distribution influence is explicitly considered [1, 3]. Although these changes have no impact on members subjected to compression, their effect may be more relevant for tapered beams and beam-columns, particularly in situations where lateral-torsional buckling is governing. Within the scope of the RFCS European Research project TaperFrame, this study assesses the influence of these revised design alternatives on the resistance prediction of tapered steel members. The design results are compared with reference values obtained from geometrically and materially nonlinear analyses with imperfections (GMNIA), allowing the conservativeness and consistency of the different approaches to be evaluated.

Keywords. *Eurocode 3; general method; GMNIA; lateral-torsional buckling; tapered members*

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[CESAM] Environmental sustainability

Green public procurement in higher education institutions: a case study

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Abstract

Sustainability is a global priority for Higher Education Institutions (HEIs). Green Public Procurement (GPP) is a powerful tool to reduce ecological footprints by embedding environmental criteria into purchasing decisions [1]. However, GPP implementation remains under-explored in Portuguese HEIs.

While GPP offers strategic benefits, institutions face significant barriers: limited staff awareness, inconsistent legal and policy frameworks, insufficient data, and a lack of standardized accountability mechanisms [2]. Understanding these challenges is vital for embedding sustainability into procurement.

This study uses a case study approach to investigate GPP at the University of Aveiro. Document analysis of institutional policies, strategic plans, sustainability reports, manual of good practices, and contracts for the acquisition of goods and services provided data to analyze and interpret in an institutional ecosystem of procurement practices.

Environmental considerations are partially integrated, as evidenced by contracts for the acquisition of goods and services; however, major gaps persist. Inconsistent and limited application of green criteria, limited monitoring of procurement outcomes, a lack of clear accountability structures, and fragmented staff awareness and engagement prevail widely. Conversely, the study identifies distinct opportunities for improvement, including targeted capacity-building programs, refined procurement policies, and the mandatory implementation of evaluation and monitoring systems.

This research provides empirical insights into green purchasing practices at a Portuguese HEI, highlighting current barriers and drivers. To enhance environmental performance, HEIs should adopt comprehensive, standardized GPP strategies. Investing in systematic staff training and capacity-building, as well as strengthening institutional frameworks for monitoring and accountability, are key areas of focus.

Embedding sustainability into public procurement is essential to achieving institutional environmental goals and aligning with global agendas, such as the United Nations Sustainable Development Goals (SDGs). HEIs and policymakers must leverage GPP's transformative potential to ensure purchasing decisions drive long-term, meaningful environmental change.

Keywords: *Green purchasing; Environmental sustainability; Higher education institutions; Green transition; SDGs.*

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DISPERFIRE: a fast lagrangean local-scale wildfire smoke forecasting model

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Abstract.
Wildfire smoke has an important impact on air quality, human health and ecosystems. The growing number of smoke forecast models in Europe is tending towards Eulerian chemistry-transport-models with satellite-derived smoke emissions. The present model, DISPERFIRE, is more computationally efficient and faster for local-scale smoke dispersion. The emissions are derived from a fire spread simulation and fuel-type maps, which removes the dependence on satellite data. The meteorological wind fields used have a fine resolution and are based on a dynamic downscaling algorithm. The plume rise algorithm uses meteorology and the fireline intensity estimate from the fire growth simulation. Finally, a Lagrangean algorithm deals with the advection and diffusion of pollutants.
A case-study was run with DISPERFIRE, and the results were compared with measurements. The Gestosa experimental burn, carried out in May 2023, consisted in the burning of two experimental parcels in the Centre of Portugal. An array of air quality sensors was stationed downwind of the fire. The resulting measurements of Particulate Matter, Carbon Monoxide and Nitrogen Oxides, among others, showed a clear peak from the passage of the plume.
DISPERFIRE was run using fuel data obtained on site, such as moisture and type. Anemometers registered the wind speed, which was used to drive the downscaling algorithm into the required resolution of the smoke spread simulation. The fire progression simulation came from the IMFire model. The DISPERFIRE simulations were carried out for Particulate Matter, Nitrogen Oxides and Carbon Monoxide. The ground concentration results closest to the sensors were compared with the measurements and showed a good general agreement.
Overall DISPERFIRE proved its ability to forecast smoke accurately at local scales. It may be used for forecasting air quality close to wildfires in real time, hopefully aiding in the mitigation of the effects of wildfire smoke. In the future, it may also be coupled to existing regional Air Quality models running at coarse spatial scales to improve the modelling of sub-grid scale smoke dispersion.

Keywords. *Wildfires; Air-Quality; Smoke; Modeling; Local-Scale*

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Should the adoption of nature-based solutions be citywide or neighborhood-specific? A case study of green roofs in Eindhoven, the Netherlands

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Abstract. As cities seek to accelerate climate adaptation, nature-based solutions are often promoted as scalable interventions, yet their adoption by private owners may depend on local conditions. This study investigated whether green roof adoption in Eindhoven, the Netherlands, should be approached through a uniform citywide strategy or through district-specific policies. Using survey data from 1,012 respondents and the Adoption and Diffusion Outcome Prediction Tool [1,2], we assessed adoption potential at both the municipal and neighborhood levels. The citywide analysis suggested a relatively low overall peak adoption level of about 3% and a long time to reach this level, approximately 17 years [3,4]. However, the neighborhood analysis (29 Postal Codes) revealed substantial spatial heterogeneity. Peak adoption levels differed considerably across postal codes, ranging from roughly 1.5% to ~10%, while time to peak adoption varied from 13 to 19 years. Sensitivity analysis further showed that the variables most likely to improve adoption differed across areas, indicating that local constraints and motivations were not distributed evenly across the city. In some postal codes, changes related to environmental costs and benefits had the strongest effect on adoption potential, whereas in others, skills and knowledge played a larger role in shortening the time to adoption. These findings show that citywide averages conceal meaningful spatial variation and that policy responses should reflect district-level differences. The study supports a combined strategy in which broad municipal goals are complemented by targeted neighborhood interventions to better support the diffusion of nature-based solutions.

Keywords. *Nature-based solutions; green roofs; adoption potential; spatial differentiation; Eindhoven*

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Salinity-driven modulation of reactive dye toxicity in *Mytilus galloprovincialis*: A multi-biomarker and PCoA assessment of sublethal effects of remazol brilliant blue R.

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Abstract. Salinity is a key environmental factor influencing contaminant toxicity in coastal ecosystems. This study assessed how salinity modulates the sublethal effects of the reactive dye Remazol Brilliant Blue R (RBBR) [1] in *Mytilus galloprovincialis* through fifteen biochemical biomarkers and multivariate analysis. The organisms were exposed for 28 days to 0.01, 0.1, and 1.0 mg/L RBBR under two salinities (20 and 29). Low salinity (20) induced a physiological pre-stress condition characterized by reduced ETS activity, lower protein content, increased GSTs and GR activities, and proline accumulation, indicating intensified osmotic and oxidative stress. At higher dye concentrations, antioxidant defenses (TAC, CAT, GPx) were insufficient, accompanied by elevated protein carbonylation and altered AChE activity. At Salinity 29, mussels exhibited greater metabolic and antioxidant stability. CAT and GPx were induced at higher concentrations, ETS and PROT remained stable, and oxidative damage markers increased only at 1.0 mg/L, suggesting effective redox control. Principal Coordinates Analysis (PCoA) explained 59.1 % of total variance, with PCoA 1 = 40.4 **%** separating mussels by salinity and correlating with LPO, PROL, SOD, CAT, and GSTs under hyposalinity. PCoA 2 = 18.7 % captured the contaminant-driven gradient, distinguishing increasing RBBR concentrations and highlighting intensified metabolic and oxidative challenges at 1.0 mg/L, particularly at salinity 20.
In conclusion, the integrated biomarker data established that RBBR induces significant sublethal toxicity in *M. galloprovincialis*, especially under hyposaline conditions commonly found in estuarine environments. These results indicate that natural or climate-driven salinity fluctuations may intensify the ecological risks associated with reactive textile dyes in coastal ecosystems [2].

Keywords. *Reactive dyes; Oxidative stress; Detoxification enzymes; Osmoregulation; Estuarine ecotoxicology*

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Bioplastics vs. fossil plastics: cytotoxic effects in human cells

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Abstract. Nanoplastics (NPs) are emerging environmental contaminants increasingly detected in different environmental compartments. Humans may be exposed through air, food, and beverage with NPs detected in biological samples including urine and blood, as well as in tissues such as lung, liver, and brain. Scientific research has focused on pristine polystyrene nanoplastics, overlooking the wide range of polymers present in the environment [1]. Biopolymers – polymers derived from natural sources - are marketed as environmentally friendly alternatives to fossil-based plastics, however, remain poorly studied [2]. This study evaluated the effects of polyethylene terephthalate (PET), a fossil-based polymer widely used in plastic water bottles, and polyhydroxybutyrate (PHB), a bacterially produced biodegradable polymer, on two human cell lines: HepG2 (hepatocyte-like cells, used as a metabolic model) and HCT116 (intestinal epithelial cells, representing a main route of particle absorption into the body). Cells were exposed to PET (191 nm) and PHB (195 nm) at concentrations ranging from 100 to 0.0064 mg/L and 50 to 0.0032 mg/L, respectively, and assessed for cell viability at 24, 48, and 72h using MTT assay and membrane integrity with LDH assay. LDH levels remained unchanged across all conditions and time points, indicating no membrane damage or cell death. MTT results showed a decline in cell metabolism, with no progressive effect over time in both NPs. PHB nanoplastics were generally more cytotoxic than PET, with HCT116 cells being more sensitive cell line to NPs. These findings indicate that biopolymers are not innocuous and seem to be a biological risk. Ongoing work aims to further characterize the impact of these particles on overall cell function including genotoxicity.

Keywords. *Biopolymers; Nanoplastics; Cytotoxicity; Human health; Environmental impact*

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High-resolution multi-sector emission projections using big data and climate scenarios

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Abstract.
Air pollution and climate change represent the greatest environmental threats to human health, causing around seven million premature deaths annually worldwide [1], which makes accurate atmospheric emission inventories essential for estimating air quality, particularly under climate change conditions [2]. In this context, this study aims to develop a high-resolution emission inventory of the main anthropogenic sources (e.g., public power, road transport and residential sectors) in Portugal for a mid-term climate scenario (2050). To achieve this, the historical data (2020-2023) from the BigAir® [3] and BioBurn projects, as well as activity projections from the Portuguese Environment Agency (APA), were used. The historical Portuguese source locations (e.g., road network, industrial and residential building locations) and activity data (e.g., fuel consumption, and road traffic volume) were considered for spatial allocation. Additionally, a machine learning (ML) algorithm incorporating socioeconomic proxy data (i.e., gross domestic product, population, and urbanization) according to the Shared Socioeconomic Pathway 3 (SSP3-7.0), CMIP6 climate projections (e.g., temperature and precipitation), and temporal indicators was used to project activity data (e.g., road traffic volume) for the mid-term scenario at source locations (e.g., road segments). Regarding the emission factors, for road transport, the non-exhaust emissions (i.e., tyre wear, brake wear, road abrasion, and resuspension) were estimated using experimental data [4], and were adjusted for the projected zero-emission vehicle fleet. For the residential heating activities, a database from extensive testing of typical heating equipment (e.g., fireplace, and woodstove) and biomass fuels (e.g., maritime pine) in Portugal [5] was used, while for the remaining activity sources, the European Air Pollution Emission Inventory Guidebook [6] and the Intergovernmental Panel on Climate Change (IPCC) guidelines for national greenhouse gas inventories [7] were considered. The developed emission inventory was also designed for integration into a high-resolution numerical air quality modelling framework over mainland Portugal at 0.03° × 0.03° horizontal resolution. The modelling system used combines the Weather Research and Forecasting (WRF) model, driven by climate projections from the Max Planck Institute Earth System Model under the SSP3-7.0 scenario, with the Comprehensive Air Quality Model with Extensions (CAMx). The results provide insights for future air quality management, exposure assessment, and climate mitigation in Portugal's mid-term mobility transition.

Keywords. Air pollution; Shared Socioeconomic Pathway; Machine learning; Air quality modelling; Portugal

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Impacts of the co-exposure of PMMA NPs and cadmium on *Hediste diversicolor*

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Abstract. Sediments play important roles as sinks and secondary sources of pollution, accumulating contaminants, often at concentrations higher than those detected in the water column. Over the last 50 years, micro - nanoplastics (NPs) have raised increasing concern about their impact on organisms and, although polymethylmethacrylate (PMMA) is generally detected in low concentrations, it has been shown to negatively affect several species. Moreover, studies have demonstrated that animals accumulate NPs during long-term exposures. Nonetheless, limited information is available regarding the combined effects of NPs and environmental contaminants, like cadmium (Cd). Cd is a non-essential metal capable of interfering with enzymatic activities and mimicking essential metals and benthic species, like the polychaete *Hediste diversicolor*, are continuously exposed to such sediment-associated contaminants, being particularly vulnerable. Thus, this study aimed to assess the individual and combined effects of PMMA NPs and Cd in spiked sediments on *H. diversicolor*. Specimens were collected from a reference site in Ria de Aveiro and acclimated to laboratory conditions (15 days). Subsequently, worms were exposed to the following conditions for 10 days: control; 0.05 and 0.35 mg Cd/kg; 1 and 10 mg PMMA NPs/kg; 0.05 Cd+1 PMMA NPs and 0.05 Cd+10 PMMA NPs; 0.35 Cd+1 PMMA NPs and 0.35 Cd+10 PMMA NPs. At the end of the exposure, animals were selected for the behavioural and biochemical assays. Behavioural responses were not significantly affected, whereas cholinesterase activity considerably increased, particularly in co-exposures. Additionally, worms displayed significantly enhanced energy metabolism and increased sugar content, while glycogen content was depleted in mixture treatments. Reduced activity of defence-related enzymes was also observed, accompanied by cellular and protein damage, in co-exposures. Overall, these findings highlight the importance of assessing sediment-associated exposures and demonstrate the deleterious effects of contaminant co-exposure scenarios, likely driven by increased energetic demands and impaired defence responses.

Keywords. *Benthic species; Metals; PMMA NPs; Behavioral assay; Biochemical assay*

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Recent morphosedimentary evolution and benthic habitat characterization of the inner continental shelf adjacent to Aveiro

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Abstract. Monitoring the morphological evolution of the seafloor using high-resolution multibeam sonar systems is essential to understand sediment dynamics, characterize benthic habitats, and support integrated coastal zone management. Here we present the first phase of this study, which analyzes the morphological evolution of the seafloor in the northern coastal area of Aveiro, a highly hydrodynamic zone between São Jacinto and Gafanha da Boa Hora, based on multibeam bathymetric surveys provided by the Portuguese Coastal Monitoring Program (COSMO), conducted in 2018, 2019, 2020, and 2025, and covering an area of approximately 18.15 km² at 0.3 m spatial resolution. Seafloor Digital Elevation Models (DEMs) were analyzed for each survey campaign, and DEM of Difference (DoD) models were calculated between consecutive and cumulative periods to quantify sediment erosion and deposition.

The results reveal a dominant erosive trend, with alternating erosion and deposition along the coast, and the most intense sediment redistribution occurring near the inlet of the Ria de Aveiro. DoD values ranged from -9.63 m to +6.64 m over the cumulative 2018–2025 period, with the most significant inter-annual variations between 2018 and 2019 (-6.93 m to +7.08 m). For the 2020–2025 period, DoD values ranged from -8.31 m to +6.32 m; despite localized erosion at the lagoon inlet, this period showed a positive sediment budget (0.682×10^6 m³), possibly related to beach nourishment interventions in the region. Over the cumulative 2018–2025 period, a sediment deficit of approximately -1.98×10^6 m³ was calculated. The bathymetric analysis identified spatial and temporal patterns of erosion and deposition, as well as bedforms associated with the hydrodynamic regime of the region. The second phase will consist of a new multibeam campaign in 2026 covering a wider area, including backscatter analysis for benthic habitat characterization, sediment and benthic fauna sampling, high-resolution seismic reflection profiles, and in situ inspection to validate the morphodynamic evolution model.

Keywords. *multibeam bathymetry; sediment budget; DEM of difference; morphology; coastal erosion*

Acknowledgements. The authors acknowledge the support given by the Portuguese Environment Agency (Agência Portuguesa do Ambiente) and AtlanticLand Consulting for providing the datasets used in this study, acquired within the scope of the Portuguese Coastal Monitoring Program (COSMO).

Investigating isopod biodiversity patterns (crustacea: peracarida: isopoda) in the clarion-clipperton fracture zone (pacific ocean) to assess the impact of deep-sea mining.

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Abstract. In recent years, the Clarion-Clipperton Fracture Zone (CCZ) has attracted increasing scientific and socio-economic interest due to the high biodiversity, high levels of endemism in polymetallic nodule rich habitats. However, deep-sea mining activities for the extraction of these valued resources pose potential risks to benthic ecosystems, and their effects on community structure, ecosystem functioning, and recovery potential are not yet fully understood [4]. Isopods are an abundant component of deep-sea macrofauna, but current knowledge of their morphological, genetic, and functional diversity in the CCZ remains limited. This PhD project aims to a) investigate the biodiversity of isopod in the CCZ using an integrative taxonomic framework and b) examine the spatial and temporal distributions of the isopods assemblages and understand the potential impacts of deep-sea mining. Boxcore samples were collected during three oceanographic campaigns SO268 [1], IP21 [2], and SO295 [3], in two different regions of the CCZ before and after mining collector tests. The specimens are being identified using integrative taxonomy. Different biodiversity indices will be applied and a non-metric, multidimensional scaling approach will be used to assess the impact of a nodule collector. Morphological identification already revealed 12 families and 32 genera. Nannoniscidae and Desmosomatidae showed the greatest richness and abundance, while Gnathiidae showed the lowest. Most of the identified species are potentially new to science and will be formally described after molecular analysis. The results of this study will contribute to evidence-based decision-making for the conservation and management of deep-sea ecosystems.

Keywords. *Integrative Taxonomy, Resilience, Environmental Disturbance, Eastern tropical Pacific.*

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Isolation and Characterization of Novel Lytic Bacteriophages for the Biocontrol of *Pseudomonas* Spoilage in Sodium-Reduced Cheeses

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Abstract. The dairy industry's shift towards sodium-reduced cheeses can negatively affect the quality and safety of the final product, favoring psychrotrophic spoilage bacteria such as *Pseudomonas lundensis* and *Pseudomonas taetrolens*. To address this challenge, this study aimed to isolate and characterize strictly lytic bacteriophages capable of controlling these specific spoilage bacteria in sodium-reduced dairy environments. Three bacteriophages (C7GGH, AR2_7H, and AR1_8) were isolated from cheese factory environments and characterized through host range analysis against 84 bacterial strains, adsorption kinetics, *in vitro* bacterial inactivation assays, and whole-genome sequencing. Additionally, their stability under dairy-relevant temperature, pH, and salinity conditions was evaluated. Phages C7GGH and AR2_7H exhibited narrow specificity for *P. lundensis*, whereas AR1_8 exclusively infected *P. taetrolens*. *In vitro* application resulted in rapid and significant reductions in bacterial counts of up to 7 log colony-forming units per milliliter during the first 12 hours of infection. Furthermore, all phages demonstrated remarkable halotolerance to increasing sodium chloride and potassium chloride concentrations (up to 18%), high thermal tolerance (4 - 25 °C), and pH stability (5-7). Genomic analysis confirmed the absence of known virulence factors and antimicrobial resistance genes. These findings show that the isolated phages are safe and effective targeted biocontrol agents for sodium-reduced raw-milk cheeses, thereby supporting sodium-reduction strategies without compromising food safety, quality, or economic viability.

Keywords. Phage therapy, Psychrotrophic bacteria, Whole-genome sequencing, Halotolerance, Food preservation

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An integrated urban environmental comfort framework for evidence-based policy

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Abstract
Thermal indices have traditionally dominated Urban Environmental Comfort (UEC) research. It simplifies a complex human experience into a single physical parameter that planners cannot effectively govern [1].
This abstract presents recent advances in ongoing doctoral research aiming to challenge this reductionist approach and to provide an evidence-based framework adapted to planning practices [2]. The research is based on a systematic literature review of 153 peer-reviewed studies (Scopus, 2014-2022). It employs causal loop analysis [3] to determine the main drivers of environmental comfort in urban environments. The results consistently rank the socio-economic and spatial elements of comfort higher than thermal conditions. The level of activity in urban spaces was represented in 91% of the analyzed loops, followed by public perception and thermal preferences at 87% and human-social factors at 86%. Nonetheless, these critical factors are predominantly missing from most current planning guidance.
The integration of these findings into a system dynamics-informed Drivers-Pressures-State-Impact-Response (SD-DPSIR) framework [4], [5] divides UEC into three controllable subsystems: spatial morpho-functionality, human-social dynamics, and air quality-soundscape. This framework redefines thermal comfort as an external, exogenous driver. This change in concept has important policy implications. It moves planning interventions towards variables that can be regulated by municipalities, such as mixed-use zoning, networks for active mobility, distribution of public spaces, and management of the soundscape-air quality.
The present research focus is on translating this framework into a Composite Urban Environmental Comfort Index (CUECI) for evidence-based policy benchmarking. This work directly addresses the summit theme by transforming solid, peer-reviewed evidence into usable planning tools that improve comfort, vitality, and environmental quality in urban areas.

Keywords. *Urban Environmental Comfort (UEC), Evidence-Based Urban Policy, System Dynamics and DPSIR Framework, Socio-Spatial Urban Planning, Composite Urban Comfort Index (CUECI)*

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PMF-resolved metal-rich sources drive acute PM_{10} ecotoxicity in Luanda, Angola

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Abstract

African megacities remain underrepresented in source-resolved evaluations of particulate matter toxic potency, even as urbanisation and population size continue to grow rapidly. This study linked acute ecotoxicity of atmospheric particulate matter lower than 10 µm (PM_{10}) with Posisitive Matriz Factorisation (PMF)-resolved sources and selected elemental markers in Luanda, Angola. A total of 116 daily PM_{10} samples collected from 27 June to 5 November 2023 were analysed for water-soluble inorganic ions, anhydrosugars/polyols, organic and elemental carbon, and major and trace elements by IC, HPAEC-PAD, thermal–optical analysis, ICP-OES and ICP-MS, respectively. Aqueous PM_{10} extracts were assessed using the Microtox® *Aliivibrio fischeri* assay, with responses expressed as Toxic Units at 15 min of exposure (TU_{15}) and as ΔTU ($TU_{15} – TU_5$). Daily source apportionment was performed with the U.S. EPA PMF model. PMF reproduced PM_{10} mass well (R^2 = 0.95; RMSE = 3.95 µg m^{-3}) and resolved six sources: traffic (37.6%), crustal/resuspended dust (16.5%), secondary aerosol mixed with biomass burning (15.5%), marine aerosol (13.1%), non-ferrous metallurgy plus galvanised/metal scrap handling and burning (10.8%), and a Ni-rich metallurgical source with possible aviation influence (6.4%). Toxicity was moderate but variable, with TU_{15} = 0.84–8.54 and ΔTU = -1.51 to +4.84. Only three samples showed $TU_{15} < 1$, and none reached $TU_{15} \geq 10$. The strongest ecotoxic signal was associated with metal-rich sources. The non-ferrous/galvanised scrap factor correlated most strongly with TU_{15} (ρ = 0.63) and ΔTU (ρ = 0.78), followed by the Ni-rich metallurgical factor (ρTU_{15} = 0.51). Elemental screening supported this interpretation, with Cd, Pb and Zn strongly correlated with TU_{15} (ρ = 0.81, 0.76 and 0.65) and ΔTU (ρ = 0.72–0.76). Conversely, marine aerosol was negatively associated with both endpoints. These results suggest that PM_{10} ecotoxicity in Luanda was less driven by particle mass alone than by metal-rich source mixtures, highlighting metallurgical and scrap-related activities as priority targets for source-oriented mitigation.

Keywords

PM_{10}; Microtox; *Aliivibrio fischeri*; source apportionment; trace metals; Luanda.

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Co-creation of public policies for soil education: a participatory approach in national workshops of the CURIOSOIL project in Portugal

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Abstract. Soil literacy is increasingly recognised as fundamental to sustainability transitions, yet its systematic integration into formal education remains limited across European curricula. This study presents a structured participatory process designed to translate empirical diagnostic evidence on soil education gaps into actionable public policy recommendations, engaging key stakeholders from the Portuguese educational sector. Within the CURIOSOIL project framework, a diagnostic document was co-produced through consultation with teachers, educators, policymakers, and civil society representatives, mapping soil-related content across the national curriculum, relevant legislation, and identified structural gaps. This document informed two national hybrid-format workshops held at the University of Aveiro, attended by a total of 40 participants representing 6 stakeholder categories across 7 regions of Portugal. The hybrid modality ensured geographic inclusivity. Using a structured facilitation method focused on collaborative problem mapping, participants mapped the educational landscape, identifying key challenges and opportunities, and co-formulated specific recommendations. This yielded two distinct sets of stakeholder-owned proposals: for higher education, recommendations centred on interdisciplinary curricular integration, the inclusion of field-based learning, and the development of modular guidance or training to support the integration of soil-related topics across programmes; for basic and secondary education, proposals focused on a national soil literacy awareness campaign, a certified teacher training course, and the embedding of hands-on soil activities in curricula. The study demonstrates that sequential co-production, combining diagnostic analysis with facilitated hybrid deliberation, yields contextualised, operationally feasible policy recommendations. It provides a concrete methodological contribution to the literature on participatory science–policy interfaces. Limitations include potential self-selection bias and the non-binding nature of outputs. Consolidated recommendations will be formalised into a policy brief for the Portuguese CURIOSOIL National Conference in 2027.

Keywords. *Soil literacy; Participatory diagnosis; Hybrid workshop; Science–policy interface; Soil health*

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A composite sustainability index (CSI) for the bicycle industry

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Abstract. The bicycle industry plays a significant role in sustainable urban mobility and climate change mitigation. However, no established framework integrates its environmental, social, and economic sustainability dimensions whilst accounting for externalities through monetary valuation. This gap limits the sector's capacity to measure performance and substantiate its societal value. This study addresses that gap by proposing a Composite Sustainability Index (CSI) as an integrated sustainability indicator for bicycle and component manufacturing, grounded in internationally recognised sustainability reporting frameworks widely adopted by industry. The CSI framework produced two complementary outputs: a performance score aggregating normalised indicators across environmental, social, and economic and governance dimensions; and a Net Externality Impact (NEI), expressed in €/unit produced, that monetises both negative externalities from production and positive externalities from product use. This second component represents the framework's key novelty, as existing sustainability indices rarely account for externalities in monetary terms, whether the environmental and social costs incurred during production or the broader societal benefits generated through product use, such as public health gains, modal shift, and congestion reduction. To support practical implementation, a sustainability performance tool was developed in Excel and web formats, enabling automated calculation, scenario analysis, and temporal tracking. The tool is currently being validated through a case study with bicycle manufacturers and component producers in Portugal. Upon validation, the CSI framework will provide the bicycle industry with a science-based instrument to measure performance, substantiate its societal contribution, and support evidence-based decision-making at both organisational and policy levels.

Keywords. *Sustainability assessment; Indicators; Externalities; Costs; Performance tool*

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Comparative Analysis of drying methods on the lipid profile and nutritional value of *Atriplex portulacoides* and *Salicornia ramosissima*

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Halophytes are increasingly recognized for their resilience and nutritional value, particularly as sources of essential fatty acids (FA) and bioactive compounds, being looked as functional foods [1,2]. These plants can be consumed fresh, but they can also be consumed dried to extend their shelf life and facilitate commercialization, meeting the growing consumer interest. The influence of post-harvest processing on halophyte lipids and nutrition properties remains limited. To address this gap, this study investigated the effects of freeze-drying (−55 °C), oven-drying (60 °C), and sun-drying (17–27 °C) on the lipid composition of *Salicornia ramosissima* and *Atriplex portulacoides*, two edible halophytes with recognized nutritional potential. Lipid analysis was performed using GC–MS and LC–MS/MS for FA and lipidome characterization, respectively. Total lipid content remained unaffected by the different drying methods, however, oven- and sun-drying promoted a significant reduction in esterified FA, particularly FA 18:3 *n-3* and FA 16:0, compared to freeze-drying. This effect was more pronounced under sun-drying conditions, suggesting increased lipase activity processes during drying. Despite this, total FA composition remained relatively stable, indicating lipid hydrolysis rather than extensive oxidative degradation was the predominant process.

Overall, around 270 lipid species were identified in both halophytes, including glycerophospholipids, glycolipids, acylglycerols, sphingolipids, sterol lipids, and prenol lipids. Drying treatments promoted a decrease in the membrane phospholipids, particularly phosphatidylcholine and phosphatidylethanolamine, accompanied by increased levels of lysophospholipids, supporting phospholipid hydrolysis. In addition, ceramides, triacylglycerols, and diacylglycerols increased following drying treatments. Among the tested drying methods, sun-drying induced the most pronounced lipidomic changes, followed by oven-drying.

This study provides an overview of the impact of post-harvest drying on halophyte lipid composition, showing that processing methods significantly modulate their lipidome and may consequently influence their nutritional and functional properties. These findings highlight the importance of selecting appropriate drying strategies to balance processing efficiency with the preservation of lipid quality in halophyte-based foods.

Keywords: Halophytes, lipids, drying methods, mass spectrometry, lipidomics

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Production of H_2- and CO-rich gas from RDF and biomass gasification in a bubbling fluidized bed reactor

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Abstract. The transition toward low-carbon energy systems requires flexible thermochemical routes for converting heterogeneous solid residues into valuable gaseous products. This study investigated the production of hydrogen- and carbon monoxide-rich gas from refuse-derived fuel and biomass through gasification in a bubbling fluidized bed reactor. The work focused on evaluating the influence of gasifying agent and feedstock composition on product gas quality. Air gasification and steam gasification were examined under selected operating conditions, while mixtures of refuse-derived fuel and biomass were also considered as a relevant pathway for improving process flexibility and gas composition. The results showed that the use of air produced a combustible gas with hydrogen and carbon monoxide concentrations within the range of 3.3-9.0 vol.% and 5.8-18.2 vol.%, respectively. Steam gasification promoted higher hydrogen formation, with hydrogen and carbon monoxide concentrations in the range of 25.3-49.4 vol.% and 8.8-32.0 vol.%, respectively. The co-gasification of refuse-derived fuel and biomass demonstrated additional potential, as the interaction between the two feedstocks affected gas composition and conversion behavior. Overall, the findings indicated that both the choice of gasifying agent and the chemical and physical properties of the feedstock played a direct role in determining the quality of the produced gas. These results support further optimization of bubbling fluidized bed gasification for sustainable production of H_2- and CO-rich gas from waste-derived and renewable feedstocks.

Keywords: *Co-gasification; Syngas; Hydrogen production; Waste valorization; Feedstock variability*

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Title: Organic PM_{10} Extracts Modulate Macrophage Viability and Phagocytic Activity in RAW264.7 Cells

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Abstract

Particulate matter (PM) pollution represents a major public health concern due to its association with respiratory and cardiovascular diseases. Particles with an aerodynamic diameter lower than 10 μm (PM_{10}) can penetrate the respiratory tract, while their finer fractions may reach the alveolar region and potentially enter the bloodstream, contributing to systemic adverse effects. Luanda, a highly polluted urban environment, is characterized by PM concentrations that frequently exceed the World Health Organisation daily guideline values, highlighting the need to better understand the biological mechanisms underlying PM-induced toxicity [1,2]. Macrophages play a critical role in pulmonary defence through the recognition and clearance of inhaled particles. However, exposure to airborne PM_{10} may alter macrophage function and affect innate immune responses. In this study, RAW264.7 cells were exposed to organic extracts from PM_{10} collected in Luanda. Viability was initially assessed by the MTT assay to determine sub-cytotoxic concentrations (IC20) for subsequent functional studies. The effects of organic PM_{10} extracts on macrophage phagocytic activity were evaluated after exposure to IC20 for 24 h. Phagocytosis was assessed using fluorescein-labelled *Escherichia coli* BioParticles. Exposure to most samples increased phagocytosis capacity on macrophages suggesting that organic PM_{10} extracts may stimulate macrophage activation and particle uptake. Overall, both the cell viability and the phagocytoses evaluation results demonstrate that organic components of PM_{10} can differentially affect macrophage behaviour, potentially influencing pulmonary immune defence mechanisms. The variability observed among extracts likely reflects differences in chemical composition and associated inflammatory or oxidative stress responses. This research aims to provide a mechanistic understanding of PM toxicity in Luanda, offering insights to support public health interventions and pollution mitigation strategies.

Keywords: Luanda; PM_{10}; macrophages; cell viability; phagocytosis.

Acknowledgements

Artificial light at night (ALAN) induces biochemical and behavioural alterations during early zebrafish development

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Abstract.
Artificial light at night (ALAN) is an emerging pollutant in urban aquatic ecosystems [1], with increasing evidence suggesting its potential to disrupt circadian-regulated physiological processes in aquatic organisms [2]. However, its effects during early vertebrate development remain poorly understood. This study evaluated the effects of environmentally relevant ALAN intensities on developmental, biochemical, and behavioural endpoints in *Danio rerio* embryos and larvae. Two independent 120 h exposures were conducted under controlled laboratory conditions based on OECD Test Guideline 236, with adaptations to incorporate nocturnal light exposure regimes. Embryos were exposed to three light conditions during nighttime: 0 lux (control), 1 lux, and 10 lux keeping daytime light levels constant. The first assay assessed mortality, hatching success, and morphological abnormalities. The second assay focused on sublethal responses, including biomarkers of neurotoxicity (acetylcholinesterase activity, AChE), oxidative stress (catalase activity, CAT), and energy metabolism (lactate dehydrogenase activity, LDH), together with larval swimming behaviour. No significant differences were observed in mortality, hatching rate, or malformation frequency between treatments. In contrast, exposure to ALAN significantly inhibited AChE, CAT, and LDH activities in both ALAN treatments compared to the control, indicating neurophysiological and metabolic disruption. Behavioural analysis further revealed a significant decrease in swimming distance and locomotor activity in exposed larvae, with stronger effects observed under 10 lux exposure, suggesting a ALAN-intensity-dependent response. Overall, these findings demonstrate that ALAN can induce significant sublethal alterations during early zebrafish development, even in the absence of overt developmental toxicity. The integration of biochemical and behavioural endpoints highlights the sensitivity of these markers for detecting light pollution-induced stress and reinforces the need to consider ALAN within ecotoxicological risk assessment frameworks for freshwater ecosystems.

Keywords. *Light Pollution; Biochemical markers; Fish larvae behaviour; Zebra fish*

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Chemical characterization of respirable urban road dust and its potential biological effects

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Abstract. According to the European Union Air Quality Directive (2008/50/EC), one of the most hazardous components of urban air pollution is PM_{10}. Particles in this size range can enter the lungs and cause severe respiratory as well as cardiovascular diseases due to their large specific surface area and high reactivity [2] but also their chemical components. The contribution of resuspended urban aerosol to the atmospheric PM_{10} mass concentration can account for up to 30%, as particles previously deposited on road surfaces can be easily resuspended [1]. We aimed to investigate the biological effects of the inhalable fraction of dust samples collected from road surfaces in the vicinity of construction and demolition sites (at distances of 50–300 meters) using a human lung (BEAS-2B) cell line. To perform the biological tests, each sample was tested at three concentrations (50, 150, and 300 μg mL^{-1}). The ratio of live to dead cells was determined by flow cytometry using a combination of propidium iodide and Hoechst 33342 fluorescent dyes; cell viability was assessed using the MTT assay; genotoxic effects were assessed using the alkaline Comet assay. The elemental composition was determined by TXRF, the ratio of organic and elemental carbon (OC/EC) will be analyzed by thermo-optically. The concentrations of water-soluble ions will be determined by ion chromatography, and the oxidative potential of samples will be assessed using ascorbic acid (AA) and dithiothreitol (DDT) assays. We observed a dose-response relationship and identified a biologically relevant difference between the viability of the treated and untreated cells. Furthermore, we highlighted the critical trend that samples collected along busier road sections may pose an increased health risk due to combined effects of sources (construction and traffic). The results clearly confirm the significant health risks associated with the inhalation of resuspended road dust highlighting the importance of this issue.

Keywords: *resuspended urban dust, PM10, cytotoxicity, genotoxicity*

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From Evidence to Action: Climate Justice and Adaptation Policies to Coastal Risks in Portugal

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Abstract. In a context of escalating climate change, translating scientific knowledge into effective public policies constitutes a critical challenge. The Portuguese coastline illustrates this urgency, having been severely battered by successive coastal storms in the first months of 2026, causing significant damage to coastal defence structures and beach infrastructure across the region. Given the direct physical impacts of these events and their unequal distribution across social groups, the following question arises: to what extent do local risk management policies integrate evidence of socio-spatial vulnerabilities and the principles of climate justice? This study analyses the intersection between science, policy, and impact in the governance of coastal risks in the municipality of Ovar. Considering the distributive, procedural, and recognition dimensions, the objective is to evaluate the adequacy of institutional strategies in relation to the real vulnerability of the affected communities. To generate actionable evidence, a mixed-methods approach is adopted, combining: (i) documentary analysis of territorial planning and civil protection policies; (ii) spatial characterization and modeling of risk and vulnerability in the most exposed coastal areas, Esmoriz, Cortegaça, and Furadouro; and (iii) empirical evaluation of the lived impact, gathering local population perceptions regarding institutional responses and the historical memory of extreme events and interventions. The results demonstrate a significant gap between territorial evidence and planning, showing that areas with higher social and biophysical vulnerability exhibit lower levels of protection and recovery. Furthermore, current local governance policies reflect limited integration of climate justice principles and remain anchored in poorly inclusive participatory processes. It is concluded that adaptation remains centred on techno-structural solutions while neglecting the social dimension of risk. To effectively transition from evidence to action, a structural reconfiguration of governance models is imperative. Future mitigation strategies must rely on holistic scientific knowledge to ensure equitable, inclusive policy interventions that mitigate socio-environmental impacts on the territory.

Keywords: scientific evidence; public policies; socio-environmental impact; climate justice; coastal risks; coastal storms.

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From willingness to pay to willingness to act: bridging governance gaps in deep-sea restoration

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Abstract. Deep-sea ecosystems provide critical services to society, yet restoration science and governance remain underdeveloped compared with coastal systems. Focusing on the Condor Seamount, at depths between 185 and 2000 m in the Azores, Portugal, this study combines a nationwide contingent valuation survey with a governance arrangement analysis to assess whether public support and institutional structures align with the implementation of deep-sea restoration under the EU Nature Restoration Regulation (NRR). The contingent valuation survey, conducted with 750 adult residents in Portugal, introduced deep-sea coral and sponge habitats, anthropogenic pressures, and a national restoration programme including a 100 ha pilot site at Condor. Respondents were asked whether they would pay an earmarked tax of 10, 50, or 150 euros annually over ten years to finance the programme. Socioeconomic and statistical analyses identified the marine benefits most valued by citizens and their willingness-to-pay levels. The governance analysis draws on 17 stakeholder interviews involving scientists, NGOs, fisheries representatives, regional and national authorities, and philanthropic actors. It examined discourses, actor coalitions, institutional rules, and resources shaping restoration efforts at Condor. Results reveal strong public support: 81% of respondents agreed that deep-sea ecosystems should be preserved or restored, and most were willing to contribute financially at lower and intermediate tax levels. Motivations included biodiversity conservation, natural heritage, climate regulation, and moral responsibility. However, affordability concerns and expectations that restoration should be financed through existing public budgets explained many negative responses. In contrast, governance arrangements remain dominated by conservation-oriented, science-led coalitions prioritising marine protected areas, fisheries closures, and monitoring, while active restoration is treated as experimental and politically sensitive. Fragmented competences, limited funding, and the absence of clear leadership constrain the expansion of initiatives such as REDRESS coral transplantation. The findings reveal a mismatch between public willingness to support restoration and governance structures focused on protection approaches.

Keywords. *Condor Seamount; Governance Arrangement; Contingent valuation; Nature Restoration Regulation.*

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Combined effects of bisphenol A and lithium on biochemical and behavioral responses in the estuarine polychaete *Hediste diversicolor*

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Abstract. Increasing inputs of emerging contaminants into estuarine environments raise concerns regarding their combined effects on benthic organisms. Among these, bisphenol A (BPA), a widely used plastic additive, and lithium (Li), an element of increasing environmental concern associated with battery use, are likely to co-occur in aquatic systems. However, their combined toxicity remains poorly understood. Benthic organisms, such as polychaetes, are particularly vulnerable to sediment contamination and are widely used as ecotoxicological models. This study evaluated the single and combined effects of sediment spiked with BPA and Li on biochemical and behavioral responses of *Hediste diversicolor*.

Organisms were collected and, after a 15-day acclimation, exposed to BPA (5 and 45 µg/kg), Li (12.5 mg/kg), and their mixtures for 14 days under controlled laboratory conditions. Burrowing behavior and biomarkers of antioxidant defense (catalase, CAT; glutathione S-transferases, GSTs), metabolism (glycogen, GLY), neurotoxicity (acetylcholinesterase, AChE), and oxidative damage (protein carbonylation, PC) were analyzed. Burrowing data indicated that polychaetes took longer to burrow at 12.5 mg/kg Li, whereas reduced burrowing time was observed at 45 µg/kg BPA, suggesting potential impacts on sediment reworking and ecosystem functioning. Combined exposure decreased CAT activity and increased GSTs activity in the mixture treatments, indicating impairment of antioxidant defenses and activation of detoxification pathways. GLY levels decreased under BPA exposure, especially in mixture treatments, suggesting increased metabolic demand under contaminant exposure. Increased PC levels, particularly in organisms exposed to 12.5 mg/kg Li + 5 µg/kg BPA, indicate enhanced oxidative damage, while AChE activity was significantly increased at 12.5 mg/kg Li + 45 µg/kg BPA.

Overall, these findings demonstrate that co-exposure to BPA and Li can disrupt antioxidant, metabolic, neurotoxic, and behavioral endpoints in estuarine polychaetes, emphasizing the importance of considering contaminant mixtures in ecotoxicological risk assessment.

Keywords. *Emerging contaminants; Mixture toxicity; Biochemical markers; Behavioral responses; Benthic organisms*

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Improving dry deposition modelling in mediterranean ecosystems: sensitivity analysis and stomatal parameterisation at castelporziano

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Abstract. Accurate simulation of dry deposition is essential for air quality and ecosystem assessments, particularly in drought-prone Mediterranean regions. Chemistry Transport Models (CTMs) often rely on deposition schemes developed for temperate climates, increasing uncertainty due to differences in vegetation characteristics and stomatal behaviour [1].
This study evaluates modelled dry deposition fluxes against in-situ ozone flux measurements collected between 2012 and 2020 at Castelporziano, a Mediterranean evergreen forest near Rome, Italy. Dry deposition was calculated using the DEPAC-1D module, and sensitivity analyses were conducted for the three main deposition pathways: stomatal, soil and cuticular uptake [2]. Results indicate that stomatal deposition exerts the strongest control on modelled fluxes, while soil and cuticular pathways play a secondary role. Stomatal conductance parameters were updated using literature values representative of Mediterranean evergreen forests, and a new phenology parameterisation was introduced. In addition, an updated cuticular resistance parameterisation was implemented, improving the representation of seasonal variability, drought stress and photo-oxidative stress [3, 4].
These changes substantially improved agreement with observations. For 2013, the default DEPAC-1D configuration underestimated annual mean ozone fluxes by 41% and daytime values by 30%. After the updates, the annual mean bias was reduced to 17%, while daytime fluxes showed a slight overestimation of 7%.
The improved parameterisations were subsequently implemented in LOTOS-EUROS, resulting in higher effective deposition velocities and reductions exceeding 10% in daily maximum 8-hour ozone concentrations across parts of the Mediterranean basin. Overall, the results highlight the importance of region-specific deposition schemes for reliable air quality and ecosystem impact assessments in Mediterranean climates.

Keywords. *Ozone; Chemistry transport model; LOTOS-EUROS; DEPAC-1D*

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Deep learning detection of *Pinus pinaster* seedlings from UAS multispectral point clouds

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Abstract. Early detection and quantification of tree seedling establishment are essential for monitoring regeneration success in coastal dune plantations, where conventional field-based assessments are labour-intensive and spatially constrained. This study presents a deep learning framework for the detection of Pinus pinaster seedlings using multispectral unmanned aerial system (UAS)-derived point clouds. Field data collection occurred in a coastal dune plantation in Matas Nacionais de Quiaios, and included the georeferenced survey of approximately 1,500 seedlings, with individual measurements of crown diameter, height, and health condition, supported by high-precision GNSS positioning and field photographic records.

Multispectral imagery was acquired using a DJI Mavic 3 Multispectral platform and processed through a structure-from-motion workflow to generate radiometrically calibrated dense point clouds and digital terrain models. Training data preparation combined spectral thresholding, object-centred buffers, and manual refinement to isolate seedling-related points from surrounding dune vegetation. Deep learning model training was conducted in ArcGIS Pro using the Point Transformer V3 architecture, integrating multispectral information and relative height attributes derived from the terrain model. Model performance was evaluated through an object-level methodology based on the number of classified seedling points retrieved within field-mapped buffers.

Initial model training achieved an 88% recall, demonstrating strong capability for seedling detection across heterogeneous coastal vegetation conditions. Subsequent retraining and targeted refinement reduced false positive detections associated with shrub vegetation while maintaining high detection performance, resulting in a refined recall of 84%. Results demonstrate that multispectral point cloud classification using a transformer-based architecture provides an effective and scalable approach for monitoring early-stage forest regeneration. The proposed workflow highlights the operational potential of integrating UAS photogrammetry, multispectral sensing, and deep learning within reproducible GIS-based environments for precision forestry applications.

Keywords. *UAS-based monitoring; Multispectral point clouds; Seedling detection; Pinus pinaster; Point Transformer V3; Deep learning*

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On the remote tracking of shorebird behavior: characterizing the functional roles of different habitats for shorebirds

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Abstract. Global environmental change is rapidly affecting ecosystem structure through widespread habitat loss and degradation. Wetlands are among the most threatened ecosystems due to increasing anthropogenic pressures and development. Many migratory birds depend on wetland networks during their annual cycle, especially in the non-breeding period, making habitat loss a major concern for their populations. Since 1970, nearly 22% of global wetland areas have disappeared, alongside documented declines in several shorebird species. Understanding how migratory shorebirds use and depend on different habitats during the non-breeding season is therefore crucial for developing effective conservation strategies.

This project aims to investigate how migratory shorebirds use their non-breeding landscape across intertidal habitats, with a particular focus on the functional roles of these habitats. The study will be conducted in Ria de Aveiro, Portugal, an important coastal habitat system supporting diverse shorebird assemblages. This research will provide a comprehensive understanding of how resource distribution, behavior, and habitat use are interconnected by integrating approaches from various biological disciplines.

First, the spatial distribution of macrozoobenthic communities will be quantified across intertidal habitats, along with sediment characteristics. These data will be used to classify and map intertidal sub-habitats using satellite imagery and remote sensing. Second, shorebird assemblages and foraging behavior will be assessed across these habitats to determine whether prey distribution influences shorebird distribution, intake rates, and prey selection. Finally, high-resolution GPS and accelerometer data will be used to examine how different shorebird species use space and habitats across tidal, circadian, and seasonal periods, allowing the identification of habitat-specific behavioral functions across this axis of variation, such as foraging and roosting.

This study combines benthic prey distribution, feeding ecology, and movement patterns to understand how migratory shorebirds use coastal habitats across space and time. The findings will improve understanding of habitat use and support conservation of shorebirds in rapidly changing coastal ecosystems.

Keywords. Migratory Shorebirds; Macrozoobenthos; Foraging Ecology; Remote Sensing; Human-Managed Wetlands; GPS Tracking

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Light pollution in urban aquatic ecosystems: biological impacts and scientific challenges

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Abstract. Natural environments are constantly changing as a result of anthropogenic pressures, that pose new challenges for the ecosystem functioning. Light pollution (or artificial light at night - ALAN) is an emergent stressor that is rapidly growing with urbanisation and electrification, with sky brightness increasing annually [1]. This trend is expected to continue due to the growing use of light-emitting diodes (LEDs), as they are an efficient and affordable lighting option. Traditionally, human settlements are located near water bodies, therefore urban freshwater ecosystems are constantly exposed to high levels of nocturnal illumination, coming from streetlights, buildings, advertisements, etc. [1]. Contrary to what would be expected, effects of ALAN on freshwater ecosystems and invertebrates remain understudied comparatively to marine, estuarine, and terrestrial systems [2]. By breaking natural darkness patterns, ALAN disrupts circadian rhythms, eliciting many physiological and behavioural changes [3]. This work addresses our current knowledge on the effects of ALAN on biochemical, behavioural, and reproductive responses of different freshwater invertebrates. Using laboratory assays and testing ecologically relevant levels of ALAN (1 and 10 lux), we observed common responses in different organisms such as oxidative stress and damage, and changes in metabolic activities. Interestingly, ALAN disrupted feeding and respiratory rates, and impaired reproductive output in most organisms tested. Substantial research on the ecological effects of ALAN remains necessary. For example, while common effects are suggested from these single-species assays, future studies should prioritize community- and ecosystem- level effects, such as food web dynamics. Long-term studies and interaction with other biotic and chemical stressors, and even how light spectrum can change ALAN impacts should also be considered. Improving our understanding of ALAN should support the development of mitigation strategies, to help protect aquatic ecosystems which are hotspots of biodiversity in our cities.

Keywords. *Artificial light at night (ALAN); Urbanisation; Freshwater organisms; Physiology; Behaviour*

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Carbon-First pyrolysis platform for high stability biochar and verifiable carbon removal

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Abstract: Durable carbon removal requires pathways that maximize long-term carbon stability while remaining verifiable and regionally adaptable. Carbon-first pyrolysis, designed to prioritize stable carbon formation over energy products, offers strong potential for regions such as East Africa, where biomass residues are abundant but underutilized. Yet the field lacks an integrated framework linking feedstock chemistry, reactor operation, permanence science, and practical monitoring systems suited to developing-country contexts.

This research develops a unified carbon-first pyrolysis platform that advances three contributions. First, it establishes an optimization framework quantifying how feedstock composition, temperature, residence time, and reactor configuration influence carbon yield, aromaticity, and stability. Experimental characterization and modeling map the mechanistic pathways, aromatic clustering, condensation, and microbial resistance that govern permanence.

Second, it designs a field-ready MRV architecture using accessible technologies such as low-cost sensors, mobile data capture, geotagged sampling, and cloud computing platforms. The system integrates reactor telemetry, batch-level mass balance, biochar characterization, and application-site verification to meet carbon standards requirements in a way that is practical for small and medium-sized operators.

Third, it constructs a permanence-focused carbon accounting model that links reactor-level retention to post-application decay kinetics under East African soil and climate conditions, generating defensible permanence factors for carbon crediting and policy use.

Together, these contributions provide a scientifically rigorous and regionally grounded blueprint for deploying carbon-first pyrolysis as a scalable, verifiable carbon-removal pathway in the Global South.

Keywords: carbon-first pyrolysis, biochar permanence, carbon accounting, MRV, Global South. biomass residues, carbon removal, East Africa.

Across deep Atlantic cold-water coral mounds: a comparative assessment of megabenthic communities

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Abstract. Cold-water corals (CWCs) create structurally complex habitats widely recognized as Vulnerable Marine Ecosystems (VMEs) and support diverse faunal communities. In particular, scleractinian species form reef structures that can develop into large coral mounds over geological timescales. Image- and sampling-based studies along Atlantic margins highlight that these habitats support diverse megabenthic communities by enhanced food availability, diversity of attachment surfaces, refuge and nursery areas. However, research has largely focused on framework-forming scleractinians, while associated megabenthic assemblages remain understudied, particularly outside the NE Atlantic, limiting basin-scale understanding. This work focus on characterizing megabenthos composition, richness, abundance, and environmental variables across three areas: Angola Margin (SE Atlantic), Campeche Bank (NW Atlantic), and Porcupine Seabight (NE Atlantic). A total of 15 ROV dives in CWC mounds were analysed using a two-step workflow: imagery screening to identify morphospecies, followed by annotation of video frames to quantify organisms along transects. A total of 732 morphospecies were recorded. The Angola Margin showed the highest richness (314), followed by Campeche Bank (240) and Porcupine Seabight (206), likely reflecting higher imagery resolution. Porifera and Cnidaria were the most represented phyla, though their contributions varied. Morphological (CATAMI) and trait-based classifications revealed diverse sponge growth forms and branching cnidarians contributing to habitat complexity beyond scleractinians. Quantitative annotations are currently complete for the Angola Margin, comprising 36,078 organisms, dominated by cnidarians (44%) and sponges (43%). Hierarchical clustering showed reef-forming corals, particularly *Desmophyllum pertusum*, associated with specific sponge and octocoral morphospecies, defining recurrent assemblages. Quantitative analyses for the Campeche Bank and Porcupine Seabight are ongoing, and preliminary observations indicate variation in structuring taxa. *Desmophyllum pertusum* and *Madrepora oculata* occur in Angola and Porcupine Seabight, while Campeche Bank is dominated by *D. pertusum*, with *Enallopsammia profunda* unique to this site. Substrate differences include widespread coral rubble and soft sediments, and extensive dead sponge frameworks in Angola.

Keywords. *Cold-water corals; Megabenthos; Atlantic Margin; ROV imagery; Deep sea*

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Chain length–dependent toxicity of long-chain PFAS in the mussel *Mytilus galloprovincialis*: biochemical, physiological, and histopathological responses

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Abstract. Long-chain per- and polyfluoroalkyl substances (PFAS) are highly persistent and bioaccumulative contaminants in marine environments[1,2], yet their chain length–dependent toxicity in bivalves remains insufficiently understood. [3] This study evaluated the biochemical, physiological, and histopathological effects of four long-chain PFAS (PFUnDA, PFDoA, PFTriDA, and PFTeDA) in the mussel *Mytilus galloprovincialis*, aiming to determine whether increasing carbon chain length enhances organismal stress. Mussels were exposed to individual PFAS at 1, 10, and 100 ng/L, and metabolic, oxidative stress, detoxification, neurotoxicity, physiological, and histopathological biomarkers were integrated using the Integrated Biomarker Response (IBR) index. The longest-chain PFAS (PFTriDA and PFTeDA) induced pronounced metabolic activation, evidenced by increased electron transport system activity and respiration rate, alongside higher protein and lipid reserves and carbohydrate depletion, indicating elevated aerobic metabolism and energetic costs. Antioxidant defenses and total antioxidant capacity increased simultaneously with lipid peroxidation, suggesting oxidative damage exceeded defense efficiency. Biotransformation enzymes showed compound-specific responses, with stronger activation under PFDoA and limited induction under longer-chain PFAS, indicating constrained detoxification under high oxidative stress. Acetylcholinesterase inhibition across all treatments suggested neurotoxic impairment. Histopathological analyses corroborated biochemical responses, with gills and digestive gland displaying the highest lesion indices under longer-chain PFAS exposure, including digestive tubule atrophy, connective tissue fibrosis, vascular enlargement, and brown cell aggregates. Kidney lipofuscin accumulation and neural tissue necrosis also increased with PFAS chain length, while gonadal and adipogranular indices remained unaffected. Overall, PFAS toxicity was strongly dependent on carbon chain length, with PFTriDA and PFTeDA emerging as the most disruptive compounds. This study contributes to the research scope of the Doctoral Programme in Biology and Ecology of Global Changes by advancing knowledge on the ecological impacts of persistent contaminants in marine ecosystems.

Keywords: Long-chain PFAS; Marine Bivalves; Oxidative Stress; Energetic Balance; Tissue alterations

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

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Abstract. The presence of antibiotics in aquatic environments contributes significantly to the spread of bacterial resistance, a major public health risk of the 21st century. The development of efficient treatments for removing antibiotics from wastewater is essential to reduce their entry into natural waters. Among the most used antibiotics, and therefore commonly present as micropollutants in wastewater, are amoxicillin (AMX), sulfamethoxazole (SMX) and trimethoprim (TMP), which have been included in the watch lists of priority substances in the context of the Water Framework Directive (WFD, Directive 2000/60/EC; Decision 2018/840; Decision 2020/1161; Decision 2022/1307). Furthermore, at the beginning of 2025, the European Union revised the Urban Wastewater Treatment Directive, promoting the application of quaternary treatment in wastewater treatment plants to remove micropollutants (Directive EU 2024/3019). A sustainable way to effectively remove antibiotics from wastewater is using sunlight-induced degradation. However, such a treatment lacks the efficiency required for widespread implementation, and its application has been mainly laboratory-based. To overcome this limitation, this work aims to develop sunlight-efficient photocatalysts by incorporating carbon dots onto titanium dioxide and coupling them with magnetic iron oxides, thereby imparting magnetic properties to the composite photocatalysts that enable easy after-use recovery and reuse. The photocatalysts were synthesised by co-precipitation and optimised using a full factorial design with 2 factors at 3 levels. Five different responses were evaluated: AMX, SMX, and TMP photodegradation; magnetisation saturation; and synthesis yield. After determining the optimal synthesis conditions using a desirability function, the photocatalyst performance was evaluated. The effect of photocatalyst dosage, pH, and dissolved organic matter, as well as reactive oxygen species determination, reuse cycles, and mineralisation were studied. Additionally, the residual antibacterial activity after photocatalytic treatment was evaluated, and the photocatalyst's performance was assessed in a pilot-scale photoreactor. The proposed strategy is aligned with green chemistry principles and materials circularity, with a special focus on the magnetic after-use recovery and subsequent reutilization of photocatalysts.

Keywords. *Emerging Organic Microcontaminants; Photodegradation; Photocatalysts; Carbon dots; Antimicrobial resistance; Water treatment*

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[CICECO & I3N-FSCOSD] Advanced materials: From research to innovation

Modular Human Platelet Lysate Microgels as a Self-Sustaining Granular Bioink for Scalable Biofabrication

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Abstract

A major limitation in 3D bioprinting is the trade-off between biological complexity and manufacturing control. While native tissues achieve adaptability and function through modular organization, localized resource management, and dynamic biochemical signaling, most printable bioinks rely on simplified, chemically defined systems that lack these features and require continuous external supplementation. This constraint is particularly pronounced for human-derived biomaterials, whose intrinsic heterogeneity and processing sensitivity hinder scalability and reproducibility.

Here, we present a bioinspired granular bioink platform that leverages, rather than suppresses, biological complexity by transforming xeno-free human platelet lysate (hPL) into modular microgel building blocks. Derived from expired donor blood and enriched with endogenous growth factors, hPL is discretized into photocrosslinkable microgels that enable independent and orthogonal tuning of material properties and biological function within a single printable ink.

The platform integrates two orthogonal microgel populations: (i) photocrosslinkable microgels that undergo post-print annealing to produce mechanically robust, shape-stable constructs, and (ii) photocleavable hPL microgels that enable on-demand release of bioactive proteins and growth factors, supporting sustained cell growth without serum supplementation. These microgels can also function as microcarriers in dynamic culture systems, enabling scalable cell expansion in bioreactor-based biomanufacturing.

By decoupling printability, mechanical integrity, biochemical signaling, and metabolic support, this granular system enables rapid customization through compositional tuning. Adjusting microgels and ratios provides a manufacturing-relevant handle to tailor construct mechanics and cellular microenvironments for specific applications.

This work establishes a self-sustaining, multifunctional bioink that recapitulates key features of living tissues and advances the scalability and translational potential of biofabrication platforms.

Materials library for next-generation contacts for flexible ultrathin solar cells

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[*] Corresponding author: b.sieira@ua.pt; [†] Presenting author; [I3N] Materiais avançados: da investigação à inovação.

Abstract. Ultrathin Cu(In,Ga)Se_2 (CIGS) solar cells are a promising technology for photovoltaic applications due to their high absorption coefficient and potential for reduced material consumption [1]. However, reducing absorber thickness enhances the impact of interface recombination and non-ideal contact properties, which can significantly limit device performance. Since the 1980s, major efforts have focused on developing and optimizing absorber deposition techniques to improve the efficiency and performance of CIGS solar cells, although architecture optimization remains limited. Selective contacts based on transition metal oxides (TMOs) offer a promising strategy to improve charge extraction and carrier selectivity in next-generation CIGS devices. Their electronic properties can be tuned through deposition conditions, enabling control over interface quality and band alignment with the absorber. In addition, integrating TMOs into interdigitated back-contact architectures can reduce front-interface recombination and parasitic light absorption while improving light management and carrier collection. In this work, TMOs - NiO, Ta_2O_5, Ga_2O_3, ZrO_2, MoO_3, WO_3, V_2O_5, and Nb_2O_5 - are investigated as selective contact materials for CIGS solar cells. The study focuses on their influence on band alignment and optoelectronic properties, with the goal of defining design guidelines for selective contact integration. The proposed contact strategy is based on three key requirements: selectivity, passivation, and conductivity. To address these aspects, the TMOs were deposited by RF sputtering with controlled thicknesses and systematically characterized using complementary techniques. X-ray photoelectron spectroscopy (XPS) was used to determine chemical composition and oxidation states, providing insight into stoichiometry and oxygen deficiency. Ultraviolet photoelectron spectroscopy (UPS) was employed to extract work function and valence band alignment, while reflection electron energy loss spectroscopy (REELS) was used to determine bandgap values. By correlating stoichiometry with electronic structure parameters, this work establishes a comprehensive TMO materials library and provides a first framework for selective contact design in ultrathin CIGS solar cells.

Keywords. *Selective contacts; Transition metal oxides; CIGS; Band alignment; Contact design.*

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Periscopes for edge-to-surface coupling of photonic integrated circuits

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Abstract. In the context of packaging of photonic integrated circuits, edge coupling of optical fibers is typically preferred over surface coupling in order to reduce packaging stress. New co-packaged optics assemblies sometimes require edge-to-surface coupling and vice-versa. Developing coupling methods generally requires access to semiconductor fabs. This study analyzed a solution that combined both edge and surface coupling, utilizing a total internal reflection (TIR) periscope to steer and couple a horizontal to a vertical beam. The mode matching of the beam must be considered when designing beams coupled into waveguides. In this work the beam is outputted by the fiber and collected by the photodetector, having into account its pixel size. This periscope was manufactured using two-photon-polymerization (TPP) methods. TPP utilizes the simultaneous absorption of two photons to polymerize certain photoresists, enabling the additive manufacturing of voxels at the nanometer scale [1]. To simplify the approach, a single mode fiber represented the edge coupler, and the top-illuminated photodiode represented the surface coupler. A periscope, which, would be unmanufacturable using other methods, that collected, steered and coupled the beams was manufactured. The re-design of the periscope with a curved TIR mirror, to increase alignment tolerances and, PIC to PIC edge-to-surface coupling are potential future works.

Keywords. *edge-to-surface; packaging; photonics; PICs; two-photon-polymerization;*

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Recycling PET waste with PEF via Eutectic Solvent-based Catalysis: Evaluation of rPET Thermal Properties and Elucidation of the Depolymerization Mechanism

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Abstract.

The widespread use of plastics has significantly contributed to global economic development, with annual production surpassing 430 million tons in 2024.[1] However, only around 15% of plastic waste is currently recycled due to paramount challenges associated with mixed-polymer streams, often resulting in incineration or landfill disposal.[2] Among these materials, poly(ethylene terephthalate) (PET) is frequently combined with polymers such as polyolefins in packaging applications, complicating sorting and selective recycling processes. Furthermore, the upcoming market introduction of poly(ethylene 2,5-furandicarboxylate) (PEF) raises concerns regarding its impact on existing PET recycling streams due to potential cross-contamination.[3,4]

In this study, the chemical recycling of PET containing residual PEF contents (2%, 5%, and 10% molar percentages) was investigated using a greener catalytic system, an eutectic solvent composed by urea:zinc acetate. This study represents the first report addressing the structural, thermal, and thermo-mechanical properties of recycled rPET-co-PEF copolymers. These recycled materials exhibited thermal behaviour similar to virgin PET, demonstrating the viability of this recycling approach even in the presence of PEF contamination.

Additionally, the depolymerization mechanism was investigated through density functional theory (DFT) calculations, revealing that hydrogen bonding interactions between the amine groups of urea and the ester groups of PET play a crucial role in lowering the reaction activation energy, thereby confirming the catalytic effect of the urea-based ES. Importantly, inelastic neutron scattering (INS) and proton nuclear magnetic resonance (^{1}H NMR) data further confirmed the proposed depolymerization mechanism and the role of hydrogen-bond interactions during the catalytic process.

Overall, these findings highlight the potential of eutectic solvent-based systems as sustainable and efficient catalysts for the chemical recycling of mixed PET/PEF waste streams.

Keywords. *Depolymerization, PET, PEF, Recycling, Density Functional Theory*

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Rheumatoid arthritis research: development of human-derived platelet lysate-placenta hydrogels for synovial fibroblast culture

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Abstract. Rheumatoid arthritis (RA) is a chronic autoimmune disease that impacts nearly 20 million people worldwide. Despite advancements in treatments, clinical trials for RA drug candidates have an 84% failure rate, emphasizing the urgent need for better preclinical models.[1,2] Existing in vitro and animal studies often fail in replicating RA complexity because they lack a genuine human environment. To address this limitation, this work aimed to develop a human-derived biomimetic matrix for synovial fibroblast culture by combining methacryloyl human platelet lysates (hPLMA, Metatissue, Portugal), rich in growth factors, and methacryloyl human placenta (hPCMA, Metatissue, Portugal), rich in collagens. For this, the SW982 cell line was encapsulated in hPLMA-hPCMA microspheres, and the cell density and material composition were optimized. The hydrogels were characterized in terms of mechanical properties, permeability, pore size, shrinkage behavior, and cytocompatibility. Among the tested formulations, a 1:1 hPLMA-hPCMA composition showed the most suitable properties for cell culture, maintaining high cell viability and preventing the hydrogel shrinkage observed in collagen-based formulations. This mixture presented a Young's modulus of approximately 20 kPa, pore sizes ranging from 10 to 70 μm, and high permeability to molecules up to 150 kDa. Preliminary inflammation induction studies using interleukin-1β suggested that this hPLMA-hPCMA matrix is compatible with inflammatory stimulation of SW982 cells. Overall, these results demonstrate the potential of hPLMA-hPCMA hydrogels as human-derived platforms for synovial fibroblast culture and future in vitro models for RA.

Keywords. *SW982 cell line; 3D cell culture; interleukin-1β; inflammation; human-based scaffolds*

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Balancing Design and Performance in Photovoltaics: a novel RGB-inspired Strategy

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Abstract. Recent global instability issues have highlighted the urgent need for resilient and decentralized energy solutions. [1] Although photovoltaic (PV) technology continues to experience strong annual growth, further deployment is required for a substantial contribution to global electricity generation. [2], [3] In this context, Building Integrated Photovoltaics (BIPV) emerge as a promising solution for urban environments, where aesthetic integration plays a critical role alongside device performance. [4] This work presents a novel tuneable colouring strategy for flexible Cu(In,Ga)Se_2 (CIGS) solar. Inspired by RGB LED display technology, the proposed approach combines side-by-side Red, Green, and Blue Bragg reflector [5] coatings of silica and silicon nitride in adaptable proportions, enabling the tailoring of the final perceived colour while balancing optical gains and losses. Two micro-scale line-based architectures were first fabricated on soda lime glass to validate their spectral response and subsequently implemented on flexible CIGS solar cells. White coloration was selected as the primary target due to the prevalence of neutral and low-saturation tones in building façades, although the feasibility of producing additional colours was also demonstrated. The fabricated patterns were designed to remain indistinguishable to the naked eye at a distance of 1 m, resulting in the perception of a uniform colour. Experimental results demonstrate a reproducible and defect-free microfabrication process on both substrates, successful colour perception, and reduced colour angle dependence compared to conventional uniform Bragg reflector structures. While all coloured devices exhibited lower overall performance than the bare reference cell, the RGB strategy limited short-circuit current density losses to below 1.5 $mA \cdot cm^{-2}$, outperforming equivalent uniform coatings. Moreover, the Blue coating produced a current density increase of 3.3 $mA \cdot cm^{-2}$. The proposed strategy therefore demonstrates strong potential for aesthetically integrated, high-efficiency coloured BIPV systems with losses as low as 1 - 4% and possible performance gains approaching 10%.

Keywords. *RGB, colour filter, flexible, CIGS, BIPV*

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Toward smarter hepatotoxicity testing: a xeno-free 3D human liver model

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Abstract. Drug-induced liver injury (DILI) remains a leading cause of drug attrition during clinical development and post-market withdrawal, emphasizing the urgent need for more predictive human-relevant preclinical models. Conventional animal-based approaches often fail to accurately mimic human liver physiology and metabolic responses. In this context, three-dimensional (3D) *in vitro* systems incorporating biomimetic extracellular matrix (ECM) components have emerged as promising alternatives for improving hepatotoxicity assessment while reducing animal experimentation. [1,2] This study aimed to establish a human-derived, xeno-free 3D liver model capable of supporting hepatocyte-like cell functionality and improving DILI evaluation.

A xeno-free culture platform for HepG2 cells was developed using human platelet lysates (hPL) as a substitute for fetal bovine serum (FBS). Cell proliferation, metabolic activity, urea synthesis, and CYP450 activity were assessed to validate hepatic functionality. To better replicate the native liver microenvironment, cells were encapsulated within photocrosslinkable hydrogels composed of methacryloyl-modified hPL (hPLMA) and human-methacryloyl placenta (hPCMA). Hydrogel composition and cell density were optimized to enhance cellular performance. The model was further evaluated using dose-response assays with FDA-recognized DILI-associated drugs, including acetaminophen, ibufenac, and busulfan.

Hydrogels containing 10% hPLMA and 0.7 hPCMA (1:1) with 10×10^6 cells/mL generated a soft and ECM-enriched environment resembling native liver tissue, supporting high cell viability and sustained metabolic activity. Encapsulated cells exhibited clear dose-dependent responses to acetaminophen, while busulfan and ibufenac exposure reduced CYP450 activity and urea production by approximately 20%. These findings demonstrate the permeability and functional relevance of the developed platform for hepatotoxicity studies.

Keywords. *Liver; DILI; xeno-free; hydrogels*

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Human dECM-MA: a tunable and bioactive ink for 3D bioprinting

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Abstract. Collagen is the main structural protein of the extracellular matrix (ECM), playing a crucial role in tissue organization, mechanical support, and cell regulation. Due to its excellent biocompatibility and low immunogenicity, collagen-based materials are widely explored in tissue engineering.[1,2] In parallel, 3D bioprinting has emerged as a powerful strategy for fabricating biomimetic tissue models through the controlled deposition of bioinks containing cells and biomaterials.[3]

In this work, a novel human-derived photocrosslinkable biomaterial (dECM-MA) was developed from decellularized extracellular matrix (dECM). Human-derived collagen was isolated and chemically modified to obtain a methacrylated material with tunable mechanical properties. The thermoresponsive nature of the bioink, characterized by increased viscosity at physiological temperature, enabled efficient extrusion bioprinting.

Printing conditions were optimized to improve print fidelity, with the best results achieved using a 27G needle, 15 kPa pressure, and a printing speed of 15 mm/s following one hour of preheating. Printed grid structures displayed good shape fidelity and pore definition. Furthermore, biological assays using cardiac fibroblasts and human umbilical vein endothelial cells demonstrated high cell viability and metabolic activity, highlighting the bioactivity and biocompatibility of the developed material.

Keywords. *Human dECM; 3D Bioprinting; Photocrosslinking; Thermoresponsive; Tissue Engineering*

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Magnetite nanoparticles: shaping the future of cancer treatment

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Abstract. In recent years, nanotechnology has emerged as a transformative field in oncology, opening new perspectives for more precise and effective therapies. Among the most promising nanomaterials, magnetite nanoparticles (Fe_3O_4) have attracted considerable attention due to their unique magnetic properties, biocompatibility, and multifunctional potential in cancer treatment.

Magnetic hyperthermia (MH), first introduced by Gilchrist et al. in 1957, is an innovative therapeutic strategy that employs magnetic nanoparticles to selectively destroy cancer cells through localized heating, typically raising tumor temperatures to 40–46 °C. When exposed to an alternating magnetic field, magnetite nanoparticles can generate heat in a controlled manner, enhancing the effectiveness of conventional therapies such as chemotherapy and radiotherapy. Importantly, tailoring the size, shape, and composition of Fe_3O_4 nanoparticles enables optimization of their magnetic performance and therapeutic efficiency. This work aims to explore the potential of magnetite nanoparticles in shaping the future of cancer treatment through the development of an advanced hybrid therapeutic platform that combines chemotherapy and magnetic hyperthermia within a single nanoparticle for the treatment of aggressive breast cancer.

To achieve this, multifunctional Fe_3O_4 nanoparticles loaded with a chemotherapeutic agent will be engineered, coated with polyethylene glycol (PEG) to improve stability and biocompatibility, and functionalized with a targeting peptide capable of selectively binding to breast cancer cells. This multifunctional approach seeks to enhance treatment specificity, minimize systemic side effects, and improve therapeutic outcomes, highlighting the promising role of magnetite nanoparticles in next-generation oncological therapies.

Keywords. *Breast Cancer; Chemotherapy; Magnetic Hyperthermia; Magnetic Nanoparticles*

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Comparative analysis of annealing time at two temperatures in the recovery of CIGS solar cells for space applications irradiated with protons (80–180 keV)

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Radiation tolerance and degradation mechanisms in Cu(In,Ga)Se_2-based thin-film solar cells (CIGS) have been the subject of intense research, as this technology offers concrete advantages over traditional solutions, such as Si, and multiple junctions in scenarios where mass and structural integration are determining factors. In this context, the adoption of CIGS solar cells as a power source for small satellites and space missions is becoming increasingly consistent and strategic due to: i) flexible technology; ii) low mass due to being thin-film; and iii) energy conversion efficiency already demonstrated at up to 23.60% [1]. However, solar cells face an unavoidable adversary: ionizing radiation, which promotes the formation of defects in the crystal lattice. In orbit, the cells are subject to significant fluxes of protons, electrons, and gamma radiation, among others [2]. The radiation-matter interaction results in a progressive loss of available power and compromises the mission, a particularly serious problem for low-power satellites. The relevance of this challenge is amplified by the thermal regime in low Earth orbit (LEO). A satellite in LEO completes an orbit in approximately 128 minutes, alternating between periods of solar illumination and Earth shadow, making the development of methodologies that enable performance recovery after exposure to radiation crucial [3, 4].

In this work, we analyzed CIGS solar cells subjected to proton irradiation under a deliberately aggressive implantation profile. The recovery strategy adopted evaluated recovery over time at two moderate temperatures, with greater emphasis on the prolonged effect of annealing, to quantify the recovery rate and the role of temperature in defect reconfiguration. Solar cells were analyzed in different states (as grown, after irradiation, and after thermal treatments) through external quantum efficiency (EQE) analysis, electrical, and optical measurements. The results demonstrated that annealing at moderate temperatures (120–180 °C) can significantly restore cell functionality after irradiation, highlighting the potential of this strategy as a viable and operationally compatible solution for the space context. This study clarifies the relationship between proton-induced damage in the depletion region and thermal recovery in CIGS technologies intended for space missions.

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Laser patterning of boron-doped diamond for thermal and liquid-phase sensing

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Abstract. Boron-doped diamond (BDD) is an exceptional material for robust physical and electrochemical sensing due to its thermal stability, wide potential window, and chemical inertness [1]. However, macroscopic BDD films often exhibit uneven electrical conductivity, compromising sensor reliability. This study addressed this challenge through structural miniaturization, employing laser patterning on BDD-coated silicon nitride substrates to fabricate two distinct sensing architectures: elongated track designs for highly sensitive thermistors and interdigitated electrodes (IDEs) for liquid-phase analysis [2]. Both geometries significantly increase the effective electrical path length, thereby mitigating the impact of local conductivity variations . BDD films were synthesized via hot-filament chemical vapor deposition using a 10,000 ppm boron oxide in ethanol precursor. Because the thermal energy of the laser ablation induced local graphitization of the diamond and decomposition of the substrate into metallic silicon, a rigorous two-step chemical cleaning protocol was implemented. Immersion in a hydrofluoric and nitric acid mixture (50% v/v) followed by Piranha solution successfully etched these conductive byproducts, restoring critical electrical insulation between patterned structures [3]. For the analytical validation of the liquid-phase sensors, the IDEs were immersed in aqueous sodium chloride solutions of varying concentrations. To prevent water electrolysis and mitigate electric double-layer capacitance, an alternating current (AC) signal of 35 kHz at a 3V amplitude was applied, coupled with an AC/DC converter. Initial calibration established a clear correlation between the rectified impedance response and electrolyte concentration, confirming the sensor's sensitivity. Simultaneously, the patterned thermistor tracks provided a reliable platform for temperature monitoring. Ultimately, this scalable dual-fabrication and post-etching methodology successfully overcomes the inherent material heterogeneities of bulk BDD films, establishing a versatile foundation for both accurate thermal monitoring and future bio-functionalized analytical biosensors.

Keywords. *HFVCD; Patterning; Boron-doped diamond; Temperature sensing; Liquid-phase sensing.*

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Development of keratin-rich hydrogels for nucleic acid delivery

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Abstract. Nucleic acid therapies have emerged as powerful tools for addressing infectious, cancer, immunological, and genetic disorders by modulating gene expression or promoting protein synthesis to trigger immune responses. However, efficient systemic or localized delivery remains a major challenge due to strict biological and physical barriers. In fact, naked DNA faces rapid degradation by extracellular nucleases and serum proteins, leading to premature clearance and potential immunogenicity [1]. To overcome these issues, while simultaneously striving for waste valorization within a circular economy model, this work aims to develop agarose-based biomaterials for nucleic acid delivery enriched in biologically active keratin extracted from sheep wool.

Keratin was extracted from wool, an abundant animal byproduct that, despite often being discarded, offers the possibility of endowing the resulting materials with additional antioxidant and anti-inflammatory properties [2]. Using ILs, a keratin extraction yield from wool of 79.35% ± 6.80 was obtained. Moreover, the structural integrity and thermal stability of keratin were maintained, therefore confirming the efficacy of the IL-based extraction method. Keratin was then integrated into agarose gels, and the capacity of these structures to entrap and release plasmid DNA (pDNA) was evaluated. Results demonstrate that protein incorporation allowed for modulating the pDNA release profiles, showing a gradual release between 0-3h, and a total release after 24h. Furthermore, pDNA was complexed with chitosan to form stable polyplexes, incorporated into the designed keratin-agarose gels, and the transfection efficiency of lixiviates onto A549 and human fibroblast cell lines was evaluated. Overall, MTS-based assays demonstrated a cellular viability above 70%, indicating that these formulations can be considered non-cytotoxic, therefore highlighting their potential as biocompatible therapeutic platforms. Under the light of sustainable concepts, this research successfully developed an efficient process for keratin extraction and hydrogels formulation capable of releasing pDNA, thus providing an alternative platform for the delivery of (bio)pharmaceuticals.

Keywords. *Nucleic acids; Ionic liquid; Keratin; Non-invasive systemic administration*

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Self-healing magnetic nanocomposite protective coating activated by alternating magnetic field

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Abstract. Growing environmental awareness, together with rapid technological progress, has increased the demand for sustainable materials with enhanced performance and durability. In this context, self-healing materials have attracted considerable research interest due to their ability to restore performance after damage, extend service life, and promote sustainability [1].

This study investigated a magnetic nanocomposite protective coating with alternating current (AC) magnetic field induced self-healing capability. The proposed system integrates magnetite-based nanoparticles within a thermoplastic polymeric matrix. The concept is based on the ability of magnetic nanoparticles to induce localised heating under an applied high-frequency AC magnetic field. This heat enables local rearrangement of the thermoplastic coating matrix and the controlled healing of defects, without damaging the substrate.

The design of a magnetite-based responsive polymeric coating and its self-healing functionality were investigated on a glass fibre reinforced plastic substrate commonly used in the marine industry. Artificial scratches extending down to the substrate were introduced into the coating, and a high-frequency AC magnetic field was applied to the samples to induce the healing functionality using a commercial magnetic hyperthermia system. The influence of magnetic field strength and frequency on the heating of the coating was investigated, with the temperature monitored via a thermographic camera. The healing of the induced defects was evaluated by stereo microscopy and optical 3D profilometry. A reference thermoplastic coating without magnetic particles was also investigated for comparison purposes.

The results demonstrated successful self-healing of the magnetic nanocomposite coating after 15 minutes of magnetic field application, whereas the reference coating remained damaged. These findings highlight the potential of AC magnetic field-induced self-healing systems as a promising pathway toward sustainable material protection.

Keywords. *Protective coating; Self-healing; Magnetic nanoparticles; Magnetic field; Nanocomposite*

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Effect of tannin-based additives on the interfacial and mechanical performance of natural fibre-reinforced bio-epoxy composites

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Abstract. Natural fibre-reinforced biocomposites have emerged as promising sustainable alternatives to conventional synthetic composites, particularly for lightweight automotive applications. However, the relatively poor compatibility between hydrophilic natural fibres and hydrophobic polymer matrices often results in weak fibre-matrix adhesion and limited mechanical performance. In this context, the incorporation of bio-based additives into the matrix has become an effective strategy to improve interfacial interactions and stress transfer efficiency.

Among the available natural additives, tannins have attracted increasing interest due to their polyphenolic structure, high hydroxyl group content, renewability, and potential to promote intermolecular interactions. In the present work, two different tannin extracts, namely Tan 737B and Tan QRC, were incorporated into a partially bio-based epoxy resin (≈ 45 % bio-content) used for the manufacturing of unidirectional natural fibre-reinforced composites.

Composite laminates were produced by compression moulding, and the effect of tannin incorporation on the mechanical behaviour of the composites was evaluated through tensile, flexural, interlaminar shear strength (ILSS), and Charpy impact tests. The results demonstrated that the addition of 5 wt.% tannin significantly improved the mechanical performance of the composites, indicating enhanced fibre-matrix adhesion and more efficient load transfer mechanisms. Improvements were particularly observed in tensile and flexural behaviour, interlaminar properties, and impact energy absorption, confirming the effectiveness of tannins as sustainable interfacial modifiers for bio-based composite systems.

Overall, the results highlight the strong potential of tannin-modified bio-epoxy composites for sustainable engineering applications. Future work will focus on evaluating the long-term durability and environmental ageing behaviour of these materials, aiming at their implementation in lightweight automotive components.

Keywords. *Natural fibre composites, bio-based resins, natural additives, tannins, mechanical properties, automotive applications.*

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Data-driven design of photodynamic starch-based coatings for antimicrobial paper-based sterile barrier systems

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Abstract. Medical paper packaging still relies heavily on fossil-based multilayer laminates to ensure sterility, despite growing environmental and regulatory pressure to replace these materials with sustainable alternatives. However, developing bio-based solutions that remain compatible with sterilisation processes and preserve barrier properties and mechanical performance remains a major challenge. This project proposes the development of photodynamic starch-based coatings for antimicrobial paper-based sterile barrier systems, combining renewable materials with active functionality.

The approach explores the incorporation of porphyrin-based photosensitisers capable of generating reactive oxygen species upon light exposure, enabling broad-spectrum antimicrobial activity without promoting microbial resistance. The work will investigate the relationship between formulation, coating structure, and performance, with particular focus on sterilisation compatibility, coating stability, and the preservation of key properties such as sealability, mechanical strength, and barrier performance.

To accelerate formulation design, a data-driven strategy will be implemented to guide the selection of photosensitisers and optimise coating composition and processing parameters. Machine learning-assisted modelling will support the identification of formulation–property relationships and predict coating performance based on physicochemical and functional descriptors. By integrating materials science, photodynamic antimicrobial technology, and sustainable packaging design, the project aims to advance next-generation sterile barrier materials. Moreover, it seeks to contribute to safer and more environmentally responsible medical packaging solutions, reducing dependence on fossil-derived laminates while maintaining the stringent functional requirements of healthcare applications.

Keywords. *Thermoplastic starch (TPS); Porphyrin-based photosensitisers; Medical paper packaging; Machine learning; Sterilisation compatibility.*

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Formulation of ionogels for the delivery of rna-based biopharmaceuticals

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Abstract.
Messenger RNA (mRNA) based vaccines were first used on a wide scale during the COVID-19 pandemic. Although proved to be safe and effective, challenges related to mRNA technology remain. The mRNA molecule is inherently unstable, requiring complex logistics and a strict cold chain for storage and transportation. Furthermore, the primary method of mRNA administration is intramuscular injection. While effective, this method is associated with low patient compliance due to pain and discomfort associated with injections, and the prevalence of needle phobia, particularly among younger persons [1]. Ionic liquids (ILs), a class of organic salts with remarkable structural diversity, represent effective solvents for the stabilization of nucleic acids [2] and can be used as skin permeation enhancers of synthetic drugs and biopharmaceuticals. ILs can also be incorporated into solid networks, leading to the formation of ionogels that retain some of the properties of the ILs used in their composition. As such, this work aims to develop gelatin-based ionogels for the transdermal delivery of RNA-based biopharmaceuticals, while simultaneously maintaining and/or improving RNA stability. RNA-loaded ionogels were created via a simple one-pot mixing approach: heated gelatin was mixed with maltodextrin, and a cholinium-based IL, after which RNA was added. Gel formation occurred once the solution cooled down. The produced ionogels were characterized using FTIR, through which it was possible to confirm the presence confirming successful incorporation of all components. RNA release assays, performed at 37ºC, showed full RNA release occurring after 90 min. Agarose gel electrophoresis showed that the RNA integrity was maintained after release from gels.
These results demonstrate the feasibility of developing RNA-loaded ionogels with temperature-triggered release. Future work will focus on evaluating their potential for transdermal mRNA delivery.

Keywords. *RNA-biopharmaceuticals; Ionogel; Transdermal delivery; mRNA stability; Ionic Liquid*

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Stretchable wearable sensors for continuous respiratory monitoring

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Abstract. Respiratory volume assessment plays an important role in the management of chronic respiratory diseases, including asthma and chronic obstructive pulmonary disease [1]. Nevertheless, conventional techniques such as spirometry rely on patient cooperation and forced respiratory maneuvers, limiting their applicability for continuous or bedside monitoring. Unobtrusive and passive monitoring technologies capable of supporting early detection of respiratory decline may contribute to tackling the escalating burden associated with respiratory disorders and ageing populations [2]. This study outlines the development and preliminary validation of a wearable respiratory monitoring platform designed for continuous respiratory assessment. The system consists of a soft skin-mounted patch incorporating a flexible sensor capable of detecting thoracic motion associated with breathing.

Two biodegradable sensor architectures were fabricated and evaluated: a porous structure and a micropatterned pyramidal configuration, both engineered to improve electromechanical responsiveness. Respiratory signals acquired from the sensors were compared against measurements obtained using a clinical-grade airflow transducer.

Thirty-eight healthy adults (17 females and 21 males) were initially recruited. Signal quality assessment based on predefined criteria identified seven outliers, resulting in a final cohort of 31 participants (15 females and 16 males, aged 18–45 years). Both sensor variants showed strong correlation with the reference device ($R^2 > 0.91$) and low mean absolute errors in respiratory volume estimation. An area-based segmentation method revealed mean absolute percentage errors below 15% for both sensors, when compared with the reference. The proposed sensors combine flexibility, skin conformity, and non-invasive design, demonstrating potential for future use in long-term and remote health monitoring applications. Further studies involving target patient populations are required to assess real-world feasibility and usability.

Keywords. *wearable sensors, respiration, signal processing, statistical analysis*

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Correlating atomic-scale defects with macroscopic quantum magnetism in acetate-synthesized BaY_2NiO_5

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Abstract. BaR_2NiO_5 oxides (R = Y, rare earth) are of significant interest due to their low-dimensional quantum magnetism and structural complexity. Among them, BaY_2NiO_5 is a prototypical Haldane-gap system and also an intermediate phase formed during the synthesis of proton-conducting $BaZrO_3$-based ceramics. Understanding its magnetic properties is therefore relevant to both condensed matter physics and solid-state ionics. In this work, BaY_2NiO_5 powders were synthesized using a wet-chemical acetate precursor route. Phase purity and chemical states were investigated by Rietveld refinement of X-ray diffraction data and X-ray photoelectron spectroscopy, confirming the formation of a high-purity orthorhombic phase without detectable secondary phases. DC magnetization measurements were performed between 5 and 300 K to probe the magnetic behavior. Analysis of the temperature-dependent susceptibility using a thermodynamic Padé approximation allowed determination of the intrachain exchange constant (J) and the Haldane gap (Δ). The low-temperature Curie contribution, attributed to fractional spin states at broken chain ends, was used to estimate the concentration of chain-breaking defects and the average magnetic chain length. The results showed that disruption of the one-dimensional spin chains may be primarily governed by atomic-scale defects rather than microstructural grain boundaries. These findings establish magnetic characterization as a sensitive tool to correlate quantum magnetic properties with structural continuity and to monitor phase evolution in advanced ceramic electrolytes.

Keywords. *Magnetometry; Haldane Gap; Padé Approximation; Acetate Synthesis; Proton-Conducting Ceramics*

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Enhancing the porosity of additively manufactured geopolymers for wastewater treatment

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Abstract. Additive manufacturing enables the production of complex geopolymer geometries with precise control of porosity and surface area for environmental applications [1]. However, these bulk structures generally exhibit lower specific surface area (SSA) than their powdered counterparts, limiting their adsorption performance [2]. Herein, we present a novel strategy to address this limitation through ethylenediaminetetraacetic acid (EDTA)-assisted dealumination of 3D-printed metakaolin-based geopolymers. The chemical treatment was explored as a strategy to increase the porosity of the 3D-printed geopolymers lattices by selectively removing aluminum species from the geopolymeric network. The effects of EDTA concentration and contact time on the physicochemical properties of the lattices were systematically investigated. The results confirmed successful dealumination, evidenced by an increased Si/Al ratio. The optimized lattice (treated with 0.1 M EDTA for 8 h) achieved a specific surface area of 137 m^2/g, representing a 41% increase compared with the pristine structure and presented one of the highest SSA values reported for 3D-printed geopolymers. Although the treatment reduced mechanical strength, the lattice maintained sufficient structural integrity (2.4 MPa) for an adsorption application. In methylene blue adsorption tests, the modified adsorbent reached a maximum adsorption capacity of 30.86 mg/g and removal efficiencies above 98% at pH 10.5 (C_0 = 165 ppm). These findings demonstrate that dealumination is an effective strategy for enhancing the adsorption performance of 3D-printed geopolymers and highlight their potential for wastewater treatment applications.

Keywords. *Alkali-activated materials; 3D-printing; Porosity; Dealumination; Adsorption*

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Direct ink writing of acid-activated geopolymer adsorbents for Pb^{2+} adsorption from wastewaters

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Abstract. Acid mine drainage is one of the biggest environmental risks associated with mining activities, generating highly acidic waters that carry high concentrations of toxic metals such as Pb, Cd, Cu, among others. The use of alkali-activated geopolymers as bulk-type sorbent materials is emerging as a cost-effective alternative compared to conventional sorbents, including activated carbons, however, in the remediation of highly acidic effluents, their use typically requires prewashing to avoid metal precipitation. In this study, acid-activation of aluminosilicate precursors was studied as an alternative to conventional alkaline activation. The porous adsorbents were synthesised using an extrusion-based additive manufacturing technique – robocasting, also known as direct ink writing. Metakaolin-based pastes were formulated with phosphoric acid and optimized for 3D printing. The produced structures were characterized by SEM, FTIR, XRD, zeta potential, rheology, calorimetry, and compressive strength, and then evaluated in batch adsorption tests with Pb^{2+} solutions. The printed adsorbents showed a densified filament surface with uniform spacing, stable shape, and good mechanical integrity, while also maintaining high stability under acidic conditions. Adsorption results indicated an initial fast uptake of lead ions followed by a slower removal, reaching 61% Pb^{2+} removal after 48 h. The 3D-printed acid geopolymers showed impressive compressive strength (ca. 33 MPa), and a high specific surface area of 76 m^2/g – the highest ever reported for 3D-printed acid-activated geopolymers. Overall, the work showed that additively manufactured acid-activated geopolymers combined structural robustness with effective Pb^{2+} removal, supporting their potential use as adsorbents for treating acidic metal-contaminated waters.

Keywords. *Acid-activated geopolymers; Additive manufacturing; Heavy metal removal; Adsorbents; Wastewater treatment;*

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Defect engineering of Bi-doped $LiYGeO_4$ for enhanced UV persistent luminescence in photocatalytic systems

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Abstract. Water scarcity and contamination have become critical global challenges, with billions of people lacking access to safe drinking water and persistent pollutants increasingly entering aquatic systems. Conventional treatment technologies are often unable to effectively remove these contaminants, highlighting the urgent need for advanced water remediation strategies. Among these, semiconductor-based photocatalysis has been established as a promising approach due to its ability to degrade a wide range of organic pollutants into harmless end products. However, its practical implementation remains constrained by the requirement for continuous ultraviolet (UV) irradiation and by limitations associated with catalyst recovery and post-treatment processes.

In this work, a photocatalytic system based on the integration of TiO_2 with UV-emitting persistent luminescence (PersL) materials is explored, where the PersL component acts as an "internal" light source. Recently, Bi-doped $LiYGeO_4$ has been investigated as a UVA-emitting PersL phosphor with long-lasting afterglow. A defect engineering approach is implemented through solid-state synthesis, including lithium deficiency, germanium excess, and yttrium variation to account for Bi^{3+} incorporation at Y^{3+} lattice sites. Structural and optical characterization revealed that controlled deviations from the "original" stoichiometry strongly influence defect formation, trap distribution, and consequently the intensity and duration of UV persistent luminescence. These results provide new insights into the structure–defect–property relationships in $LiYGeO_4$ and support the development of integrated photocatalytic systems with reduced dependence on external UV irradiation.

Keywords. *Persistent luminescence; Defect engineering; Photocatalytic systems; Ultraviolet emission; $LiYGeO_4$:Bi*

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Human protein-based ultrathin membranes toward the development of self-assembled cell aggregates for osteo differentiation.

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Abstract.
Tissue engineering has increasingly focused on developing scaffolds that support intrinsic cell behavior and promote microenvironments resembling native tissue. Yet many current approaches rely on predefined architectures that passively host cells. Here, we present a fully human-derived system in which cells actively remodel their substrate, autonomously sculpting dynamic three-dimensional (3D) microenvironments.
Ultrathin membranes were produced by solvent casting of amyloid-like nanofibrils formed from human platelet lysate methacryloyl (hPLMA) in the presence of the ionic liquid cholinium tosylate.[1] To modulate the membrane properties, the fibrillar network was produced by varying the concentration of hPLMA, yielding membranes with distinct thicknesses. Bone marrow mesenchymal stem cells (BM-MSCs) were seeded on top of the membranes. The viability, metabolic activity, 3D self-organization, and osteogenic differentiation were assessed through confocal imaging, ALP activity assays, ELISA, RT-qPCR, and Proteomics. Morphometric parameters (area and circularity) were used to characterize cell-driven folding.
Both membrane formulations supported cell adhesion and proliferation. However, hPLMA concentration directly influenced thickness and thus folding capacity. Membranes with higher hPLMA content exhibited increased thickness, resulting in reduced folding efficiency and larger, less compact aggregates. Under osteogenic stimulation medium, constructs exhibited increased circularity and upregulation of osteogenic markers (OSP, ALPL, RUNX2, COL1A1, DCN) while maintaining increased viability without necrotic core formation.
This system provides a bioactive and tunable platform where cells shape their 3D microenvironment according to their needs, offering a promising and novel strategy for osteoregenerative tissue engineering.

Keywords. *Human protein; Ultrathin membranes; Osteogenes;*

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Title:
From risk identification to mitigation: a structured non-clinical risk-management framework for ATMPs in spinal cord injury

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Keywords: Advanced Therapy Medicinal Products; Spinal Cord Injury; Classification; Non-clinical Development; Clinical Development

Advanced therapy medicinal products (ATMPs) incorporating biomaterial scaffolds hold considerable promise for the treatment of spinal cord injury (SCI) [7]. However, their translation remains challenged by biological complexity, process variability, and limited predictability of non-clinical models [1,5]. Although safety-related risks are widely acknowledged, practical and reproducible approaches to structurally prioritize and manage these risks during early development are still lacking [6].

In this study, a systematic risk-management framework for non-clinical ATMP development is proposed, combining a structured literature review (2019–2025) with Failure Mode, Effects and Criticality Analysis (FMECA) applied to a representative biomaterial-based ATMP case study. Potential failure modes across starting materials, manufacturing processes, analytical controls, and non-clinical testing were assessed during a multidisciplinary expert workshop. Severity, occurrence, and detectability were scored using predefined criteria to enable semi-quantitative prioritization through Risk Priority Numbers (RPNs) [8,9].

The analysis identified the most critical risks as being primarily associated with residual chemical toxicity and insufficient control of polymerization processes. For all medium- and high-priority failure modes, targeted mitigation measures were defined and explicitly linked to verification assays and acceptance criteria aligned with regulatory guidance and international standards, including those of the European Medicines Agency (EMA)

[CICECO] Building matter: from atomic design to material reality

Sustainable renewable co-polyesters via entropically driven ring-opening polymerization for functional biodegradable materials

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Abstract. The development of sustainable polymeric materials from renewable resources is essential to reduce the dependence on fossil-derived plastics and to enable the transition toward a circular bioeconomy. In this study, novel biodegradable furan-based co-polyesters will be synthesized from lignocellulosic-derived monomers through sustainable ring-opening polymerization (ROP) strategies combined with lignin valorisation approaches.

The PhD work, that is now starting, focuses on the entropically driven ROP of Tulipalin A (TlpA)[1] and alkyl-substituted ε-caprolactones (alkyl-CL)[2] with aromatic furan-diol-lactones (FDLs) to generate bio-based co-polyesters with tuneable thermal, mechanical, optical, and degradation properties. The FDLs will be advantageously prepared by enzymatic-assisted synthesis and the selected polymerization strategy offers several advantages over conventional polyester synthesis, including improved atom economy, reduced polymer color change, lower melt viscosity, and shorter reaction times. By systematically varying monomer composition and polymerization conditions, a broad range of co-polyesters with controllable properties can be obtained. To further enhance materials functionality, a second aim of this PhD work plan, will be the combination of the prepared co-polyesters with well-defined lignin nanoparticles and polyphenolic fractions to produce multifunctional bio-composites. The incorporation of lignin is expected to improve UV stability, stiffness, antioxidant behaviour, and gas-barrier properties while simultaneously promoting the valorisation of lignocellulosic side streams. The influence of lignin content and dispersion on polymer performance will be investigated with the aim of establishing structure-property relationships in fully bio-based composite systems.

Keywords. *Polyester synthesis; Ring Opening Polymerization; lactones; co-polyesters; lignin*

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SUPPORTED IONIC LIQUID (SILs) AS CHROMATOGRAPHIC SUPPORTS FOR THE CONTINOUS MONOCLONAL ANTIBODY PURIFICATION

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Abstract. Nowadays, the global predominance of non-treatable or hard-to-treat diseases has been worsening rapidly, mostly driven by an aging population worldwide. Therefore, innovative biopharmaceuticals, including monoclonal antibodies (mAbs), have been developed and manufactured to effectively address this problem. Indeed, their manufacturing presents significant challenges in their production (upstream) and subsequent stages (downstream), driving up costs and timelines[1]. Supported Ionic Liquids (SILs), formed by the solid immobilization of ionic liquids (ILs), offer an advantageous solution due to their unique designer-level tunability, which facilitates the precise tailoring of mAbs by encompassing specific physicochemical properties[2]. In this scenario, the present work investigated a new strategy for the purification of anti-hepatitis C virus (anti-HCV) mAbs from Chinese Hamsters Ovary (CHO) cell culture supernatants using SIL-based chromatographic columns. The chromatographic purification of anti-HCV mAbs was achieved using two carefully chosen SILs: 1-methyl-3-propylimidazolium-based supported silica with chloride ([SSi][C_3mim]Cl) and propyltrioctylammonium-based supported silica with chloride ([SSi][N_{3888}]Cl). This process effectively employed two distinct chromatographic approaches: (i) flowthrough mode – with protein impurities being adsorbed to the column, while mAbs were eluted; and (ii) bind-and-elute mode – where the opposite behavior occurred. The successful application of these contrasting purification mechanisms highlighted the intrinsic tunability conferred by the ILs within the SIL matrix. Subsequently, the protein profile and structural integrity of the anti-HCV mAbs were assessed by SDS-PAGE (Sodium Dodecyl Sulfate Polyacrylamide Gel Electrophoresis). In summary, the results obtained in this study demonstrates that SILs enabled the development of a promising and cost-effective downstream strategy for mAbs, highlighting their potential as an alternative to current industrial purification processes.

Keywords. *Antibodies; Downstream; ProA substitutes; Computational simulation*

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Human platelet lysate-based hydrogels support angiogenesis under static and dynamic conditions

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Abstract. Tissue vascularization remains a critical challenge in both tissue engineering and the development of physiologically relevant in vitro models, where vascular networks are essential to support nutrient delivery, oxygen transport, and tissue maturation. Tissue-engineered constructs translation to clinical settings depends not only on the development of biomaterials with clinical compatibility but also on their ability to promote vascular organization and support long-term tissue functionality. Animal-derived and synthetic materials present key limitations, including variability, immunogenicity, regulatory concerns, and limited bioactivity, which together hinder their translational potential.[1] Human platelet lysate-based matrices offer a promising xeno-free alternative due to their endogenous reservoir of signaling molecules that may contribute to vascular organization.[2] Therefore, this study aimed to evaluate the intrinsic angiogenic potential of human platelet lysate methacryloyl (hPLMA, Metatissue) hydrogels in supporting vascular network formation in three-dimensional stromal–endothelial co-cultures and to assess how dynamic conditions influence the organization and complexity of these structures. Human adipose-derived stem cells (hASCs) and human umbilical vein endothelial cells (HUVECs) were encapsulated within hPLMA hydrogels and cultured for up to 14 days under static and dynamic conditions. Cell viability and vascular organization were assessed through the analysis of CD31-positive structures and quantitative parameters including vessel area fraction, junction density, and vessel length density. hASCs and HUVECs encapsulated within hPLMA hydrogels maintained high viability throughout the culture period, while HUVECs progressively organized into vascular-like structures within the 3D matrix. Endothelial cells self-assembled into interconnected networks, demonstrating the intrinsic bioactivity of hPLMA, likely driven by its naturally derived signaling molecules. Under dynamic conditions, network architecture was further enhanced, with increases in vessel area, junction density, and vessel length density observed from early culture time points compared to static culture. These findings highlight the interplay between matrix-derived biochemical cues and flow-induced mechanical stimulation in shaping vascular morphogenesis and support hPLMA as a fully human, xeno-free and translationally relevant biomaterial for advanced vascularized tissue engineering platforms.

Keywords. *Vascularization; hPLMA hydrogel; Xeno-free scaffolds; ASCs; HUVECs*

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Lung tumoroids as a standardized 3D platform for advanced preclinical drug screening

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Abstract. Lung cancer remains the leading cause of cancer-related mortality, highlighting the urgent need for physiologically relevant tumor models to improve preclinical drug screening. Although patient-derived organoids (PDTOs) are promising, conventional tumoroid culture doesn´t allow the stromal component integration and suffer from heterogeneity, limiting their reproducibility and translational accuracy [1].
Here, we present a standardized, stromal-enriched 3D lung tumoroid model designed to replicate the tumor microenvironment and thetumor-stroma interface. The engineered tumoroids were optimized for structural uniformity and characterized via live-cell imaging, immunohistochemistry, and gene expression profiling to evaluate architecture, extracellular matrix deposition, and phenotype. The resulting 3D tumoroid models displayed uniform morphology, successfully integrated stromal components, and exhibited enhanced biomimicry compared to conventional cultures. To validate its screening potential, the model was treated a dual drug cocktail [2]. Drug screening assays revealed differential, compartment-specific therapeutic responses. This study introduces a highly reproducible, human-relevant lung tumor model combining multi-cellular co-culture and optimized 3D architecture of lung tumor organoids. By successfully recapitulating the tumor-stroma interface and showing distinct responses to targeted drugs, this system addresses key limitations of conventional organoids devoid of stromal components and offers a reliable tool to improve the translational accuracy of preclinical drug testing.

Keywords. *Lung tumoroids; Tumor-stroma interface; Cancer-associated fibroblasts; High-content screening; Combination therapy*

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Selective lithium recovery from aqueous media using tailored nanoporous materials

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Abstract.
Lithium has become a strategic raw material due to its central role in lithium-ion batteries used in electric vehicles and energy storage systems. The rapid growth in global lithium demand, combined with Europe's dependence on imported lithium and the environmental limitations of conventional extraction methods, has intensified the search for more sustainable recovery strategies [1]. In this context, nanoporous materials have emerged as promising materials for selective lithium recovery from aqueous media.

Selective lithium recovery from aqueous systems remains highly challenging because lithium ions are small, strongly hydrated, and commonly present at much lower concentrations than competing ions such as Na^+, K^+, Mg^{2+} and Ca^{2+}. Lithium extraction processes are often energy-intensive, chemically demanding, and have environmentally impacts, particularly when applied to low-grade or secondary sources such as geothermal brines, seawater or industrial effluents [2]. This work proposes the use of tailored nanoporous materials as selective sorbents for lithium recovery from aqueous media.

Several nanoporous materials were synthesised and evaluated through batch sorption experiments. Lithium removal tests were performed under controlled conditions while varying parameters such as sorbent dose, contact time and pH. Lithium concentrations were quantified by ICP-OES.

Preliminary results demonstrated that sorbent dose strongly influences lithium removal efficiency. One of the materials studied achieved up to 99% lithium removal after 48 h at a sorbent dose of 5 g/L. These findings highlight the potential of nanoporous materials for the sustainable and selective lithium recovery from aqueous media.

Keywords. *Lithium; Recovery; Nanoporous materials; Sorption; Aqueous matrices*

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Novel xeno-free hPLMA/dECM-MA biomaterial for 3D DLP bioprinting

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Abstract. Over the years, Digital Light Processing (DLP)-based 3D bioprinting has emerged as a promising technology to develop platforms that accurately mimic native human tissues.[1,2]A fundamental factor in bioprinting techniques is the bioink's composition and properties. Recently, researchers developed photopolymerizable biomaterials of human origin – human methacryloyl platelet lysates (hPLMA) and methacrylated decellularized extracellular matrix (dECM-MA) derived from placentas.[3,4]This work aimed to combine hPLMA with dECM-MA, creating a novel xeno-free bioink for DLP bioprinting.
To achieve this, precursor solutions of hPLMA and dECM-MA were prepared at 15% and 1%(w/v), respectively, in a photoinitiator solution.The ink was prepared by combining the precursor solutions in equal parts and adding a photoabsorber. Biocompatibility studies were conducted in hPLMA/dECM-MA hydrogels with cultures of human adipose stem cells(ASCs), and after 7 days of culture hydrogels were stained for live/dead and nuclei/actin filaments observation.Vertical distribution of cells in a bioprinted structure was assessed with nuclei-stained cells and hydrogels were characterized through compression tests, photorheological assays and Scanning Electron Microscopy (SEM) imaging. To prove the capability of these biomaterials for bioprinting, a bioink with ASCs was bioprinted and after 7 days, live/dead and nuclei/actin filaments staining were carried out.
Simple structures were printed, demonstrating high shape fidelity, resolution, structural stability and reproducibility. Live/dead and nuclei/actin filaments staining images revealed good cell viability and proliferation, including in the bioprinted hydrogels, and bioprinted constructs demonstrated evenly distributed cells. The hydrogel characterization tests revealed that by modulating the biomaterials' concentrations, proportions or functionalization degrees, their mechanical and structural properties can be finely tuned to meet specific TE requirements. The tunability of the herein developed bioink, combined with its human origin and inherent content of bioactive and structural proteins, positions it as a highly translational bioink for the fabrication of physiologically-relevant, stable scaffolds supporting long-term in vitro cell culture and potential clinical applications.

Keywords. *Digital Light Processing; Human Bioink; Platelet Lysates; Placenta; Tissue Engineering*

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Reprogramming poly(ethylene terephthalate) for circularity: green ring opening polymerization and cyclodepolymerization of PET/PEF copolyesters

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Abstract. Biomass-derived platform molecules have emerged as attractive alternatives to widely consumed petroleum-based polymers. This is the case of 2,5-furanedicarboxylic acid (FDCA), the starting monomer used to prepare poly(ethylene 2,5-furandicarboxylate) (PEF), which has emerged as a highly promising replacement of poly(ethylene terephthalate) (PET), due to the superior gas barrier properties, higher glass transition temperature and enhanced mechanical strength. However, the large-scale replacement of PET by PEF remains challenging due to the high cost of FDCA, making partial substitution, via copolyester synthesis a more practical approach [1]. Moreover, those copolyesters are usually synthesized using bulk step-growth polymerization, which typically involves harsh reaction conditions. Among greener polymerization techniques, ring-opening polymerization (ROP) a significant advantage. It achieves high atom economy by avoiding by-product formation and can operate under milder reaction conditions with high polymerization rates [2]. In this context, we have introduced PEF/PET copolyesters synthesis via a mild ROP of the corresponding cyclic species approach using a non-toxic bismuth catalyst which acts at lower reaction temperatures than other tin-based ones. the obtained copolyesters were thoroughly characterized by NMR, FTIR, viscosimetry, and XRD, while their thermal properties were evaluated using TGA, DSC, and DMTA. Preliminary studies confirmed also their potential for chemical recycling via cyclodepolymerization methodology.

Keywords. *Poly(ethylene furanoate), poly(ethylene terephthalate), copolyesters, ring opening polymerization, furanic polyesters, Bismuth-based catalysts; cyclodepolymerization and recycling*

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Chasing the SAN: dissolution-based recycling of ABS polymers

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Abstract. With global plastic production on the rise, important engineering polymers such as acrylonitrile–butadiene–styrene (ABS) are no exception: ABS production capacity reached 14 Mt in 2022 and is projected to exceed 20 Mt by 2027 [1]. Despite its widespread use in automotive, electronics and durable goods, efficient recycling of ABS remains challenging due to its multiphase morphology and structural complexity; with a promising solution to this issue involving the utilization of physical recycling processes such as dissolution. Recently, *greener* alternative solvents have attracted attention for various purposes, owing to their potentially low toxicity, as well as their cost-effective synthesis [2]. Thus, this work aims to develop a technology for physically recycling ABS based on the use of renewable solvents, in alignment with circular economy principles. To this end, an extensive *in-silico* screening of benign, safe-by-design, and suitable renewable-based solvents for selectively dissolving the styrene-*co*-acrylonitrile (SAN) from the polybutadiene rubber (PBR) of ABS was performed using the Conductor-like Screening MOdel for Real Solvents (COSMO-RS). This thermodynamic method was used to calculate the activity coefficients of polymers in solution (at infinite dilution) for a library of >60 renewable-based solvents. Results suggest that oxygenated, carbonyl-containing, and moderately polar solvents are the most promising for the selective dissolution of SAN. Subsequently, experimental dissolution tests confirmed that the identified family of solvents was indeed the most effective. The waste-derived recycled SAN products were then characterized using various spectroscopic techniques, including Fourier-transform infrared spectroscopy (FTIR) and ^{1}H nuclear magnetic resonance (NMR), for structural analysis and process validation, achieving yields above 60% and purities up to 99.6%. In summary, this study suggests that careful selection of appropriate renewable solvents for the efficient and selective dissolution and recovery of complex engineering polymers, such as ABS, represents a significant advancement in the circular management of plastic waste.

Keywords. *Acrylonitrile-butadiene-styrene; Styrene*-co-*acrylonitrile; Polymers; Recycling; Dissolution; Chemical physics*

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Sustainable fast sintering of thermoelectric ceramic oxides

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Abstract. Thermoelectric materials enable the conversion of waste heat into electricity, a promising technology for sustainable energy and off-grid systems in the Internet of Things. However, their use is limited by the scarcity and toxicity of elements required for the highest-performance thermoelectric materials [1]. Strontium titanate-based electroceramics provide an alternative using relatively cheap and abundant precursors, when properly manufactured to enhance electrical conductivity and lower thermal diffusivity [2].

This work introduces ultrafast high-temperature sintering (UHS), using carbon strips as heaters in inert atmosphere and allowing a sintering to occur in 3 min, as a manufacturing method to produce dense Nb-doped $SrTiO_3$ (STN) ceramics. The reducing sintering conditions cause an enhancement of the charge-carrier concentration, increasing the electrical conductivity. Moreover, the fine microstructures resulting from the extreme heating rates of UHS should act as phonon-scatterers, aiming to reduce the lattice contributions to thermal conductivity. Together, these effects can cause an increase of ZT compared with conventionally sintered ceramics, across various stoichiometric compositions.

These results show great promise for UHS as a more energy efficient option for the production of thermoelectric materials with increased performance and open the door for future studies to enhance the ZT by other low embodied energy methods.

Keywords. *Thermoelectrics; Strontium titanate; ultrafast high-temperature sintering; oxygen vacancies; microstructure*

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Biocatalytic valorisation of avocado seed biomass for the development of functional bioplastics

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Abstract. The environmental pressure to replace petroleum-based plastics has accelerated the search for sustainable materials derived from agrifood by-products [1]. This work focuses on the enzymatic valorisation of avocado seed biomass, rich in starch and phenolic compounds, aiming to enzymatically optimise or modulate its antioxidant potential, without compromising its ability to form bioplastics. Laccase acts as a biocatalyst, promoting the oxidative polymerisation of phenolic molecules within the starch matrix, while changes in phenolic content and enzyme activity are monitored through spectrophotometric analyses [2], [3]. By controlling enzymatic activity, this approach is expected to enhance the antioxidant functionality of the avocado seed-derived material while preserving its structural integrity and bioplastic-forming capacity [4]. This study integrates biotechnology, green chemistry and materials engineering, demonstrating how enzymatic biocatalysis can be monitored and optimised to valorise agro-industrial residues, combining enhanced antioxidant properties with functional bioplastic production.

Keywords. *Agro-industrial residues, Oxidative biocatalysis, Phenolic polymerization, Circular bioeconomy, Sustainable processing, Functional biomaterials*

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Effect of ionic liquids on the enzymatic digestion of antibodies for antigen-binding fragments production

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Abstract. Antigen-binding fragments (Fabs) are a class of antibody derivatives that, due to their reduced size and lack of the crystallizable fragment (Fc) when compared with full-length antibodies, offer better tissue penetration and lower immunogenicity. Conversely, the lack of Fc hinders the application of the well-established capture/purification technique for full-length antibody purification – Protein A chromatography – for Fabs downstream processing. Despite the advances achieved in Fabs production, their downstream processing constitutes the major contributor to their high biomanufacturing costs, lacking standardized methodologies and relying on multiple chromatographic techniques that are difficult to scale up, laborious, time-consuming, and resort to expensive affinity ligands and hazardous organic solvents [1]. The development of alternative purification platforms is, therefore, crucial to overcome this bottleneck, enabling scalable, cost-effective, and more eco-friendly production of high-quality and purity Fabs, required to meet the market demands. Ionic liquids (ILs) are salts constituted by large organic cations and smaller organic/inorganic anions, that have been successfully applied to the extraction and partial purification of monoclonal antibodies (mAbs) from cell culture supernatants as components of aqueous biphasic systems (ABS) [2]. Thus, it is expected that IL-based ABS can also be a promising approach as an alternative platform for the capture and purification of Fabs produced through papain digestion of antibodies. Aiming at the integration of the up- and downstream processes of Fabs, in this work, we studied the influence of ILs on papain's ability to digest antibodies. The papain concentration for commercial polyclonal immunoglobulin G (IgG) digestion was optimized without the presence of ILs in the digestion medium, and then, the influence of different families of ILs in the digestion process was investigated at the best conditions identified. Digestion mixtures were analyzed by size exclusion high-performance liquid chromatography (SE-HPLC) to assess the enzymatic digestion efficiency and Fabs production performance along 24 h. The effect of the addition of ILs to the papain and IgG secondary structure was also investigated to infer on possible IL-induced modifications. The results that were obtained provide new insights into ILs influence on enzymatic digestion performance, showing their potential application in the development of simpler and effective alternative platforms for Fabs downstream processing.

Keywords. *Antigen binding fragments; downstream processing; ionic liquids; enzymatic digestion*

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Avian Immunoglobulin Y as biopharmaceutical strategy to address Antimicrobial Resistance

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Abstract. Antimicrobial Resistance (AMR) is a severe global health concern often associated with antibiotic misuse, with Methicillin-Resistance *Staphylococcus aureus* (MRSA) representing one of the most harmful pathogens [1,2]. Immunoglobulin Y (IgY) can be envisioned as an alternative to conventional therapeutics due to their polyclonal nature that not only allow it to recognize multiple epitopes on a single antigen, as well as to reduce the risk of bacterial resistance [3]. In this work, IgY targeting Penicillin-Binding Protein 2a of MRSA was investigated as a biopharmaceutical for the treatment of related infections. Antibodies were purified from the egg yolk of hyperimmunized hens by a process based on a selective precipitation method with a biopolymer. IgY formulations, with and without stabilizers, were prepared and stored under diverse conditions. Protein aggregation and structural integrity were evaluated by Size-Exclusion High Performance Liquid Chromatography and Circular Dichroism, respectively. Antigen-antibody recognition was assessed by dot-blot and Enzyme-Linked Immunosorbent Assays, whereas toxicity was evaluated in both human colorectal adenocarcinoma cell lines and rodent models. The stabilizers minimize protein aggregation, and the antigen recognition was preserved overtime, while no *in vitro* and *in vivo* toxicity was confirmed. Alternative purification strategies were also studied, namely one resorting to Three-Phase Partitioning Systems (TPP), based on Aqueous Biphasic Systems formed by polyethylene glycol and sodium polyacrylate, with cholinium-based Ionic Liquids as electrolytes. Under suitable compositions, IgY selectively precipitated at the TPP interphase, enabling its simpler recovery. The potential of TPP as efficient, biocompatible and simple platform for IgY downstream processing was confirmed, achieving a purity of >90% in a single step from the WSPF. These findings support IgY as a safe and effective biopharmaceutical towards infections related to MRSA, attending AMR challenges.

Keywords. *Antimicrobial Resistance; Methicillin-Resistant Staphylococcus aureus; Biopharmaceuticals; Immunoglobulin Y; Purification*

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FEMCE.multiphysics – a comprehensive tool for magnetic regenerator optimization

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Abstract. The optimization of magnetic regenerators is critical for the improvement of the performance of magnetic refrigeration. FEMCE [1] was created to facilitate this process by simulating the non-linear magnetostatics problem considering a given regenerator shape and refrigerant material, determining the Magnetocaloric Effect (MCE), as well as the demagnetizing field-induced Rotating Magnetocaloric Effect (dRMCE). This work extends the capability of FEMCE to calculate other important quantities, namely the magnetic work and force/torque required to (de)magnetize the refrigerant; the pressure drop of the passing fluid; and the time it takes for the heat to transfer to the fluid and after an adiabatic (de)magnetization. This software, which was named FEMCE.multiphysics, was made publicly available on GitHub [2]. This simulation tool can be employed in optimization problems, including comparing the efficiency of different thermomagnetic processes [3].

Keywords. *finite-element method; multiphysics; magnetocaloric effect; fluid flow; heat transfer; refrigeration*

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Bioengineering a humanized bone-on-a-chip model leveraging macroporous cryogels

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Abstract. There is an urgent need to develop robust and predictive platforms to test and optimize new therapies for bone healing. In recent years, organ-on-chips (OoCs) have emerged as powerful microscale systems that mimic organ-level functions by integrating perfusable microchannels with complex cellular architectures [1]. However, the effectiveness of these models strongly depends on the scaffold's ability to mimic the structural intricacies of the native tissues. For bone engineering, high porosity and interconnectivity are key features, and cryogels offer controllable, highly porous, and biocompatible structures with tunable mechanical properties that emulate in vivo structural complexity [2].

The aim of this work is to develop a novel biomimetic 3D bone-on-a-chip model based on human placenta (hPC)-derived cryogels as an innovative platform that can be explored to investigate the effects of advanced therapeutic medicinal products on bone regeneration at an injured site. Human methacryloyl PC (hPCMA) cryogels were fabricated via photocrosslinking followed by freeze-drying, resulting in scaffolds exhibiting a fully interconnected macroporous network (confirmed by SEM and 3D confocal imaging), as well as unique shape memory and rapid swelling kinetics. These cryogels were integrated into a microfluidic device designed to enable controlled and continuous fluid flow. Human Bone Marrow-derived Mesenchymal Stem Cells (hBM-MSCs) were seeded onto the scaffolds and subjected to dynamic perfusion to induce osteogenic differentiation, assessed through the expression of key osteogenic markers and matrix mineralization. Our results demonstrate that the interconnected porosity ensured efficient nutrient transport and oxygenation, sustained cell viability, and progressive infiltration for up to 21 days of culture. Overall, this study validates the successful integration of hPCMA cryogels into microphysiological systems, providing a physiologically relevant bone model for evaluating therapeutics efficacy in tissue regeneration.

Keywords. Bone-on-a-chip; Human-derived biomaterials; Cryogels; Microfluidics

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Shaping the future of RNA bioprocessing: from purification until its improved stabilization with biobased ionic liquids

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Abstract. The major challenges constraining the widespread application of RNA-based therapeutics continue to be related with RNA instability issues, particularly during its long-term storage, and the complexity/cost associated with conventional purification strategies. In fact, current RNA bioprocessing technologies still lack efficient strategies that prevent RNA degradation and thus allow RNA to perform its therapeutic function [1]. Given the exposed, amino-acid-based ILs (AA-ILs) may play a significant role in this field, due to their tunable and biocompatible character and their ability to establish specific affinity interactions with RNA nucleobases [2].

To tackle both challenges, this work aims to develop efficient platforms for the stabilization and purification of RNA from real biological matrices using biobased ILs, aqueous biphasic systems and related three-phase partitioning (TPP) approaches.

A novel set of AA-ILs combining amino acids in the cation and/or anion was synthesized and characterized. Purification studies demonstrated that ABS formed by polypropylene glycol 400 $g.mol^{-1}$ and the ILs argininium chloride, cholinium L-phenylalaninate, cholinium DL-aspartate stand out as the most promising ones, allowing the selective precipitation of the impurities, and thus fitting within the TPP concept. Regarding the stability studies, several aqueous solutions of AA-ILs in concentrations ranging from 0.1 to 10 mM were investigated, and circular dichroism spectroscopic measurements revealed that aspartate-based ILs stand out as the most promising AA-ILs in maintaining the structural stability of RNA after a 10 month-storage period, at room temperature. Complementary cell viability studies performed onto two human cell lines confirmed the non-cytotoxic nature of the synthesized AA-ILs. Ongoing work focuses on the application of molecular dynamics simulations to identify the mechanisms ruling-out the ability of ILs responsible for their enhanced purification and stabilization performances over RNA.

These findings highlight the potential of the selected AA-ILs as versatile platforms to obtain high-quality RNA molecules with potential use as biotherapeutics.

Keywords. *RNA-biopharmaceuticals; Three-phase partitioning systems; Long-term storage; Excipients*

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Exploring biological valorization of lipid industry waste streams through acidogenic fermentation by mixed microbial cultures

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[*] Corresponding author: andreoliveira98@ua.pt ; [†] Presenting author; CICECO – Aveiro Institute of Materials, Building matter: from atomic design to material reality.

Abstract. Lipid industry waste from food processing and household kitchens have increased significantly, with spent frying oil (SFO) and the wastewater generated during the cleaning of SFO transport tanks (TTWW) standing out due to their difficult treatment. Both waste streams share similar environmental challenges and therefore require effective valorization strategies to mitigate their impact [1]. Thus, this study aims to explore the possibility of using SFO and TTWW as substrates for acidogenic fermentation (AF) to produce short-chain organic acids (SCOAs). SFO was composed of 97.9% triacylglycerides, mainly esterified oleic (49.1%), linoleic (26.6%) and linolenic (14.5%) acids, with a high chemical oxygen demand (COD) of 1032.14 g COD/L. TTWW exhibited a carbohydrate content of 67%, with glucose as the main constituent, and a COD of 90.04 g COD/L. Four wastewater treatment plant (WWTP) sludges were tested as inocula, two aerobic (AES and AESER) and two anaerobic (ANS and ANSER), with varying food-to-microorganism (F/M) ratios of 1:1, 1:2, 2:1 and 3:1 g COD/g Volatile Suspended Solids (VSS). Assays with pH control at 5.5 and 10.5 using ANS as inoculum, at a F/M ratio of 1:2, were performed. All assays led to significant SCOAs production, with the ones using TTWW as substrate leading the highest acidification degrees and diverse SCOAs mixtures of acetic, propionic, butyric and valeric acids. SFO-based assays mainly produced acetic and propionic acids, while pH-controlled experiments broadened the SCOAs spectrum without significantly increasing yields. A continuous stirred tank reactor (CSTR) operating with TTWW revealed a production of mainly propionic and acetic acids, highlighting shifts in metabolic patterns under continuous larger volumes operation. Overall, this work demonstrates the feasibility of converting SFO and TTWW into valuable SCOA-rich streams, highlighting their potential integration into sustainable bioprocesses.

Keywords. *Acidogenic Fermentation, Spent Frying Oil, Transport Tank Wastewater, Short-Chain Organic Acids, Mixed Microbial Cultures*

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Exploring the use of chitosan for the development of novel thermoplastic and thermosetting materials

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Abstract. Over the past years, growing attention has been given to the use of biobased resources as an alternative to fossil fuels, whose depletion and extensive usage have contributed to serious environmental problems [1]. In this context, oceans represent a unique source of functional biopolymers, and particularly of polysaccharides. Amongst marine polysaccharides, chitosan is one of the most explored and studied [2].

This PhD aims to develop new functional and more sustainable materials incorporating chitosan or its derivatives into thermoplastic or thermosetting formulations, decreasing their fossil-based content, while potentially being imparted with some interesting novel functionalities, such as antimicrobial properties. For this, three approaches were explored. The first approach consisted on the development of more hydrophobic chitosan derivatives by chemical modification with aliphatic isocyanates, to be used as additives in thermoplastic formulations.

The formulations were prepared by melt-mixing the chitosan derivatives with poly(propylene) or poly(hydroxybutyrate) and processed in form of films by melt-pressing. These films were fully characterized regarding their thermal and mechanical properties, as well as other relevant features, such as water absorption and color parameters. The second and third strategies aimed at the production of more sustainable cork thermosets using chitosan as a direct replacement of the conventional poly(urethane) resin (up to 30%) or for the design of a fully biobased binder in combination with an organic acid, leading to an increase in the total biobased content of the cork-based materials. The materials were characterized thoroughly, and showed good structural integrity, and thermal and mechanical properties comparable to the industry standards, while having new functionalities due to the presence of chitosan. These works prove the potential of integration of chitosan in everyday materials without compromising their functions and even imparting some interesting properties.

Keywords. *Chitosan, Cork, Thermoplastics, Thermosetting*

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Pressing-induced electrical signals in flexible pdms/knn/graphite hybrid generators

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Abstract. Flexible PDMS-based composites are attractive for mechanical energy harvesting and self-powered sensing because their electrical response can be tailored by filler selection and electrical poling. However, the combined effect of a lead-free piezoelectric material like potassium-sodium niobate (K0.5Na0.5NbO3, KNN, 30 wt.%) and a conductive path (graphite, G, 2 wt.%) on PDMS films (PDMS/30KNN/2G) has not been systematically addressed. In particular, the correlations among filler dispersion, filler-induced mechanical behavior, charge alignment under poling, and the influence of these factors on the pressing-induced electrical response under dynamic conditions remain underexplored in the literature for this composition. In this work, the pressing-induced electrical response and dielectric behavior of those films, as hybrid generators, combining triboelectric and piezoelectric effects, with an emphasis on the effect of Corona poling on the two-filler system (PDMS/30KNN/2G-pol), are analyzed. Microstructure (optical microscopy/SEM), density (Archimedes), and tensile behavior (tangent modulus) were investigated for a comprehensive discussion of dielectric and electromechanical performance. The PDMS/30KNN/2G-pol exhibited an enhanced dielectric response, reaching a relative permittivity of $\varepsilon r = 3.81$ at 10 kHz. Electrical output was quantified under periodic pressing using a dynamic shaker (10 Hz, ~1 N) across a resistive load (5 MΩ), with the electrodes in continuous contact to emulate realistic integration conditions. Variations in force (1 to 5 N), frequency (1 to 50 Hz), and load resistance (99 k to 5 MΩ) indicated that the nanogenerators possess higher performance at low frequencies, high forces, and 5 MΩ. Overall, the results demonstrate that Corona poling significantly enhances the dielectric response and electrical output of the PDMS/30KNN/2G-pol. The observed improvements are attributed to charge alignment induced by Corona poling and to the synergistic interaction between the piezoelectric and conductive fillers. The superior performance under low-frequency and high-force conditions provides a starting point for designing hybrid generators with this composition for use in energy-harvesting devices.

Keywords. *PDMS; potassium–sodium niobate (KNN); graphite; Corona poling; hybrid; pressing-induced electrical response.*

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Computer simulation of piezoelectricity in polymers

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Abstract. Piezoelectric materials can transform mechanical stress into electrical polarization, and electric field into deformation. This has been widely used for sensing applications, mechanical energy harvesting, and actuator applications, all of great interest for self-powered devices and biomedical applications [1]. Polymers are more flexible and stretchable than traditional piezoelectric materials, which are stiff and fragile by nature, enabling multiple new technologies and devices [2]. Nonetheless, there are limitations in terms of options and electromechanical coupling to be completely viable. Because of this, poly vinylidene fluoride (PVDF) is by far the main piezoelectric polymer on the market. PVDF is the most used one not only because of its high piezoelectric coefficient and flexibility, but also because its piezoelectric response is similar to traditional ceramics while other piezoelectric polymers display shear direction piezoelectricity [3]. Due to this, there is a huge demand to find new piezoelectric polymers that display their polarization perpendicular to the applied stress. Computational tools like chemical simulations can help in identifying piezoelectricity in polymers, but to achieve material screening, we need a simulation model capable of identifying and quantifying the piezoelectric effect in polymers. This work developed a semi-automatic high-throughput simulation protocol based on atomistic molecular dynamics that can identify and quantify electromechanical properties of polymers. This methodology could be used for material screening of new piezoelectric polymers and also better our understanding of piezoelectricity in polymers.

Keywords. *Piezoelectric polymers; Molecular dynamics; Atomistic simulations; Electromechanical coupling; High-throughput screening; Structure–property relationships*

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B-Phycoerythrin Encapsulated with Polysaccharides for Potential Plant-Based Food Uses

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Abstract. The increasing demand for sustainable food production has driven the development of innovative alternatives to conventional animal-based foods. Among these, plant-based seafood products have emerged as promising options that provide nutritional value, safety, and environmental benefits while aiming to replicate the taste, texture, and appearance of traditional seafood. Visual characteristics play an important role in consumer acceptance, creating a need for natural colorants that can enhance product appeal.[1]

Phycobiliproteins are photosynthetic pigments found in cyanobacteria, red algae, and cyanelles. They are classified based on their light absorption properties, amino acid composition, and chromophore characteristics. Major groups include phycoerythrin, phycocyanin, phycoerythrocyanin, and allophycocyanin, with phycoerythrin being the dominant form in Rhodophyta[1]. B-phycoerythrin has attracted significant interest due to its antioxidant and antitumor activities, highlighting its potential health benefits. In addition, its intense pink coloration makes it a suitable natural alternative to synthetic food pigments.

The use of algae-derived R-phycoerythrin in plant-based seafood products may improve visual appearance while supporting sustainability goals through reduced reliance on animal-derived ingredients. However, its broader application is limited by challenges related to the economic recovery of phycobiliproteins and the low stability of pigment–protein complexes.

This study focuses on improving the stability of algae-derived pigments using industry-approved methods and solvents. Encapsulation was employed as a stabilization strategy to protect pigments from environmental factors such as light and temperature. Renewable polysaccharides, including alginate, carrageenan, and inulin, were investigated as encapsulating materials [2,3]. Following extraction, samples underwent centrifugation and freeze-drying before stability testing under different conditions. Color changes were assessed using UV–Vis spectroscopy and color analysis, with the final objective of incorporating stabilized pigments into fish analog formulations.

Keywords. *B-Phycoerythrin; Polysaccharides; Algae; Plant-based Seafood; Food industry.*

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Preserved constituents in abiotic fixed spheroids enable NF-κB regulation without cGAS-STING activation

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Abstract. There is a growing need for localized cell therapies with a predictable and safe outcome [1]. Thus, alternatives to the use of viable mesenchymal cells have been sought, such as the use of abiotic fractions of these cells (such as the extracellular matrix) [2] or even inactivated cells [3], [4]. To understand the role of these different cellular fractions in immunomodulation, a comparative study was conducted between decellularized and devitalized mesenchymal cell aggregates. Decellularization followed well-established literature protocols, whereas cell inactivation and fixation were achieved using methanol. Biochemical characterization showed that the cellular fraction was successfully removed in decellularized aggregates, resulting in structures mostly composed of extracellular matrix proteins. In contrast, devitalized spheroids preserved dsDNA and other cellular components, including membrane domains. To evaluate the immunomodulatory properties of these materials, a reporter monocyte cell line was chosen to monitor the activation of a prominent inflammatory signaling pathway (NF-κB). The results demonstrated that devitalized spheroids reduced pathway activation in a dose-dependent manner (spheroid-to-monocyte ratio), unlike decellularized aggregates, which showed no significant effect. To assess if cellular remnants within devitalized spheroids could trigger an adverse response through another mechanism, a second pathway involved in DNA recognition (cGAS-STING) was also evaluated. The results indicated that devitalized spheroids did not induce basal activation of this pathway and successfully attenuated its stimulation in the presence of an agonist, supporting the safety of these biomaterials. We hypothesize that the surface domains preserved in the devitalized spheroids, and removed during the decellularization process, may be responsible for the different immunomodulatory effects observed for these two abiotic materials.

Keywords. *Devitalization; Decellularization; Immunomodulation; Spheroids; Extracellular matrix; Anti-inflammatory*

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Mechanochemical transesterification of potato starch with spent frying oil: elucidating starch–lipid interactions for water-tolerant biodegradable bioplastics

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Abstract. Secondary raw materials generated during food industry processing, typically regarded as low-value by-products, can be valorized through the development of water-tolerant biodegradable bioplastics[1]. In this context, this study investigated how mechanochemistry promotes transesterification between the hydroxyl groups of starch and the fatty acyl chains of the triacylglycerides present in spent frying oil (SFO), using potassium hydroxide (KOH) as catalyst. The experimental approach evaluated the transesterification reaction and subsequent film-forming capacity of starch recovered from potato chips, using commercially available potato starch as a reference. Both were processed as native dry starch (with the recovered starch previously freeze-dried and sieved) and pregelatinized starch, the latter prepared as a strategy to promote granule disruption and increase hydroxyl group accessibility for chemical modification. The two starches exhibited a similar amylose content, both within the range of 20% . When compared to neat starch-based films, all films with SFO/KOH exhibited improved stretchability and elasticity (both ca. 1–2×), and hydrophobicity (water contact angles of ca. 90º). Notably, films prepared from recovered pregelatinized starch exhibited higher hydrophobicity, reaching water contact angles of ca. 120º. ATR-FTIR spectra further confirmed the chemical modification of the starch samples through the incorporation of fatty acyl chains from SFO, as evidenced by structural differences of the carbonyl band (1740 cm^{-1}) among the produced films, although further studies are required to better understand the extent of this modification. Overall, these findings provide a foundation and highlight a promising green strategy for the development of water-tolerant starch ester-based bioplastics with enhanced hydrophobicity while simultaneously valorizing secondary raw materials from potato industry processing.

Keywords. *Starch-based bioplastic; Transesterification; Spent frying oil; Food industry by-products; Starch modification.*

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Supported ionic liquids for human serum pretreatment: enhancing cancer biomarker detection

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Abstract. The detection of cancer biomarkers in human serum, such as Prostate-Specific Antigen (PSA) and Human Epidermal growth factor Receptor 2 (HER2), has emerged as a promising non-invasive approach for the early detection and monitoring of cancer [1]. However, the analytical sensitivity of these biomarkers is significantly hindered by the presence of highly abundant serum proteins, such as human serum albumin (HSA) and immunoglobulin G (IgG), which comprise approximately 80% of the total serum protein content [2]. Consequently, biomarker analysis requires sample pretreatment and detection methods that rely on expensive and time-consuming resources and protocols [2]. Supported ionic liquids (SILs) have emerged as an innovative alternative, in which ionic liquids (ILs) are immobilized on solid supports such as silica, polymers, or other substrates [3]. This combination offers the advantages of ILs, such as stability, selectivity and tunability, while overcoming some of their limitations, including handling challenges and incompatibility with some analytical techniques [4]. In this study, two different SILs, namely [Si][C_3mim]Cl and [Si][N_{3888}]Cl, were synthesized to evaluate their potential as selective sorbents for serum proteins depletion and/or biomarker enrichment. The depletion efficiencies of HSA and IgG onto SILs were obtained by size exclusion-high-performance liquid chromatography (SE-HPLC). Enzyme-linked immunosorbent assays (ELISA) were assessed to quantify biomarker levels in the pretreated serum supernatant. Results showed that [Si][C_3mim]Cl effectively isolated 83% of PSA onto its surface, while 85% of IgG and 90% of HSA remained in the pretreated serum supernatant. Conversely, [Si][N_{3888}]Cl adsorbed 38% of IgG and 72% of HSA onto the SIL, allowing for a 50% HER2 recovery in the pretreated serum supernatant. Overall, these results demonstrate the versatility of SIL-based systems as robust, tunable platforms that can enhance serum pretreatment workflows and improve the reliability of biomarker analysis for prostate and breast cancer diagnostics.

Keywords. *Supported ionic liquids; Serum pretreatment; Cancer biomarker; Diagnostics.*

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Tuning laccase-driven poly(vinyl alcohol) depolymerisation through polyol-based biosolvents

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Abstract. Polymer-based liquid formulations (PLFs), used in detergents, coatings, and personal care products, contribute to the release of persistent water-soluble polymers into aquatic environments [1]. Among them, poly(vinyl alcohol) (PVA) is of particular concern due to its widespread use in detergent pods, coatings, and packaging applications, together with a high chemical stability that limits degradation under environmentally relevant conditions [2]. While microbial PVA degradation has been reported, it often depends on pyrroloquinoline quinone-dependent dehydrogenases, limiting broader implementation of enzymatic PVA depolymerisation [3,4]. In this work, the laccase-driven oxidative depolymerisation of PVA was investigated in polyol-based biosolvent media under mild conditions.

Polyols with different carbon chain lengths and hydroxyl group contents were screened to understand how solvent polarity, hydrogen-bonding capacity, and viscosity affect enzymatic behaviour. Laccase activity monitored at pH 4.5 over 14 days showed that short-chain, highly hydroxylated polyols enhanced laccase activity, with glycerol-containing media displaying approximately 200% higher apparent activity than buffer controls at 10–25 wt% after 7 days. PVA depolymerisation assays in selected media showed measurable reductions in polymer molecular weight. 2,2′-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid) (ABTS) and 2,2,6,6-tetramethylpiperidin-1-oxyl (TEMPO) were evaluated as mediators, while a Design of Experiments (DoE) approach was applied to assess the combined effects of laccase concentration and glycerol content. Response surface analysis showed higher PVA depolymerisation at intermediate enzyme and glycerol concentrations than at maximum levels. These findings highlight the potential of polyol-based biosolvents to enhance enzymatic PVA depolymerisation and contribute to mitigating the environmental persistence of PLF-derived polymers.

Keywords. *Poly(vinyl alcohol); Laccase; Bio-based solvents; Enzymatic depolymerisation; Laccase-mediated systems*

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Development of protein extraction and recovery from *hermetia illucens*

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Abstract. The urgent need to identify alternative protein sources for improved food sustainability, due to the substantial economic and environmental costs of conventional protein sources, as well as the versatility of insect-based proteins in medicinal and food formulations have highlighted insects as a promising alternative [1]. Insects provide significant amounts of energy, protein, essential amino acids and micronutrients, while requiring less feed, water and land for the production of 1 Kg of edible protein compared to livestock such as poultry or cattle [2], as well as possessing meaningful amounts of other compounds of interest, such as chitin and chitosan. Accordingly, this work aimed to develop a more efficient and sustainable technology for the extraction and purification of proteins from insect flour, specifically from *Hermetia illucens* (Black soldier fly, BSF), with the ultimate goal of creating a framework that allows for the implementation of insect protein in food, medicine or other products.
In this work, protein extraction was carried out with NaOH solutions [2]. Initially the extraction and recovery of proteins from different BSF flours, namely defatted and non-defatted samples were evaluated. Several operational parameters were optimized by response surface methodology, including extraction time, temperature, solvent concentration and solid-to-liquid ratio. Total protein content and protein profile of the extracts were assessed by the bicinchoninic acid assay and SDS-PAGE, respectively. Based on the results obtained, it is possible to demonstrate the development of a highly efficient and more sustainable protein extraction process, surpassing previously reported findings [3,4]. Techniques such as FTIR, Circular Dichroism and SEM analysis have allowed for a better understanding of the characteristics of the insect powder and protein preparations. Ongoing work continues in order to optimize operational conditions to maximize the efficiency of protein recovery and to study the cytotoxicity and ecotoxicity potential of the preparations.

Keywords. *Insects; Hermetia illucens; Protein Extraction; Sustainability; Optimization*

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Engineering multifunctional bio-based composites from potato side streams and onion/garlic peel-derived fillers: structure–property relationships for sustainable paper coatings

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Abstract. The agrifood sector is one of the main contributors to food waste, with significant quantities generated during both industrial processing and consumer use. Among these, potato, onion, and garlic processing industries generate large amounts of undervalued residues, including starch-rich washing effluents and lignocellulosic peels. These byproducts contain valuable bioactive constituents, such as polysaccharides and phenolic compounds, making them attractive raw materials for the development of sustainable bio-based products within food-related value chains [1]. Although starch-based bioplastics are appealing because of their biodegradable nature, their practical application is often limited by poor mechanical strength and weak barrier properties. In this study, a sustainable upcycling approach was investigated through the incorporation of onion peel (OP) and garlic peel (GP) powders into starch-based coatings to improve their functionality and performance. The addition of OP imparted an orange coloration to the coatings, while GP resulted in a brown shade. Mechanically, OP enhanced the Young's modulus of paper by up to 150%, whereas GP caused a reduction of up to 66%. Both additives increased the hydrophobicity of the coated surfaces (50% for OP and 30% for GP) and demonstrated strong antioxidant activity, indicating the successful incorporation of bioactive compounds. Furthermore, all coatings adhered effectively to the paper substrate. Overall, the results highlight the potential of agrifood waste valorisation through a circular economy approach, supporting the development of functional and sustainable bio-based coatings with improved properties for paper-based applications.

Keywords. *Paper coatings; starch; onion peels ; garlic peels*

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Distributed photonic molecular logic in lanthanide-bearing MOFs via multi-channel emission

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Abstract. Silicon-based technologies are approaching their physical and practical limits as chip miniaturization continues and the demand for computational power increases. Computational and materials research is therefore being pursued to bridge the growing gap between technological potential and current capabilities. Among the emerging alternatives, molecular computing is a promising approach, enabling computational tasks at the microscopic scale in challenging environments.[1]

Metal–organic frameworks (MOFs) based on trivalent lanthanide ions (Ln^{3+}) are ideally suited for information processing because their optical properties, modulated by light excitation and temperature, can be exploited. Eu^{3+} and Tb^{3+} act as luminescent optically active centers in molecular logic systems and emit over a broad wavelength range spanning the UV–Vis–NIR spectral regions, with characteristic narrow line-like emission bands (<10 nm) and long-lived excited-state lifetimes (>1 μs). Furthermore, the tunability of MOFs enables precise control over the local environment surrounding Ln^{3+} ions, thereby influencing their luminescent behavior and responsiveness to external stimuli. Consequently, Eu^{3+}/Tb^{3+} mixed MOFs are highly attractive for the development of molecular logic gates, using excitation wavelength and temperature as logical inputs.

By precisely tuning the relative composition of Gd^{3+}, Tb^{3+}, and Eu^{3+} within a structurally invariant framework, the optical response can be encoded at the material level, resulting in modular platforms for distributed multi-channel photonic logic. The photonic input is provided by the excitation wavelength, while spectrally resolved Tb^{3+} and Eu^{3+} emissions serve as multiple output channels. Finally, we introduce temperature as an independent control input, enabling dynamically reconfigurable logic. These results establish a distributed approach to molecular logic in which functionality is governed by material composition, providing a scalable pathway toward parallel and adaptive photonic computing.

Keywords. *Molecular logic; Lanthanide-based MOFs; Photonic computing; Isophthalic acid, Functional luminescent material*

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Challenges and best practices in the interpretation of DNA evidence in court

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Abstract. The interpretation of DNA evidence in court has become an increasingly significant issue in forensic science and criminal justice, particularly in complex cases in which errors in interpretation may contribute to misunderstanding or miscarriages of justice. One of the principal challenges lies in translating scientific findings into clear and accurate legal language without oversimplifying, distorting, or overstating the evidential significance of DNA results. Then, the forensic expert plays a central role, not only in conducting scientifically robust analyses, but also in preparing clear reports, well-founded expert opinions, and reliable courtroom testimony in accordance with professional and ethical best practice.

The interpretation of DNA evidence is grounded in scientific and technical principles that underpin forensic genetic analysis. These include the use of different genetic markers, such as short tandem repeats (STRs), single nucleotide polymorphisms (SNPs), mitochondrial DNA (mtDNA), and Y-chromosomal STRs, each of which may be appropriate in different forensic contexts. Equally important are the laboratory procedures involved in DNA analysis, including extraction, quantification, polymerase chain reaction amplification, and the analysis of amplified products. The reliability of the final interpretation depends not only on the correct execution of these procedures but also on an awareness of their limitations, particularly with regard to sample quality and quantity. Such limitations may significantly affect the evidential value of the results, especially in cases involving mixed DNA profiles, which remain among the most complex areas of forensic interpretation.

Beyond these scientific and technical foundations, the correct interpretation of DNA evidence in court depends on a broader analytical framework comprising six crucial aspects: levels of interpretation [1], probability and statistics [2], standards, quality and accreditation, ethics and legality [3], cognitive and human factors [4], and communication in court. Together, these dimensions shape the evaluation, contextualisation, and presentation of DNA evidence in legal proceedings and are essential to ensuring that its probative value is properly understood and the risk of misinterpretation is minimised.

This study seeks to examine these aspects in order to elucidate the principal causes of miscarriages of justice, contributing to their prevention and to enhancing the reliability of forensic science evidence.

Keywords. *Levels of interpretation; Probability and statistics; Quality assurance and accreditation; Ethics and legality; Cognitive and human factors*

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Improvement of pine resin production and its valorization

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Abstract. Pine resin, extracted from conifers of the genus Pinus (Pine) is composed of rosin and turpentine. The traditional extraction is made using a stimulant paste based on sulfuric acid, harmful to the environment and to those who handle it. Pine resin is a valuable raw material with several industrial applications, whose demand is global demand is increasing. Thus, alternative safer and more effective stimulants are required. Simultaneously, the demand for sustainable alternatives to fossil-based plastics has driven interest in cellulose-based materials, whose inherent hydrophilicity and high air permeability limit their application. In this context rosin components might play an important role on improving cellulose based materials barrier properties for packaging applications. The present study has been devoted to the development of a bio-based eutectic formulations (EM) were developed as eco-friendly stimulants for pine resin production, as well as to the development new paper coated materials using rosin or rosin esters combined with ethyl cellulose (EC) and phenolic antioxidants. The results demonstrate that systems based on choline chloride and oxalic acid with Fe^{2+} as a stimulant paste increase resin production up to three times compared to sulfuric acid, while maintaining the chemical composition of the resin unchanged. [1,2] Furthermore, the coatings developed for food packaging exhibited a significant improvement in hydrophobicity (water contact angles above 120°), a 99% reduction in air permeability, and a 65% reduction in the water vapor transfer rate (WVTR). Practical validation using Rocha pears confirmed the effectiveness of the coating in reducing weight loss and the browning index. [3] In summary, this study demonstrates that it is possible to guarantee a safer and more sustainable process from the forest to the final product, highlighting the potential of resin-based systems.

Keywords. *Natural resin; Stimulants; Rosin; Food packaging; Bio-based coatings*

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Cell-driven dynamics of spontaneous particle folding

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Abstract. This study investigates whether mesenchymal stem cells (MSCs) can autonomously generate mechanically instructive microenvironments by exerting contractile forces on flexible polymeric substrates, and whether this remodeling influences cellular organization[1]. Poly(ε-caprolactone) (PCL) ultrathin membranes were fabricated into ~500 μm microgeometries [2]. MSCs were seeded in suspension onto these particles and cultured for up to 14 days. Adhesion, proliferation, and particle deformation were monitored as a function of cell density and polymer stiffness. Mechanical behaviour was evaluated across different PCL concentrations, and coarse-grained numerical simulations including bending and stretching were used to model deformation under cellular traction forces.

Cell-mediated folding of PCL microparticles was governed by geometry, stiffness, and cell density. Intermediate stiffness (2.5% PCL) supported optimal proliferation and strong density-dependent bending. Softer particles (2%) deformed rapidly and uncontrollably, while stiffer particles (3%) showed limited remodeling. Higher stiffness shifted deformation toward particle centers and promoted more aligned, near-perpendicular cell organization, indicating increased force requirements. Polymer concentration also controlled edge thickening, creating stiffness heterogeneity that modulated long-term deformability without major changes in overall shape. Simulations showed that folding requires collective cellular forces, as individual cells only generate local deformations, while coordinated activity is needed for full folding.

Substrate stiffness and geometry regulate MSC-driven remodeling and the architecture of resulting hybrid structures. Inhibition of contractility significantly reduced deformation, confirming the role of active force generation. Experimental and numerical results agreed, showing that folding emerges from the interplay between cellular traction and material properties. Overall, these findings improve understanding of cell-driven mechanical remodeling of soft substrates with potential applications in engineered microenvironments for regenerative strategies.

Keywords. *Mechanotransduction; Stifness; Ultrathin Membranes; Mechanobiology; Deformation*

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Electroactive poly(L-lactic acid) polymer thin films for neuronal cells modulation

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Abstract. Neural injuries and disorders often disrupt the electrical signaling required for proper nervous system function, leading to impaired cellular communication and tissue regeneration [1]. Current electrical stimulation strategies in neural tissue engineering are frequently limited by invasive procedures and dependence on external equipment, giving rise to the development of electroactive biomaterials capable of generating localized electrical cues autonomously [2,3]. This work investigates poly(L-lactic acid) (PLLA), biocompatible, biodegradable and electromechanically active polymer, which has been processed as thin films towards an electrically active platform for control over neuronal cell behavior through periodic surface potentials modulation. A 2.5 wt% PLLA solution was prepared and deposited on top of stainless steel 316L substrates by spin coating and crystallized using Rapid Thermal Annealing under different atmospheres, including air, oxygen, nitrogen, and vacuum. The resulting films were characterized through morphological, structural, and electrical analyses using Optical Microscopy, Scanning Electron Microscopy, Fourier Transform Infrared Spectroscopy, and X-ray Diffraction. Furthermore, wettability studies as well as *in vitro* assays of cytotoxicity and immunomodulation were performed. The results showed that films treated in air, oxygen, and nitrogen developed periodic spherulitic structures with dimensions comparable to PC12 neuron-like cells, while vacuum conditions suppressed crystallization. Structural analyses confirmed the formation of the α-phase in crystalline films. In addition, localized electrical polarization and surface potential patterns were observed in crystalline films, in air and nitrogen conditions. All crystalline films demonstrated suitable wettability, cytocompatibility, and no immunogenic activation. These findings highlight the potential of crystalline PLLA thin films as electroactive platforms capable of delivering localized electrical cues for neural tissue engineering applications.

Keywords. *Poly (L-lactic acid); Electroactive materials, Periodic surface potential, Piezoelectricity, Neural tissue engineering*

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Reverse bioprinting based on hydrogel waveguides with luminescent photocrosslinking sensing

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Abstract. The development of waveguides with tailored optical and mechanical properties is essential for the design of devices capable of efficiently delivering light through biological tissues. However, conventional silica optical fibers present limitations for biomedical applications due to their mechanical mismatch with soft tissues and restricted light penetration caused by absorption and scattering phenomena [1]. In parallel, current three-dimensional (3D) bioprinting approaches remain limited in the fabrication of complex and functional biological architectures [2]. In this context, hydrogel-based optical waveguides have emerged as promising alternatives due to their flexibility, biocompatibility, implantability, minimally invasive nature, and ability to deliver light directly within complex biological environments while minimizing tissue damage and immune response [3].
This work proposes a novel strategy based on 3D biofabricated alginate waveguides incorporating trivalent lanthanide ions (Eu^{3+}) for localized light delivery using low-power light sources, including LEDs and LASERs. The proposed waveguides are designed to efficiently guide light through tissue while serving as templates for channel formation within gelatin methacrylol (GelMA) hydrogels through internal photocrosslinking. This concept was demonstrated by 3D printing alginate-based bioinks using GelMA containing calcium ions as the support bath; after crosslinking of the bath and by leaching the alginate component using ethylenediaminetetraacetic acid (EDTA), we could obtain perfusable channels with controlled geometry within the hydrogel. By combining localized light delivery with in situ material crosslinking and spatially controlled hydrogel biofabrication, this approach aims to expand current waveguide-assisted and 3D bioprinting methodologies.
Furthermore, the integration of optical guidance, localized photocrosslinking, and sensing functionalities within a single platform may provide a versatile framework for advanced biomedical applications. The proposed system is being investigated for applications in optogenetics, regenerative medicine, and targeted therapeutic delivery, where precise spatial control of light and material structuring is critical.

Keywords. *Three-dimensional bioprinting; Alginate waveguides; Eu^{3+}; Localized light delivery; Photocrosslinking*

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Steady-state and time-resolved fluorescence analysis of ELP-TEMP as a step toward organelle-targeted intracellular thermometry

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Abstract. Understanding intracellular temperature variations is essential because temperature is a dynamic biophysical parameter influencing cellular function, yet resolving local heat production at subcellular scale remains technically demanding. Luminescence thermometry offers remote optical readout, high thermal sensitivity and spatially resolved measurements for intracellular temperature studies [1]. Fluorescent protein-based thermometers are suitable for live-cell studies because they can be genetically targeted to specific intracellular compartments [2]. Here, we investigate ELP-TEMP as a genetically encoded fluorescent thermometer for monitoring intracellular temperature variations based on FRET, a non-radiative energy transfer process that occurs between closely spaced donor and acceptor fluorophores. ELP-TEMP combines an elastin-like peptide with two fluorescent proteins, mVenus and mTurquoise2, a widely used FRET pair in biosensing applications. Through appropriate localization sequences, this sensor can be directed toward selected organelles and has been reported to reach a maximum thermal sensitivity of 45.1% per °C [3].

This work characterizes the temperature-dependent fluorescence response of ELP-TEMP. Emission spectra were acquired upon excitation at 430 nm over a 20–95 °C range to evaluate how ELP-TEMP emission responds to temperature. In parallel, time-resolved fluorescence measurements were performed using Time-Correlated Single Photon Counting between 25 and 75 °C to investigate whether the temperature-dependent spectral changes are accompanied by modifications in fluorescence lifetime. The decays curves were recorded under the excitation at 390 nm and monitored from 440 to 640 nm in 2 nm increments, enabling lifetime analysis across the donor and acceptor emission regions. These will help validate the proposed FRET-based sensing mechanism, since changes in FRET efficiency should affect the excited-state dynamics. So far, these tests have been conducted under controlled buffer conditions. This initial characterization is a necessary step before progressing toward intracellular-mimicking environments and, ultimately, organelle-targeted intracellular thermometry, with particular interest in mitochondrial temperature sensing.

Keywords. *Intracellular Thermometry; Fluorescent Proteins; Temperature Dependent Emission Spectra; Decay Curves; Fluorescence Lifetime*

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Building bioinspired zinc–flavonoid coordination materials: structural design and antioxidant/antibacterial activity

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Abstract. Flavonoids are natural polyphenolic compounds with recognised antioxidant and antimicrobial properties, and their coordination to metal ions is a well-established strategy to enhance and diversify their bioactivity [1]. The growing interest in dual-active systems arises from the fact that oxidative stress and bacterial infections frequently co-occur in pathological conditions, making multifunctional agents capable of restoring redox balance while suppressing bacterial growth particularly attractive [2].

In this study, new bioinspired Zn(II) complexes derived from quercetin and morin were synthesised using 1,10-phenanthroline or 2,2′-bipyridine as co-ligands, employing greener methodologies, namely solvothermal and microwave-assisted synthesis, as alternatives to traditional reflux-based approaches, and were fully structurally characterised. The complexes exhibited markedly enhanced properties compared with the parent flavonoids, achieving up to 99 % antioxidant activity and strong antibacterial effects against *Staphylococcus aureus* and *Pseudomonas aeruginosa*, with reductions in bacterial viability of ~7.5 log CFU mL^{-1} after 48 h. These findings highlight flavonoid-based Zn(II) complexes as promising multifunctional platforms for next-generation antioxidant and antibacterial agents.

Keywords. *Quercetin; Morin; Zn(II) complexes; Antioxidant activity; Antibacterial activity*

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Alternative Sample Pretreatment and Microfluidic Strategies for Enhanced Biomarker Analysis

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Abstract. Biomarkers play a key role in clinical and exposure monitoring, yet their reliable detection in human samples remains a major challenge due to matrix complexity and interference from high-abundance proteins [1]. Current analytical approaches often involve laborious sample pretreatment and remain poorly compatible with integrated and miniaturized platforms, limiting performance [2]. To address these limitations, this work explored aqueous biphasic systems and related solid-phase extraction approaches, alongside microfluidic technologies, as alternative strategies for sample pretreatment and biomarker analysis. Polyethylene glycol-bovine serum albumin systems were developed as a matrix-mimetic approach for the selective extraction of inflammatory biomarkers from human serum and plasma, enabling high-abundance proteins to be retained in the protein-rich phase while target interleukins were recovered in the polymer-rich phase. Additional aqueous biphasic systems based on polypropylene glycol and biocompatible salts were designed to control serum protein depletion through precipitation or phase retention, supporting the recovery of environmental exposure markers such as bisphenol A. The same separation principles were then translated into solid-phase extraction formats using polymer-based and ionic-liquid-supported materials, which enabled selective protein depletion and biomarker recovery from human serum. Finally, aqueous biphasic systems were combined with microfluidic devices to support miniaturized sample pretreatment and detection of cancer biomarkers, including prostate-specific antigen and human epidermal growth factor receptor 2, associated with prostate and breast cancer, respectively. Overall, this work demonstrated the versatility of aqueous biphasic system-based strategies for reducing matrix effects and improving biomarker analysis across diverse bioanalytical contexts. Green metrics further supported their sustainability, reinforcing their potential for simplified bioanalytical workflows compatible with miniaturization.

Keywords. *Bioanalysis; Serum protein depletion; Biomarker recovery; Miniaturized diagnostics; Sustainable sample preparation.*

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Understanding the role of microstructure and magnetic domains - finite-temperature micromagnetics in magnetocaloric.

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Abstract.
The microstructure of magnetocaloric materials is an essential factor in limiting or boosting their performance as solid-state magnetic refrigerants for high-efficiency cooling applications [1]. Traditional computational models of micromagnetics are not intended for this type of materials that exhibit second- or even first-order magnetic phase transitions and which operate exclusively at high temperature, near T_c [2]. We present a new finite-temperature micromagnetic model, purpose built to extend traditional micromagnetic theory to be compatible with these materials - the Landau-Lifshitz-Bernoulli equation (LLBe). The LLBe can, by design, directly couple atomic-scale simulations with micromagnetics and output consistent predictions of bulk magnetic properties at finite temperatures, from below to above the material's T_c. The LLBe model is validated against established solvers: MUMAX3 [3] for zero-temperature micromagnetics, and FEMCE [4] for high-temperature classic magnetostatics. We present an application of the LLBe model by simulating Heat-Assisted magnetic recording on a thin magnetic track with local heating, demonstrating the multi-scale finite-temperature capabilities of the LLBe.

Keywords: *Microstructure; Phase transitions; Micromagnetics; Magnetocaloric; Finite-temperature*

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N_20 sequestration from nitric acid industry tail gas using membrane contactor loaded with non-volatile solvents

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Abstract.
Nitrogen oxides (NOx), such as NO, NO_2 and N_2O have several negative effects on the environment, human health, and biological ecosystems, including acid rain and ozone layer depletion.[1] According to the European Environment Agency, total NOx emission in 2023 amounted to 4978 Gg, being transportations the primary source (49.8%), followed by agriculture (13.8%), combustion processes in the energy supply sector (12.8%), and industry (12.8%).[2] Regarding the emissions from combustion processes, the most widely applied NOx removal technologies are reduction-based processes, namely selective catalytic reduction (SCR), selective non-catalytic reduction (SNCR), non-selective catalytic reduction (NSCR) and eletrocatalytic reduction, adsorption and absorption processes.[3] Despite the existing technologies, nitrous gas emissions in nitric acid plants during transient operation periods, such as start-up and shutdown, remain a significant technological challenge. This challenge highlights the need for more efficient and environmentally friendly mitigation strategies tailored to these transient periods. Non-volatile solvents, particularly Ionic Liquids (ILs), have emerged as promising alternatives to conventional solvents, due to their negligible vapor pressure, high thermal stability and tuneable properties. However, direct implementation in traditional separation units is limited by the large separation units and high energy demands for solvent recovery.[4] To address these challenges, we proposed a membrane contactor using hollow-fiber polyetherimide membranes coated with a thin Pebax® layer functionalized with ILs, combining the high sorption capacity and selectivity of ILs with the modularity and scalability of membrane technology.

Keywords. *Ionic Liquids, Mixed-Matrix Membranes, Gas Separation and N_2O emission reduction.*

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Is age just a number? Paternal factors and early embryo development in donor oocyte cycles

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Abstract. In recent decades, both maternal and paternal ages have increased due to social, economic, and technological factors. While the adverse effects of advanced maternal age on reproductive outcomes are well established, the impact of paternal age remains less clear[1,2]. Male aging has been associated with declining semen quality and increased sperm DNA damage, but its influence on assisted reproductive technologies outcomes is still debated[2,3]. This retrospective cohort study included 131 patients undergoing intracytoplasmic sperm injection with donor oocytes at Procriar Clinic between January 2024 and December 2025. Donors were aged 18–34 years and met standard health criteria. Patients were divided based on paternal age into two groups: <40 years (n=52) and ≥40 years (n=81). Primary outcomes included fertilization, cleavage, blastulation, and clinical pregnancy rates. Secondary outcomes assessed sperm concentration and motility before and after selection using a microfluidic sperm sorting device. Baseline progressive motility and normal morphology were significantly lower in men aged ≥40 years compared to those <40 years (43.0% vs 61.5%, p = 0.0035; 4.0% vs 6.0%, p = 0.008), while sperm concentration was similar (p = 0.96). Post-processing motility did not differ significantly (p = 0.24), although a trend toward lower sperm concentration was observed in older men (p = 0.06). The number of metaphase II oocytes was comparable between groups. Embryological outcomes were numerically lower in the ≥40 group, including fertilization (76.4% vs 82.9%), blastulation (61.9% vs 67.5%), and good-quality blastocysts (30.0% vs 37.6%), though differences were not statistically significant. Clinical pregnancy rates were also similar (61.4% vs 54.8%, p = 0.48). In conclusion, advanced paternal age is associated with reduced sperm quality and may contribute to subtle differences in early embryological outcomes. These findings highlight the importance of paternal factors in ART and suggest that conventional semen analysis alone may be insufficient, supporting the need for more comprehensive sperm assessment approaches[2,3].

Keywords. *paternal age; sperm quality; embryo development; donor oocyte*

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[CIDMA] Mathematics and aplications

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General model-based clustering methods for time series of counts and anomaly detection

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Abstract. Clustering count time series according to their temporal dynamics is an important task in many application domains, as it enables the grouping of processes that share similar behaviour. Since discrete-valued time series require models specifically designed for count data, we propose two general model-based clustering methods.

The first method assumes that the observed series arise from a finite mixture of probabilistic models, where each component corresponds to a distinct data-generating mechanism and therefore defines a cluster [1] [2], while the second combines the partitioning philosophy of K-means with model-based clustering [3]. In this framework, each cluster center is defined by a set of time series models parameters, and series are assigned to the cluster which has the highest conditional likelihood.

For both clustering methods, representative series are then identified to characterize the final groups. The proposed methodologies are evaluated through simulation studies involving scenarios of increasing difficulty, determined by the similarity between each cluster's parameters, and are further illustrated using real datasets.

For both methods, anomaly detection is performed within the identified clusters using machine learning techniques [4], namely Isolation Forest, Local Outlier Factor (LOF), and One-Class Support Vector Machines (OCSVM). This two-stage framework allows the detection of both point anomalies and anomalous sequences, providing a comprehensive characterization of unusual behaviour within groups of count time series.

Keywords: *Clustering; Count Time Series; INAR; INGARCH; Anomaly Detection*

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The role of AI assistance in learning and developing R-based tools

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Abstract. The increasing integration of AI (Artificial Intelligence) technologies into data science workflows is transforming how statistical software is learned and taught. In this context, R is an open-source statistical software widely used in data analysis, which provides a suitable environment for exploring AI-supported programming practices. The development of R-based tools, namely an R package and a Shiny application, as well as the learning process associated with their development, may be substantially influenced by the use of AI assistants. Therefore, the main objective of this project is to compare manual and AI-assisted programming approaches, focusing on their strengths and limitations in a learning context. To achieve this, a comparative development process is being conducted in which the same software components are implemented using two distinct approaches: (i) manual development following traditional R programming workflows, and (ii) implementation supported by Posit's AI assistant, a tool developed for use within the R ecosystem. This dual perspective enables a reflective analysis of coding efficiency, time consumption, and the suitability of AI-generated choices. It is widely acknowledged that AI assistance is particularly effective in supporting the initial structuring of code and in reducing the time spent on implementation details, such as syntax correction and the generation of repetitive code. In contrast, manual development tends to provide a greater depth of learning and a more critical evaluation of the choices made within the specific context of the problem. As this work is still ongoing, it remains an open question whether the benefits of AI-assisted tools outweigh their limitations in this specific task. Overall, this work provides a preliminary reflection on the role of AI assistants in statistical software development, highlighting trade-offs between efficiency and critical thinking, and contributing to current discussions on learning and productivity in AI-assisted programming.

Keywords. *AI-assisted programming, Comparative study, Manual programming, R-based tools, Software development learning*

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Revisiting bootstrap inference for Rosenthal's fail-safe number: truncation and ε-correction effects

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Abstract. Publication bias may compromise the validity of meta-analytic conclusions by selectively excluding studies with non-significant or negative findings, potentially inflating overall effect estimates [1]. Rosenthal's fail-safe number is one of the most widely used measures for assessing robustness against unpublished null studies [2]. Despite its popularity, its statistical properties and inferential framework remain insufficiently understood. Previous work [3] proposed confidence interval procedures based on simulation studies, but important limitations remain, including negative fail-safe number values, omission of the ε correction in the expectation due to asymptotic approximations, and the absence of an explicit significance condition. These limitations motivate a more rigorous evaluation under realistic settings. Accordingly, this study re-examined the coverage properties of bootstrap confidence intervals based on the standard normal approximation using an updated simulation framework that restricted attention to statistically significant meta-analyses and incorporated truncation at zero and the ε correction. Simulation experiments were conducted using $10,000$ replications with significance level $\alpha = 0.05$ and $1,000$ bootstrap resamples across symmetric and asymmetric distributional settings. Results show that truncation at zero improves coverage, particularly under skewed distributions, by removing infeasible negative fail-safe number values. The ε correction improves performance for small numbers of studies but becomes negligible as sample size increases. Its omission may lead to negative expected fail-safe number values and artificially inflated coverage. Restricting the analysis to statistically significant meta-analyses can yield unstable coverage when positive fail-safe number values are rare. Overall, the results underscore the importance of respecting parameter constraints and accounting for small sample corrections when constructing confidence intervals for Rosenthal's fail-safe number, particularly under non-Gaussian settings.

Keywords: *fail-safe number; simulations; bootstrap; confidence interval; coverage probability*

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An open-source EIDORS extension for magnetic detection electrical impedance tomography

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Abstract. Electrical Impedance Tomography (EIT) is an imaging technique where electrical current is injected through electrodes on the boundary of a physical domain and the resulting voltages are used to reconstruct that domain's interior conductivity distribution. The technique is of particular interest in medical applications due to being non-invasive, radiation-free, portable and capable of real-time monitoring.
Magnetic Detection Electrical Impedance Tomography (MDEIT) is a modality of EIT which instead relies on measurements of the magnetic field induced by the injected electrical currents to reconstruct the internal conductivity distribution.
MDEIT has demonstrated the potential to produce higher quality image reconstructions than conventional EIT, particularly in the setting of fast-neural imaging. This is likely due to the technique's increased robustness to noise, resulting from a less ill-conditioned inverse problem. These improvements, however, come at increased computational cost. Calculation of the so-called sensitivity (Jacobian) matrix, a necessary step in solving the least-squares optimization problem, can become a bottleneck in large-scale problems, and the finite-difference approach becomes unfeasible in this regime. The discrete adjoint state method addresses this drawback, resulting in an efficient algorithm to evaluate the sensitivity matrix.
A MATLAB implementation of this algorithm is developed, which achieves execution times comparable to conventional EIT in the EIDORS framework. This represents a significant improvement over the recently published approaches. This implementation is integrated in a open-source toolbox for image reconstruction that extends EIDORS functionality to MDEIT inverse problems.
Future work includes optimizing the magnetometer configuration via optimal experimental design, in order to increase the technique's robustness to noise, and to evaluate the performance of a combined EIT/MDEIT technique in regards to image reconstruction quality and computational burden.

Keywords: *Magnetic Detection Electrical Impedance Tomography; Adjoint State Method; Inverse Problems; MATLAB*

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Title: Mixed Dynamic Equations and Applications

Título: Equações Dinâmicas Mistas e Aplicações

Abstract:

Our current research is focused on the discrete-time domain to generalize the framework of linear higher-order homogeneous difference equations with delay in the coefficients, which was studied by [Jekl'2020], into the formulations presented in [Agarwal'2013]. While qualitative properties like oscillation and non-oscillation are well-mapped in standard continuous settings [Györi'1991; Pinelas 2009; Ferreira'2010] and simpler discrete models [Kelley'2009], unified results on arbitrary time scales [Bohner'2001; Belarbi'2024; Belarbi'2025] are still quite rare. Right now, we are digging into the asymptotic properties of the corresponding characteristic equations. The goal is to work out the exact sufficient conditions needed to guarantee the existence of positive solutions. This investigation matters a lot for real-world modeling—especially in biological systems and non-population conserving dynamics where states simply must remain positive to make physical sense [Belarbi'2025].

Keywords: discrete-time; continuous-time; difference equations; ordinary differential equations; dynamic equations on time scales; time-delays; mixed-type equations; mathematical modeling; oscillatory and non-oscillatory solutions; existence of positive solutions.

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Psychometric validation and multivariate analysis of primary school students' attitudes toward Mathematics using the TIMSS questionnaire

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Abstract. Assessing students' attitudes toward Mathematics is an important component of TIMSS (Trends in International Mathematics and Science Study) international studies; however, the adequacy of the Student Questionnaire – Grade 4 (SQ4) for Portuguese primary school students, particularly those in Grade 3, remains insufficiently explored [1,2].

This study analysed data from 775 Portuguese students from Grades 3 and 4 attending schools in central Portugal, collected using the TIMSS 2019 - SQ4. A confirmatory approach was adopted through Confirmatory Factor Analysis, reliability, validity and measurement invariance, complemented by an exploratory approach based on ClustOfVar [3].

The results confirmed the original four-factor structure – Students Like Learning Mathematics, Instructional Clarity in Mathematics Lessons, Disorderly Behavior during Mathematics Lessons, and Students Confident in Mathematics – showing excellent model fit (CFI=0.991; TLI=0.990; RMSEA=0.042; SRMR=0.057). Configural, metric and scalar invariance were also demonstrated across grades (ΔCFI$\leq$0.002; ΔRMSEA$\leq$0.001), indicating equivalent measurement across groups. The exploratory analysis revealed a clustering structure consistent with TIMSS factors, supporting its use as a complementary multivariate method for Likert-type data.

Inferential analyses identified statistically significant differences ($p<0.05$) related to gender and academic history, including previous failure in Mathematics and grade retention, particularly for Students Like Learning Mathematics, Instructional Clarity in Mathematics Lessons, and Students Confident in Mathematics. No consistent differences were observed for Disorderly Behavior during Mathematics Lessons.

Overall, the study confirms the psychometric adequacy of the SQ4 and demonstrates stable measurement across grades. The convergence between confirmatory and exploratory findings supports ClustOfVar as a complementary approach for latent structure analysis in educational questionnaires. These findings provide robust evidence for the use of SQ4 in Portuguese primary education and strengthen methodological approaches in educational assessment research. Future work will extend the approach to ordinal data and examine neurodevelopmental influences on students' attitudes toward Mathematics.

Keywords. *Factor scores; Clustering of variables; TIMSS*

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Dimensionality reduction methods for complex structured (3-way) and mixed-data.

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Abstract. Data analysis has a key role in many aspects of our day-to-day. A couple of years back the compilation of data was in itself a hard task but nowadays we have a number of uprising challenges which keep evolving as new applications are found. Some of the latest challenges we find in data are: (1) high-dimensional data (tensors, 3-way), (2)large volumes of data, (3)datasets with mixed types of measurements (quantitative and qualitative) , and (4) collection of data from multiple heterogeneous sources, arising with new technologies as it is Internet of Things, this comes with privacy concerns for the management of data. These challenges give us the opportunity to improve the analysis and knowledge acquisition. There are statistical methods used for pattern recognition and preprocessing of datasets to reduce its size, as Principal Component Analysis (PCA)[1]; however, they often work with assumptions on the datasets that nowadays are not always complied and need to be addressed with novel methods. Furthermore, it is important to find useful visualizations that make easy the interpretation and implementation across different application areas as this is also a relevant part of the methods used for pattern recognition. The aim of this work is to present some of the latest trends in methods to deal with dimension reduction and pattern recognition studied (personalized PCA [2], personalized Tucker [3]), and the areas of opportunity identified for the application of novel methods that address the mentioned challenges (environmental, medical and official statistics applications). The revision realized has shown potential areas of interest and novel methods that can be improved and expanded to tackle the challenges mentioned.

Keywords: *Principal Component Analysis; Pattern recognition; Complex data structures; Personalization; Heterogeneous sources*

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[CIDTFF] Research in education: social responsibility and transformative potential

Encounters with the city: plurilingual and multimodal pathways in the landscape of Aveiro with 9th grade students

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Abstract. Pedagogical practices that question, interpret, and critically engage with the reality of cities through their multisemiotic elements have proven essential for the re-signification of lived spaces [1] . Navigating such "assemblages" requires attention to the diverse trajectories of people, the semiotic possibilities available, and the objects embedded within them [2] . This research is grounded in a pedagogical project developed with 29 ninth-grade students (14 years old) over the course of one academic year within the framework of Curricular Autonomy Domains in a Portuguese school cluster. The project consisted of 15 collaborative 100-minute sessions connected to the Portuguese National Arts Plan and organized as collaborative learning ateliers and multimodal workshops. The pedagogical pathway included exploratory walks across the city of Aveiro, activities focused on observing and interpreting the Linguistic Landscape (LL), theatre interventions, and the creation of sensitive cartographies of the city [3]. Drawing on plurilingual, multimodal, and arts-based approaches, students engaged in symbolic mapping processes, critical reflection, and resemiotization of urban space, culminating in the development of a collective artivist project. The research, currently at an initial stage, seeks to understand how plurilingual and multimodal pedagogical practices may foster meaning-making processes, symbolic appropriation of the city, and critical and creative forms of engagement with urban space, as well as how participants describe, interpret, and construct meanings from the LL. As the analysis progresses, the study is expected to contribute to the development of knowledge on plurilingual and multimodal pedagogies, highlighting the potential of embodied participatory mapping, sensitive cartographies, and counter-mapping to position the city as a living pedagogical space: unfinished, contested, and continuously reshaped by those who inhabit it.

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Keywords. *Multimodality, Semiotic assemblages, Linguistic landscape, Sensitive cartographies, Artivism*

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Decentralising Education in Portugal: Between Local Democracy and Transnational Managerial Rationalities

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Abstract. Educational decentralisation is frequently framed as a mechanism for strengthening democracy and bringing participation and decision-making closer to local communities. Yet, a growing body of research suggests that these reforms have increasingly incorporated managerial rationalities promoted through transnational governance agendas. This study investigates how such global agendas are recontextualised within Portuguese national reforms, focusing on the tensions between democratic participation and managerial rationalities. A qualitative documentary analysis was conducted on a purposive corpus of OECD reports and Portuguese legislation enacted after 2018. The analysis examines OECD policy recommendations for Portugal, the institutional configuration of the decentralisation process, and the tensions emerging from the interaction between democratic participation and managerial mechanisms. The results reveal an ambivalent multilevel governance process in which democratic participation becomes increasingly subordinated to managerial rationalities centred on performance, accountability, and efficiency. The study concludes that OECD recommendations are selectively translated into national policy, prioritising managerial rationalities centred on performance, accountability, and efficiency over participatory democratic governance, thereby reconfiguring the democratic purposes of educational decentralisation.

Keywords. *Decentralisation; Education; Multilevel Governance; Democracy; Managerialism*

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Capacitação linguística de migrantes em contexto multilingue e multicultural: caracterização dos projetos municipais no Fundão, cidade Unesco de aprendizagem

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Abstract.
The increasing global mobility of populations has intensified linguistic and cultural diversity in contemporary societies, placing migrant integration at the centre of political agendas across Europe [1]. In this context, linguistic empowerment - understood as a systematic process of developing communicative and sociolinguistic competences oriented towards personal autonomy, civic participation, and professional integration [2] - emerges as a key lever for inclusive policies, particularly when grounded in plurilingual and intercultural approaches [3, 4].

This study examines language empowerment projects for adult migrants in the municipality of Fundão - a border territory recognised as European Capital of Inclusion and Diversity and a UNESCO Learning City - investigating how local policies promote linguistic integration and what conditions sustain them over time.
Grounded in the Common European Framework of Reference for Languages and the Framework of Reference for Pluralistic Approaches to Languages and Cultures, the research adopts a qualitative, descriptive-interpretive case study design. Data collection draws on documentary analysis of policy reports, semi-structured interviews and questionnaires with key stakeholders - migrants, teachers, cultural mediators, and local decision-makers -, and participant observation of training initiatives. A Future Workshop supports the co-construction of evidence-based recommendations.

Preliminary findings indicate that contextualised programmes of Portuguese as a host language, articulated with local employment sectors such as agriculture and hospitality, strengthen migrant employability and autonomy. These findings further suggest that policy sustainability depends on the continuous professional development of educational agents and the integration of participatory evaluation mechanisms into programme design.

This study contributes to the debate on the role of local authorities in promoting inclusive linguistic policies, offering transferable recommendations for territories facing comparable geographical and demographic challenges.

Keywords. *Portuguese as a host language; migrant linguistic inclusion; multilingualism; multiculturalism; municipal language policy*

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Literacia para a democracia e educação política: contributos do Parlamento dos Jovens nas perspetivas de estudantes e professores.

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Resumo

A presente comunicação visa, de forma muito sucinta, partilhar o percurso realizado desde a idealização do projeto de uma investigação académica focada na **literacia democrática** e na **educação política** através do programa **Parlamento dos Jovens**, até à data da presente comunicação. Seguida de uma breve reflexão construtiva da metodologia que se tem implementado no percurso de investigação, pretende-se revisitar a proposta inicial de forma a enquadrar-se a integração de alguns reajustes ao nível da metodologia e do próprio objeto de estudo, fruto, inclusivamente, da disponibilização de dados em *open source*, pela entidade promotora do projeto em estudo. Assim, visiona-se apresentar, infograficamente, o projeto parlamento dos jovens, os seus propósitos e entidade promotora. Nomeadamente, a evolução do mesmo ao longo de 30 anos, nas suas datas mais marcantes. Consubstancialmente, proceder-se-á à divulgação da revisão de literatura realizada no que concerne às políticas da Educação para a Cidadania e participação cívica, em Portugal, nos últimos 50 anos. Com o propósito de evidenciar de que forma a evolução legislativa do pós Estado Novo, ao longo de 50 anos, tem contribuído para a Educação para a Cidadania, em contexto escolar, integrando a legislação atual. Numa perspetiva aglutinadora e complementar será ainda integrado o alargamento do conceito de cidadania a campos digitais e financeiros. Consubstancialmente, associado às preocupações atuais sobre a salvaguarda da democracia e da cidadania, preconiza-se contribuir com algumas perspetivas teóricas sobre a participação cívica e política. Pretende-se, com as mesmas alicerçar a futura análise dos dados empíricos da investigação, criando uma lente de análise integradora e crítica dos mesmos. Por fim, deixar algumas expectativas merecedoras de destaque, no âmbito do trabalho já realizado e que se preconizam concretizáveis ao nível de escrita e comunicações futuras.

Keywords. *Educação para a cidadania; Educação Política; Parlamento dos Jovens; Participação cívica e política*

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Between children's curriculum and teacher education: early literacy and literacy in normative documents from brazil and portugal

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Abstract. This ongoing research, linked to a project developed within the scope of the Doctoral Research Abroad Program (PDSE), seeks to analyze the teacher education–curricular alignment of early literacy/literacy education in initial teacher education in Brazil and Portugal. In this context, alfabetização and literacia are not understood as equivalent terms, but rather as categories situated within distinct curricular and teacher education traditions, mobilized to understand the initial teaching of reading and writing in the two contexts. Taking this into account, although both countries recognize the importance of children's early learning of reading and writing, neither has a specific initial teacher education program for literacy teachers. Against this backdrop, the question guiding this investigation is: to what extent is there alignment between the curricular requirements related to early literacy/literacy education and the normative prescriptions concerning the knowledge expected in initial teacher education? The analytical corpus comprises Brazilian normative and curricular documents from 1996 onward, and Portuguese documents from 1999 onward. The choice of these milestones is justified by the legal reorganization of Brazilian education through the LDB, and by the effects of the Bologna Process on the configuration of teacher education in Portugal. The corpus includes, among other documents, the DCN [1] and the BNCC [2] in Brazil, and Decree-Law No. 79/2014 [3] and the Essential Learning Outcomes for Portuguese [4] in Portugal. Thus, the study investigates whether there is correspondence between what curricular documents prescribe as children's learning and what initial teacher education documents indicate as necessary knowledge for future teachers. This is a qualitative comparative documentary study, articulated with an interpretive literature review. Preliminarily, the selection of the corpus suggests a mismatch between the density of curricular prescriptions concerning reading and writing and the explicitness of corresponding knowledge in initial teacher education documents.

Keywords. *Initial teacher education; early literacy/literacy education; curriculum; comparative analysis; Brazil/Portugal.*

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Environmental science competencies in teachers training for environmental sustainability

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Abstract. Current socio-environmental challenges demand teacher training approaches that foster the integrated development of knowledge, capabilities, values, and action competencies [3]. Aligned with the PISA 2025 Science Framework, environmental science education must promote student agency in the Anthropocene [2]. Grounded in a socio-critical perspective [1], participatory methodologies serve as emancipatory strategies that encourage active engagement, knowledge construction, and decision-making [4]. Within this framework, we present a qualitative, descriptive-interpretative study that analyzes an intervention based on Project-Based Learning (PBL) focused on emerging environmental issues, contextualized for the students' future educational practice. The study was conducted with forty-two first-year Basic Education students over seven sessions (fourteen teaching hours). The investigation aimed to: (i) analyze the development of environmental science competencies resulting from participatory methodologies; and (ii) understand students' perceptions of the potential and challenges of these approaches for sustainability education.

Data collection relied on the instructor's participant observation and incorporated field notes, photographs, student outputs from supervised collaborative work, and individual critical reflections. Content analysis focused on student outputs and critical reflections, complemented by the triangulation of information from field notes to reinforce interpretive consistency [1]. The results reveal progress in students' scientific knowledge, systemic understanding, and internalization of sustainability principles, with participants recognizing PBL's contribution to developing scientific and pedagogical competencies. It is concluded that participation in project-based work methodologies, oriented towards context and authentic environmental problems, fosters the integrated development of cognitive, procedural, socio-emotional, and pedagogical competencies in environmental sciences, contributing to the training of educators and teachers capable of promoting educational practices committed to environmental sustainability. However, the contextual nature of the study, the small sample size, and the lack of longitudinal follow-up limit the generalizability of the findings, recommending future research to understand the consolidation of these competencies across diverse training and professional practice contexts.

Keywords*: Participatory methodologies, Environmental sciences, Environmental sustainability, Teacher training.*

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Ballet dance as a context for developing creativity in dance school programs: analysis using a realistic evaluation framework

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Abstract. This study is currently being developed within a PhD program at the University of Aveiro, and is being conducted in dance schools in Portugal, involving students aged 12-15 years (7th-9th grade). This research study intends to understand how ballet programs impact and can have a significant influence on student creativity. Therefore, we use a Realistic Evaluation by Pawson and Tilley (1997), which explores the mechanisms and contexts that influence creativity in dance education. The primary objective is to understand if ballet dance programs improve creative skills among students, identifying specific program elements that contribute to this development and finding out which students are less influenced by ballet dance training and why. For this research, we assume a mixed-methods approach that integrates quantitative and qualitative methods, using surveys, interviews, and student artwork analysis. The goal is to provide a strong structure for evaluating creativity in dance education, guaranteeing both cognitive and embodied aspects of the creative process are recognized and valued. Insights from Enhancing Creativity and Managing Perfectionism in Dancers through Implicit Learning and Sensori-Kinetic Imagery (Karin & Nordin-Bates, 2020) inform the evaluation methods and recommendations for improving the effectiveness of ballet programs in nourishing student creativity. Although creativity in dance education has been studied, there is still limited understanding of how ballet teaching supports implicit and sensorimotor creativity over time, how individual adolescent differences shape this process, and how pedagogical and cultural contexts influence the outcome.

Keywords. *Creativity; Ballet Education; Realistic Evaluation; Dance Education*

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Tema: Formação Docente em Pedagogia Inclusiva e Desenho Universal para a Aprendizagem no Ensino Superior em Angola

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Resumo. A crescente diversidade da população estudantil no ensino superior exige processos de desenvolvimento profissional docente capazes de responder às necessidades, características, ritmos e perfis de aprendizagem de todos os estudantes. Assim, o presente estudo visa compreender de que modo uma formação estruturada, no âmbito da Pedagogia Inclusiva e do Desenho Universal para a Aprendizagem, poderá contribuir para o desenvolvimento de práticas pedagógicas inclusivas no ensino superior angolano. Metodologicamente, o estudo adota uma abordagem de natureza qualitativa, de caráter interpretativo, configurando-se como um estudo de caso com componente interventiva. A recolha de dados envolverá inquérito por questionários e por entrevistas, análise documental de produtos dos participantes e registos em diário de bordo. A análise dos dados será efetuada através da estatística descritiva e da análise de conteúdo. Para o efeito, será concebido e implementado um programa de formação orientado para o desenvolvimento de competências pedagógicas inclusivas. Espera-se que os resultados contribuam para o desenvolvimento de práticas pedagógicas inclusivas, bem como para o reforço de políticas institucionais de inclusão no Ensino Superior em Angola.

Palavras–Chave; Pedagogia Inclusiva; Desenho Universal para a Aprendizagem; Formação de Professores; Ensino Superior; Angola

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A integração das TIC no currículo da formação de professores de Matemática em Angola: reflexões no âmbito de um projeto de investigação

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Resumo. O presente estudo centra-se em determinar os fundamentos teóricos e metodológicos que sustentam a integração das Tecnologias de Informação e Comunicação (TIC) no currículo da Licenciatura em Ensino da Matemática nos Institutos Superiores de Ciências da Educação (ISCED) de Angola. A investigação parte do reconhecimento de que as TIC assumem, atualmente, um papel relevante nos processos de ensino e aprendizagem, exigindo uma reflexão crítica sobre a sua integração no contexto da formação inicial de professores de Matemática.

O estudo procura compreender a relação entre currículo, TIC e formação de professores no Ensino Superior angolano, analisando de que forma as orientações curriculares previstas nos Projetos Pedagógicos dos Cursos (PPC) se materializam nas práticas pedagógicas. Metodologicamente, o estudo enquadra-se no paradigma interpretativo, com uma abordagem predominantemente qualitativa, recorrendo à análise documental, entrevistas semiestruturadas com docentes, grupos focais com estudantes e aplicação de inquéritos por questionários.

Entre os aspetos já identificados, destacam-se a perceção positiva sobre a importância das TIC no ensino da Matemática, a existência de limitações infraestruturais e formativos, bem como a necessidade de uma integração mais reflexiva, crítica e curricularmente estruturada das tecnologias no processo formativo. Espera-se que a investigação contribua para a reflexão sobre políticas e práticas curriculares relacionadas com a formação de professores de Matemática em Angola, particularmente no que se refere à operacionalização pedagógica das TIC no Ensino Superior.

Palavras-chaves. *Currículo; TIC; Formação de Professores de Matemática; Ensino Superior.*

Potencialidades e desafios da supervisão colaborativa com foco nas estratégias de ensino em contexto de ensino superior angolano na área de Ciências Sociais

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Resumo. A supervisão colaborativa constitui uma prática pedagógica que promove a reflexão crítica e a melhoria das práticas docentes. Desenvolvida entre pares, permite a observação mútua das aulas, a reflexão sobre estratégias de ensino, a partilha de experiências e a identificação de práticas mais eficazes, contribuindo para o desenvolvimento profissional dos docentes (Guerra et al., 2025). Segundo Flores (2021), esta abordagem favorece a melhoria contínua e a inovação pedagógica, embora enfrente desafios relacionados com a resistência à mudança, a limitação de tempo e a necessidade de formação. Este estudo de investigação-ação descreve a implementação de um programa de supervisão colaborativa centrado nas estratégias de ensino, envolvendo quatro docentes da área das Ciências Sociais de uma instituição de ensino superior privada em Angola. O estudo procurou responder às seguintes questões: (i) quais as potencialidades e os desafios da implementação da supervisão colaborativa com foco nas estratégias de ensino; e (ii) que estratégias de ensino foram utilizadas durante esse processo. Os participantes organizaram-se em dois grupos e realizaram observações de aulas nos cursos de Relações Internacionais, Gestão e Contabilidade e Psicologia. O processo compreendeu dois ciclos de supervisão, estruturados nas etapas de pré-observação, observação e pós-observação. No final, realizaram-se entrevistas semiestruturadas, cujos dados foram analisados com o apoio do software webQDA. Os resultados evidenciaram benefícios como o fortalecimento da confiança entre os docentes, a melhoria da comunicação pedagógica e a adoção de estratégias de ensino participativas, incluindo trabalho em grupo, discussão e participação dos estudantes. Entre os principais desafios destacaram-se a definição de objetivos claros para as aulas, a elaboração da grelha de observação, a gestão do tempo, a disponibilidade de recursos didáticos e o elevado número de estudantes. Conclui-se que a supervisão colaborativa constitui uma estratégia viável para promover o desenvolvimento docente e melhorar a aprendizagem dos estudantes, apesar dos desafios identificados.

Palavras–chave. Desafios; Potencialidades; Supervisão Colaborativa; Estratégias de ensino; Ensino superior angolano; Ciências sociais

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From evidence to public action: heritage-based sustainability education through the *Art Nouveau Path*

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Abstract. Scientific evidence generates greater public impact when it can be mobilized by institutions, professionals, and communities [1,2]. Starting from this premise, this study investigates how a mobile augmented reality heritage intervention can foster sustainability competences and generate actionable evidence for schools and local cultural actors. The intervention engaged students and teachers in curriculum-oriented mobile augmented reality activities centered on Aveiro's Art Nouveau heritage [3]. The focus is not on presenting a single intervention as a closed model, but on discussing how locally grounded research can generate actionable knowledge for schools, municipalities, cultural institutions, and digital learning ecosystems. This perspective is aligned with international frameworks that connect sustainability competences, cultural heritage, participation, and public responsibility [1–3]. A mixed-methods approach combined teacher validation, student responses, field observations, gameplay records, including spatial trajectories, and temporal data. Results indicate that heritage-based mobile learning can support public-impact-oriented education by making sustainability values visible in concrete urban contexts, particularly care, preservation, shared responsibility, fairness, and the relationship between nature, culture, materiality, and civic life [3]. The study argues that educational research can support local policy and curriculum innovation when evidence is embedded in participatory educational practices. The intervention illustrates how digitally mediated heritage education can connect sustainability learning, cultural participation, and local educational innovation. The study further demonstrates the potential of heritage-based digital learning to support sustainability-oriented civic engagement and evidence-informed educational practices.

Keywords. *Heritage education; Sustainability competences; Mobile augmented reality; Curriculum innovation; Civic engagement*

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Listening to decide: co-design of an educational resource to support pedagogical decision-making through interpretive listening to student voice

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Abstract. Inclusive education requires creating conditions that promote belonging, presence, participation, and achievement for all students [1]. In this context, listening to student voice emerges as a central pedagogical dimension, yet it is frequently reduced to symbolic approaches with little real impact on teaching practice [2]. This study examines how interpretive listening to student voice can inform pedagogical decision-making attuned to diversity in primary education, grounded in the assumption that listening to students means interpreting what they express about their learning, relationships and school experiences, and transforming that interpretation into pedagogical action. The research is framed within a *sociocritical* paradigm and adopts an *Educational Design Research* methodology [3], combining systematic inquiry with the collaborative development of an educational resource built with teachers and students. The resource is organized around a pedagogical mediation cycle: listening, interpretation, pedagogical decision-making, and feedback to students. A b-learning professional development course, with 25 hours distributed across face-to-face, synchronous, and asynchronous sessions, serves both as a research context and a space for co-constructing the resource. Preliminary findings reveal marked variation in teachers' ability to enact the full mediation cycle. In some cases, the cycle was completed in its entirety; in others, it remained at the level of collective listening, without progressing to interpretation and the corresponding pedagogical decision. These results indicate that interpretive listening is a complex competence, shaped by factors that training alone may not address. The study, therefore, highlights the potential of the educational resource as a practical mediating tool for bridging student voice and inclusive pedagogical decision-making.

Keywords. *Student voice; Inclusive education; Interpretive listening; Pedagogical decision-making; Educational Design Research; Primary education*

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A integração da IA generativa no ensino do Português: desafios, perspetivas e implicações

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Abstract. A crescente presença da IA generativa na sociedade levanta desafios éticos, sociais e educativos particularmente relevantes para o ensino da língua portuguesa. Embora estas tecnologias apresentem potencial para facilitar os processos de aprendizagem da leitura e da escrita, levantam igualmente questões relacionadas com a autoria, o pensamento crítico, os enviesamentos linguísticos, entre outros. Esta ambivalência salienta a necessidade de abordagens críticas e eticamente orientadas para a sua integração em sala de aula [1] [2].

Resultados do mais recente relatório do *EU Kids Online* evidenciam a pertinência deste debate em Portugal. Segundo Ponte *et al*.[3], 85% das crianças e jovens inquiridos utilizam ferramentas de IA generativa, sobretudo o ChatGPT, dos quais 78% têm idades compreendidas entre os 9 e os 11 anos. Em comparação com a média europeia, Portugal destaca-se pelo uso mais intenso e diversificado destas tecnologias, especialmente em atividades escolares. No entanto, este uso coexiste com conhecimentos limitados sobre os seus impactos sociais, ambientais e éticos.

Neste sentido, a presente comunicação reflete sobre o papel das políticas públicas e das práticas pedagógicas na integração da IA generativa no ensino da disciplina de português, desde o 4.º ano de escolaridade, privilegiando uma leitura crítica sobre a sua utilização neste contexto educativo.

Concretamente, defende-se a importância da investigação empiricamente sustentada sobre a contribuição efetiva da IA generativa para a aprendizagem da leitura e da escrita, bem como de abordagens educativas adequadas à idade, centradas na mediação docente, na colaboração entre pares e na literacia de IA, que promovam usos éticos, críticos e criativos destas ferramentas. São ainda discutidos os desafios associados à implementação destas abordagens, nomeadamente a necessidade de apoio às escolas, a formação docente, e o risco de aumento das desigualdades socioeconómicas no acesso e utilização destas tecnologias.

Keywords. *Ensino do Português; IA Generativa; 4.º ano do ensino básico*

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Formação parental: capacitação de pais e encarregados de educação para a cidadania digital e a prevenção do bullying/cyberbullying

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Abstract. A cidadania digital assume crescente relevância, exigindo estratégias educativas que promovam o uso ético e seguro das tecnologias, incluindo a prevenção do cyberbullying, em consonância com as diretrizes do Ano Europeu da Educação para a Cidadania Digital (2025) [1]. Neste contexto, o presente resumo centra-se na conceção e implementação de uma formação com encarregados de educação, promovida por um agrupamento de escolas, sobre cidadania digital e prevenção do bullying/cyberbullying. A comunicação visa: descrever o desenho da formação parental, discutir de que modo esta pode contribuir para o desenvolvimento da cidadania digital dos encarregados de educação e para a mediação de situações de bullying/cyberbullying e enquadrar estes contributos no âmbito das atuais políticas públicas de cidadania digital. Nesta etapa inicial do projeto, a intervenção decorreu ao longo de quatro semanas consecutivas e assentou numa metodologia participativa em grupos de trabalho, integrando a análise de cenários de parentalidade no âmbito da mediação familiar, da educação para a cidadania digital e da procura de respostas preventivas face a situações de risco. Pretende-se, assim, compreender de que forma a formação poderá contribuir para o desenvolvimento da cidadania digital dos encarregados de educação, para a apropriação de estratégias de mediação no âmbito do bullying e do cyberbullying e para a consolidação de pontes entre escola e família, delineando as opções metodológicas que orientarão a recolha e análise de dados nas fases subsequentes do estudo. A experiência é, por fim, enquadrada nas atuais políticas públicas de promoção da cidadania digital, destacando a relevância da formação parental e de programas de capacitação que privilegiam práticas participativas, contextualizadas e sustentáveis.

Keywords. formação parental; cidadania digital; *bullying; cyberbullying*

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Pontes entre universidade e comunidade para a inclusão através da aprendizagem-serviço

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Resumo. A Aprendizagem-Serviço, à luz da literatura [1], tem vindo a afirmar-se como uma abordagem pedagógica promotora da articulação entre formação académica, participação comunitária e inclusão social [2]. O presente resumo integra uma investigação em desenvolvimento que visa compreender os benefícios e desafios percebidos da Aprendizagem-Serviço no contexto da inclusão social [3], a partir das perceções de docentes, estudantes, parceiros comunitários e beneficiários finais envolvidos em projetos com enfoque inclusivo [4]. Foi adotada uma metodologia de natureza qualitativa, recorrendo à observação, a entrevistas semiestruturadas, à análise documental e à técnica de *World Café*. Até ao momento, foram realizadas observações durante a prestação do serviço à comunidade, bem como entrevistas com estudantes, parceiros comunitários e beneficiários finais. Os resultados preliminares evidenciaram que a Aprendizagem-Serviço contribui para a criação de ambientes mais inclusivos, para o fortalecimento das relações comunitárias e para o desenvolvimento de relações intergeracionais entre jovens e idosos. Destaca-se a promoção do bem-estar e da participação de pessoas com deficiência intelectual, que demonstram sentimentos de valorização e satisfação com o envolvimento dos estudantes. Contudo, emergiram desafios relacionados com o reduzido tempo de participação dos estudantes nos projetos, dificultando a continuidade das ações. Prevê-se, como passos futuros, a realização de novas entrevistas, observações em sessões de reflexão, análise documental e a dinamização de uma sessão de *World Café*. O estudo procurará aprofundar a compreensão dos impactos desta abordagem, contribuindo para reforçar o conhecimento em contextos educativos e comunitários. Em suma, a investigação reforça o potencial da Aprendizagem-Serviço enquanto estratégia promotora de inclusão, justiça social e responsabilidade social no Ensino Superior.

Palavras-chave: *Inclusão social; Metodologia ativa; Parceiros comunitários; Impacto social; Participação comunitária.*

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Autoestudo e aprendizagem profissional docente: um estudo em contexto português

Self-study and professional learning of teachers: a study in the Portuguese context

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Abstract. Face à necessidade de inovação pedagógica nas escolas para garantir uma educação de qualidade para todos, surge esta investigação focada no autoestudo enquanto abordagem que, embora pouco difundida em Portugal, goza de prestígio internacional por permitir aos profissionais da educação investigarem a sua própria prática e assumirem responsabilidade social na transformação dos contextos educativos [1]. Definindo-se como uma oportunidade para os docentes questionarem o seu conhecimento e as suas ações em contexto real através de interações reflexivas e colaborativas entre pares, o autoestudo potencia o desenvolvimento profissional docente e a produção de conhecimento científico partilhável sobre o ensino e a aprendizagem [2] [3].

Assim, surge o presente estudo com a finalidade de analisar o impacto do autoestudo na aprendizagem de professores em exercício de funções. Adotando uma metodologia de investigação-ação, de cariz qualitativo, enquadrada no paradigma sociocrítico, esta investigação estruturou-se em três ciclos de observação, nos quais a professora-investigadora contou com o apoio de dois amigos críticos na compreensão dos contextos, identificação de problemas e construção partilhada de soluções para a melhoria das práticas educativas [4]. Os dados recolhidos, provenientes de videogravações de aulas, diário de bordo, audiogravações dos diálogos com os amigos críticos, entrevistas e artefactos produzidos, evidenciaram um maior conhecimento de si, dos alunos e da realidade, bem como o reforço da confiança, da colaboração docente e da reorganização do conhecimento profissional com reformulação de estratégias pedagógicas. Estes dados estão a ser sujeitos a análise de conteúdo, com recurso ao software webQDA, sendo categorizados em duas dimensões: capacidade de reflexão e conhecimento docente.

Reconhecendo a importância do compromisso dos participantes e do tempo necessário à consolidação das mudanças, espera-se afirmar o autoestudo como uma estratégia formativa emancipatória que, articulando investigação, colaboração e reflexão sobre a prática, contribua para o crescimento profissional e a melhoria da qualidade da educação.

Keywords. *Autoestudo; Aprendizagem profissional docente; Prática reflexiva; Amigo crítico; Investigação em educação*
Self-study; Professional development for teachers; Reflective practice; Critical friend; Educational research

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Interculturalidade no ensino básico: práticas de mediação para a inclusão de imigrantes em Portugal

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Abstract. A crescente diversidade cultural nas escolas europeias tem impulsionado a adoção de práticas orientadas para a inclusão de alunos provenientes de contextos migratórios. Neste contexto, a mediação intercultural surge como estratégia essencial para promover o diálogo e a convivência entre grupos, favorecendo o reconhecimento do outro, a comunicação, compreensão mútua, regulação de conflitos, dentre outros benefícios [1] [2]. Contudo, apesar de existir há várias décadas, a mediação em Portugal carece de regulamentação em contexto escolar. A literatura destaca três lacunas principais: a escassez de estudos empíricos em contexto escolar português que analisem como a mediação intercultural é implementada nas práticas educativas; a limitada compreensão acerca dos mecanismos através dos quais essas práticas contribuem para a inclusão educativa de imigrantes, especialmente no ensino básico; e a ausência de modelos analíticos sistematizados que permitam compreender como práticas de mediação intercultural podem ser estruturadas e replicadas em contextos escolares multiculturais. É neste enquadramento que se insere a presente investigação. O estudo busca compreender de que modo práticas de mediação intercultural desenvolvidas em escolas do ensino básico português contribuem para a inclusão de alunos imigrantes, bem como identificar fatores institucionais, pedagógicos e relacionais que condicionam a sua eficácia. A investigação adotará uma abordagem qualitativa através de um estudo de casos múltiplos realizado em três escolas públicas integradas da Rede de Escolas para a Educação Intercultural (REEI), combinando análise documental, entrevistas semiestruturadas e grupos focais. O estudo pretende identificar e caracterizar práticas, mecanismos e ações de mediação intercultural promissoras no contexto de ensino e aprendizagem, compreender as perceções dos diferentes atores educativos sobre as práticas e analisar necessidades formativas emergentes. Com base nos resultados, será proposto um modelo analítico de mediação intercultural aplicável a contextos educativos multiculturais, juntamente com recomendações para a formação de atores educativos e para o reforço de políticas de inclusão escolar.

Keywords. *Práticas de mediação; Imigração; Interculturalidade; Educação intercultural*

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Without the person at the centre, there is no impact: rethinking the transition to post-academic life

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Abstract. Research into the post-academic transition for students with intellectual and developmental disabilities (IDD) remains limited and fragmented. Although conceptualised as multidimensional, the success of the transition is empirically reduced to employability as an implicit indicator, whereas self-determination and equally relevant dimensions, such as social inclusion and interpersonal relationships, remain poorly or not implemented. A distance between how transition is described and how it is measured is hard to ignore: studies frame it as a complex, multidimensional process, yet assess it almost exclusively through employment data. This is not a minor methodological choice, because, for students who do not enter the labour market, by circumstance or preference, their transition is not counted as successful, an exclusionary nature that replicates the exclusion that inclusive higher education claims to combat.

Drawing on a Design-Based Research (DBR) approach, this study takes place within the curricular internship of a fully inclusive higher education programme for students with IDD in Portugal, where a mediation system is being developed to organise support decisions. Within this system, self-determination structures the entire process, as both guiding principle and expected outcome, operationalised through Person-Centred Planning (PCP) and PATH, placing the student's life plan at the centre of decision-making, built around the individual rather than institutional criteria. The Support Intensity Scale, Adult Version (SIS-A), grounds this principle by identifying each student's support needs for full community participation. PCP and SIS-A converge in mediation strategies and individualised support plans, revised throughout the process with all those involved.

Evidence, on its own, does not reach action. Only when individuals decide their own path, and not others on their behalf, is the success of the transition measured by the life plan each student defines, in all its dimensions. Without the person at the centre of the decision, data does not translate into impact.

Keywords. *Intellectual and developmental disabilities; Inclusive higher education; Post-academic transition; Person-centred planning; Design-based research*

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Can external school evaluation promote the development of inclusive practices? evidence from a case study in Portugal

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Abstract. This study analyzed the extent to which external school evaluation, mediated by school leadership, fostered the development of inclusive practices within a school cluster in Portugal's non-higher education system. Within a policy and regulatory framework marked by the centrality of inclusive education, it sought to understand how the External School Evaluation Program, conducted by the Inspectorate-General of Education and Science (IGEC), as an instrument of institutional regulation and a driver of improvement, contributed to converting evaluative evidence – particularly the identified areas for improvement – into organizational action [1,2]. Recognizing that policy guidelines and evaluation results do not, by themselves, ensure sustained changes in school practices, the study analyzed the conditions under which external evaluation fostered, limited, or reconfigured processes of organizational development oriented toward inclusion. In this regard, the mediating role of school leadership in articulating public policy, evaluative evidence, and situated decision-making was highlighted. Methodologically, a qualitative case study design was adopted and interpreted through the lens of realist evaluation approach, enabling an understanding of the effects of external evaluation by examining the articulation between contexts, mechanisms, and outcomes [3]. Data collection included documentary analysis and semi-structured interviews with school leaders. The data were analyzed using content analysis [4] and in accordance with the context–mechanism–outcome configuration [3]. The results suggest that external evaluation can constitute a resource for reflexivity and strategic guidance, fostering processes of self-evaluation, monitoring, and institutional alignment around inclusion. However, its transformative potential depends on leadership vision, organizational culture, and the capacity to transform the areas for improvement identified by the IGEC into sustained practices. Thus, the impact of external evaluation emerges as a contextual, relational, and mediated process, reinforcing the importance of school leadership in moving from a legal framework and evaluative evidence to inclusive action [1,2].

Keywords: *School Leadership; External School Evaluation Program; Inclusive Education; Realist Evaluation; Portugal.*

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[CIPES] Shaping high education policy: evidence, governance and impact

Identification of Going Concern Uncertainties in Auditor Opinions as Explainable Indicators of Bankruptcy: Evidence from the Textual Analysis of Auditor Reports

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This study examined whether textual disclosures in auditor opinions provided meaningful signals of financial distress and supported the early prediction of corporate failure in Portugal. A dataset of 100 audit reports from Portuguese companies, obtained through the eINFORMA database, was analyzed using transformer-based machine-learning models to extract and classify linguistic patterns related to going concern uncertainties. These patterns included references to liquidity shortages, debt maturity pressures, financing constraints, operational deterioration, and increased default risk. The results showed that these textual indicators were strongly associated with bankruptcy events in the following year. Text-based predictive models outperformed traditional approaches relying solely on financial ratios, demonstrating that narrative elements in auditor opinions contained incremental information relevant for assessing insolvency risk. The findings confirmed that going concern disclosures functioned both as explanatory indicators of underlying weaknesses and as predictive indicators of future failure. The study concluded that incorporating textual signals from auditor opinions improved the accuracy, transparency, and interpretability of bankruptcy-risk assessments in the Portuguese context. Overall, the research contributed to the understanding of auditing, going concern evaluation, and bankruptcy prediction by demonstrating that textual analysis of auditor opinions constituted a robust tool for enhancing early detection of financial distress.

Keywords.

financial distress; going concern assessment; audit report analysis; insolvency risk; machine-learning models

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Quality Management in Angolan Higher Education

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Abstract. Quality management within the higher education subsystem in Angola has attracted increasing interest, driven by its potential impact on improving the quality of institutions in the sector, as well as its ability to foster their international recognition. The ISO 9001:2015 standard presents a set of requirements that promote improvements in organizational quality and may therefore serve as a model for higher education institutions seeking to implement effective internal quality assurance systems.
In this context, the present study aims to conduct a diagnosis of the existing quality management mechanisms in Angolan higher education institutions, as well as to understand the importance that the requirements of the ISO 9001:2015 standard may have for the implementation of internal quality assurance systems in these institutions.
To achieve this, a mixed-methods research approach was adopted, combining quantitative and qualitative methods. A questionnaire survey was designed and distributed by email to Angolan higher education institutions. A total of 150 responses were obtained from 75 institutions, with 39.5% from institutional leaders and 60.1% from quality managers.
In general, the results indicate that both institutional leaders and quality managers have a very positive perception of quality and quality management within their institutions, while also perceiving very positively the importance of the ISO 9001 standard's requirements for the implementation of internal quality assurance systems in their institutions. Moreover, concerns about quality and its management span the various dimensions of higher education institutions' missions—teaching, research, outreach, and governance.
To conclude, it appears that the necessary conditions—at least at the top management level—are in place for the successful implementation of internal quality assurance systems in Angola, fostering the development of a quality culture focused on the improvement of institutional processes.

Keywords. *Qualidade; SIGQ; ISO 9001:2015; Ensino Superior*

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Custeio baseado em atividades em instituições de ensino superior: Uma revisão sistemática da literatura

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ABSTRACT

Num ambiente económico cada vez mais globalizado e com uma rápida transformação digital, as Instituições de Ensino Superior (IES) enfrentam uma pressão crescente para gerir os seus recursos financeiros e operacionais com responsabilidade, transparência e de forma mais eficiente [1]. Neste contexto, o Custeio Baseado em Atividades (CBA) emergiu como uma ferramenta de gestão capaz de fornecer informações de custos mais precisas, apoiar a avaliação de desempenho e melhorar os processos de tomada de decisão nas IES [2,3]. Este estudo oferece uma visão abrangente e crítica da aplicação do CBA na gestão de custos em IES através de uma Revisão Sistemática da Literatura (RSL). Seguindo as diretrizes PRISMA, a revisão foi conduzida com recurso à base de dados *Scopus*, resultando numa amostra final de 14 estudos relevantes publicados entre 2014 e 2025. Estes estudos abrangem dez países distribuídos por quatro continentes - África, Ásia, Europa e Oceânia – destacando um conjunto diversificado de contextos institucionais e experiências de implementação. Os resultados mostram que a implementação do CBA em IES contribui significativamente para uma maior eficácia, eficiência, melhor alocação de recursos e apoio à gestão estratégica [3]. No entanto, a adoção enfrenta obstáculos como a falta de conhecimento técnico, a resistência organizacional e a falta de envolvimento da gestão de topo [4]. A literatura aponta para a formação contínua de gestores e colaboradores como essencial para ultrapassar estas barreiras [5]. Além disso, esta revisão identifica caminhos promissores para futuras investigações, especialmente a integração do CBA com tecnologias digitais emergentes - como a Inteligência Artificial, as ferramentas de automatização e a análise de *Big Data* – e o potencial destas abordagens combinadas para promover práticas de gestão sustentáveis e resilientes no ensino superior.

Keywords: Custeio baseado em atividades, gestão de custos, instituições de ensino superior, revisão sistemática da literatura.

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[CLLC] 404 Future not Found: evidence, powers and algorithms

A Lentidão como única via possível: Proposta para responder aos desafios da Transformação Digital

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Resumo. Nesta intervenção, pretende-se apresentar uma articulação crítica entre elementos de política europeia para a investigação, o papel das Ciências Socias e Humanas (CSH) e o papel desempenhado pela chamada transformação digital (incluindo o advento e aceleração do que comummente se apelida de "Inteligência Artificial" (IA), e dos chamados "algoritmos"] neste meio. Partindo de uma análise dos temas apontados como estratégicos de forma *top-down* pela Comissão Europeia, nomeadamente no Programa de Trabalhos para 2026-2027, do Cluster 2 do principal instrumento de financiamento de investigação na U.E., o Horizonte Europa, e sua contextualização, com um foco sobre os temas relacionados com a transformação digital, propõe-se destacar a importância central e cada vez mais evidente das CSH, em particular o olhar específico das áreas críticas como os Estudos Culturais, nos desafios presentes e emergentes das sociedades digitais contemporâneas e, em especial, da investigação científica e do trabalho académico, em geral. Estas áreas de estudo encontram-se num local privilegiado para responder aos desafios que a IA tem vindo a apresentar, nomeadamente em contexto académico [1]. Contudo, para que tal aconteca, é urgente repensar toda a forma de fazer ciência e realizar a atividade académica, no sentido de uma Ciência Lenta [2], contrariando a chamada "enshittification" da academia [3], que a IA veio acelerar.

Keywords. *Estudos Culturais; Transformação Digital; Ciência Lenta; Financiamento Ciência*

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Acknowledgements. The author acknowledges the support given by the Portuguese Science Foundation (FCT) under grant UID/4188/2025.

Financiar a narrativa: o *Kickstarter* como potenciador e restrição de temáticas alternativas

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Abstract. Ao longo do desenvolvimento dos jogos de tabuleiro, as temáticas e representações neles presentes sofrem alterações de acordo com os valores das sociedades em que se inserem. A popularização destes jogos modernos promoveu um aumento substancial dos jogos de tabuleiro projetados e produzidos, enquanto os processos de globalização permitiram a sua distribuição por todo o mundo. Este contexto de fenómeno global, bem como a evolução da noção dos designers de jogo enquanto autor, levou a um processo, corrente, de afirmação dos jogos de tabuleiro enquanto meio artístico. Observa-se uma evolução na abordagem temática e narrativa que os designers procuram incutir nos jogos de tabuleiro, na tentativa de ultrapassar o modelo tradicional da produção dos jogos, no qual a temática é definida pelas editoras de acordo com objetivos comerciais. Paralelamente, assistimos à popularização de plataformas de *crowdfunding* enquanto formas de financiamento da produção. São estas novas plataformas um fator de libertação de amarras temáticas e narrativas da indústria cultural dos jogos de tabuleiro, permitindo o desenvolvimento de jogos com novas temáticas que revisitam criticamente narrativas coloniais e propõem abordagens contra-hegemónicas? Através da análise documental de três campanhas de financiamento e de três jogos de tabuleiro, refletimos sobre a natureza dual do *crowdfunding,* que permite a produção de jogos sem a alçada de uma editora com controlo sobre o produto final, mas que implica um conjunto de novos constrangimentos a nível dos conteúdos materiais expectáveis para que o projeto possa angariar apoiantes e garantir o sucesso comercial. Refletimos também sobre como estas temáticas alternativas foram construídas nos próprios jogos, a forma como os componentes materiais, as ilustrações e as regras do jogo interagem de forma a construir uma narrativa alinhada ou em tensão com a intenção do autor.

Keywords. *Crowdfunding; Jogos de tabuleiro; Indústrias Culturais; Design; Colonialismo*

[CLLC] Between text and action: research in literary studies and its impact

Entre vidas, folhas e imagens: o livro-álbum lusófono contemporâneo por meio da ecocrítica e cosmologias indígenas

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Resumo Este projeto propõe uma análise comparativa de livros-álbum contemporâneos publicados em Portugal, no Brasil, em Angola e em Moçambique, procurando compreender de que modo nessas obras se constroem relações entre diferentes formas de vida, territórios e entidades mais-do-que-humanas. O enquadramento teórico articula a ecocrítica com contributos dos estudos indígenas brasileiros, partindo do entendimento de que o livro-álbum, enquanto artefato multimodal, constitui um espaço particularmente fecundo para a representação de interações ecológicas através da articulação entre recursos verbais, visuais e materiais. O estudo pretende investigar de que forma estas narrativas configuram horizontes ecocêntricos e concepções ecológicas ancoradas em matrizes epistemológicas diversas, incluindo perspectivas ocidentais e não ocidentais. Em termos metodológicos, adotar-se-á um enfoque hermenêutico pluridisciplinar, baseado no diálogo entre diferentes áreas do saber, nomeadamente os estudos literários, a ecocrítica, a filosofia, a antropologia e a história cultural. A análise do corpus será orientada por uma grelha analítica integrada na *Matriz Natureza e Cultura* (Goga, 2018)[1], permitindo identificar convergências, tensões e especificidades entre diferentes contextos literários lusófonos. O objetivo geral consiste em compreender de que modo estas obras mapeiam concepções de ética ecológica no espaço lusófono e em que medida podem contribuir para a reflexão sobre formas mais justas de relação entre humanos, não humanos e ambientes.

Palavras-chave. *Livro infantil; ecocrítica; estudos da literatura indígena; ética ecológica*

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Dançar (n)a página: corpo, espaço e movimento no livro-álbum contemporâneo

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Resumo. O projeto Dançar (n)a página: corpo, espaço e movimento no livro-álbum contemporâneo pretende investigar a representação da dança no livro-álbum do século XXI, com incidência em edições e traduções portuguesas. A investigação decorre da escassez de estudos que articulem o livro-álbum contemporâneo e a dança, bem como da relevância crescente deste género editorial na literatura infantojuvenil e nas literacias visuais e corporais. Ancorada nos estudos interartísticos, na intermedialidade e na multimodalidade, a pesquisa identifica o livro-álbum como objeto híbrido que alia palavra, imagem, design e materialidade numa poética do corpo. A problemática central questiona como este suporte estático traduz a cinestesia e a fluidez da dança, mobilizando estratégias intermediais e recursos gráficos.

Definem-se como objetivos: mapear as relações intermediais entre dança e livro-álbum; analisar a materialidade do objeto livro enquanto espaço cénico; identificar recursos compositivos que geram a ilusão de movimento da dança; e avaliar o contributo destas obras para a alfabetização do corpo, a identidade infantil e a discussão sobre género, inclusão e diversidade.

Metodologicamente, o estudo cruza a análise intermedial, multimodal e narratológica, através de uma grelha analítica replicável, aplicada a um corpus selecionado. O enquadramento teórico articula estudos literários e filosóficos, consolidando conceitos sobre materialidade e iconotextualidade do livro-álbum, a página como espaço coreográfico e as dinâmicas discursivas do corpo. No contexto teórico da dança, convocam-se perspetivas essenciais para a conceptualização do gesto, do ritmo e da espacialidade.

Com impacto nos estudos literários, artísticos e educativos, a investigação propõe a sistematização de um modelo analítico interartístico, orientado para o estudo e entendimento do livro-álbum enquanto experiência performativa.

Palavras-chave. *Livro-álbum; Dança; Intermedialidade; Materialidade; Movimento*

THE IMPOSSIBLE HOMECOMING: TRAUMA WRITING AND GEOPOLITICAL RUPTURE IN ANTÓNIO LOBO ANTUNES, PAI HSIEN-YUNG, AND LEE CHANG-DONG

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Abstract. This research project seeks to examine the fictional representation of trauma arising from three major twentieth-century geopolitical ruptures: decolonization in Portuguese Africa, the Chinese exodus of 1949, and the division of the Korean Peninsula. Through a comparative and cross-cultural approach, it analyses selected narratives by António Lobo Antunes, Pai Hsien-yung, and Lee Chang-dong, focusing on how different historical and literary contexts fictionalize experiences of territorial loss, forced displacement, communal fracture, and the radical transformation of individual destinies[1].

Taking uprootedness as its central critical category, the study investigates convergent and divergent modes of trauma writing and memory fictionalization[2]. Special emphasis is given to narrative strategies such as temporal fragmentation, memorial discontinuity, polyphony, enunciative instability, and the emergence of marginal or silenced voices as forms of resistance to state-centred grand narratives. Theoretically grounded in theories of trauma, nostalgia, and cultural memory, the project explores how literature contests hegemonic histories while revealing both the universality and the untranslatable specificity of historical suffering.

Keywords. *Trauma Writing; Geopolitical Ruptures; Uprootedness; Transculturation.*

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Ler o desacordo: tensão verbo-visual e recepção infantil em livros-álbum publicados em língua portuguesa

Este projeto de doutoramento, em fase inicial, inscrito na área dos Estudos Literários, investiga livros-álbum em que a relação entre texto e imagem se configura por meio de *focalização contrastiva,* produzindo tensões e dissonâncias entre as linguagens verbal e visual. O estudo procura compreender de que modo essas relações verbo-visuais constroem sentidos e convocam o leitor a interpretar, inferir, negociar pontos de vista e resolver ambiguidades. O objetivo geral organiza-se em duas dimensões complementares: a primeira consiste em identificar, caracterizar e analisar obras nacionais e estrangeiras, estas últimas em versão traduzida, *com relações de focalização contrastiva*, publicadas entre 2000 e 2026; e a segunda visa analisar as respostas leitoras de crianças de 4 a 11 anos a essas obras, descrevendo e refletindo sobre os processos interpretativos e as competências de leitura mobilizados na negociação da dissonância texto-imagem. Metodologicamente, o projeto combina, em uma primeira etapa, mapeamento editorial, seleção e análise de um *corpus* de livros-álbum disponíveis em língua portuguesa e, em uma segunda etapa, a realização de sessões de leitura com crianças, com recolha e categorização das suas respostas, bem como descrição e explicação dos processos interpretativos, metalinguísticos e metaficcionais, e das competências de leitura mobilizados na negociação da dissonância texto-imagem. Ao articular análise literária e estudo da recepção infantil, a investigação procura contribuir para a compreensão do papel ativo da criança na construção de sentidos em livros-álbum marcados por tensão verbo-visual, bem como para colmatar a lacuna sobre resposta leitora nos estudos portugueses.

Palavras-chave: Livro-álbum; tensão verbo-visual; recepção infantil; competências de leitura literária.

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TITLE

Organisational bibliotherapy: literature as a care tool aimed at preventing fatigue and burnout in the workplace

ABSTRACT

This project focuses on the development and exploratory evaluation of a model of organisational bibliotherapy (OB), a mediated reading practice in the workplace aimed at the secondary prevention of fatigue and burnout. Furthermore, it aims to analyse its contribution to psychological well-being and the mitigation of psychosocial risks, drawing on the theoretical framework that situates bibliotherapy within Literary Studies, Medical Humanities, Positive Humanities and the Neuroscience of Reading. The study investigates how the literary experience fosters new ways of perceiving, narrating and managing the work experience, by bringing together: 1. The definition of a conceptual model of OB; 2. The design and implementation of a OB model; 3. The analysis of observable variations in indicators of fatigue and burnout. It is hoped that this will contribute to the academic consolidation of bibliotherapy in Portugal, extending it to the field of organisations as a practice of care and wellbeing at work.

From the superhero to the kid next door: representations of disability in children's literature in Portugal

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Abstract. Bringing together Literary Studies and Disability Studies, this project examines representations of disability in contemporary children's literature in Portugal through the analysis of a representative corpus of Portuguese works and foreign works translated into Portuguese published between 2009 — the year in which Portugal ratified the United Nations Convention on the Rights of Persons with Disabilities — and 2025. Drawing on the social model of disability, according to which disability results from barriers imposed by society and the environment, and engaging with approaches to representation in Disability Studies advanced by authors like Rosemarie Garland-Thomson (1997)[1] and Lennard J. Davis (1999)[2], the project adopts a multimodal analytical approach encompassing text, illustrations, graphic design, paratexts, and materiality. The study aims to identify, contextualize, and analyse dominant trends in the representation of disability, while also assessing whether developments in Disability Studies are reflected in contemporary children's literature. By examining how disability is constructed, negotiated, and mediated in books for young readers, the project seeks to contribute to a broader critical understanding of the treatment of disability in Portuguese children's literature and to ongoing discussions concerning inclusivity, representation, and cultural visibility.

Keywords. *Disability; Children's literature; Picturebook; Diversity; Social model of disability*

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[CLLC] Language, discourse and social impact

Research Summit 2026
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O algoritmo tem género? Simulação de julgamento como dispositivo performativo de literacia crítica algorítmica

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Resumo. Os sistemas algorítmicos que mediam o acesso ao trabalho, à visibilidade pública e à informação apresentam-se como infraestruturas neutras e objetivas, condição que os subtrai ao contraditório e à contestação. A investigação empírica da última década demonstra, porém, a produção sistemática de desvantagem comparativa em razão do género, sem que tal critério tenha sido explicitamente programado [1,2]. Persiste, contudo, uma lacuna pedagógica: os formatos expositivos transmitem esta evidência, mas raramente produzem, nos/as participantes, a competência de a mobilizar argumentativamente contra a presunção de neutralidade técnica. Este trabalho propõe e documenta um dispositivo performativo destinado a colmatar essa lacuna. Desenvolveu-se uma sessão de 70 minutos, sem requisitos tecnológicos e operável com quatro a dez participantes, estruturada como simulação de julgamento em que o arguido é um algoritmo e a acusação é a discriminação indireta em razão do género. O corpus probatório é constituído por três casos documentados - triagem automatizada de currículos (2014–2017) [3], despromoção e remoção diferenciada de conteúdos em plataformas de imagem (2019–2022) [4] e amplificação de conteúdo misógino em sistemas de recomendação (2024) [2] - e a qualificação jurídica ancora-se na Diretiva 2006/54/CE, no Regulamento (UE) 2022/2065 e no Regulamento (UE) 2024/1689. Sete papéis complementares (acusação, defesa, perita, testemunha, júri, juiz/a e sala deliberante) distribuem posições genuinamente antagónicas, sendo a defesa construída na sua versão mais forte. O enquadramento teórico convoca os Estudos Culturais, designadamente a naturalização da representação e o mito da plataforma neutra. O output é uma sentença deliberada em voz alta, com atribuição escalonada de responsabilidades e cinco medidas concretas, publicável enquanto documento cívico. A sessão encerra fora do personagem com uma pergunta autocrítica sobre os limites demonstrativos da própria forma judicial, integrando a reflexividade no desenho metodológico.

Palavras-chave. Discriminação algorítmica; Género; Estudos Culturais; Metodologias performativas.

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A Corpus-Based comparative study of portuguese and chinese health popularisation discourse

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Abstract. Public interest in health-related scientific knowledge has increased considerably in recent years, creating a growing demand for reliable and accessible information. Health popularisation discourse plays an important role in knowledge mediation between specialised biomedical knowledge and non-specialist audiences through "recontextualization of scientific discourse" (Calsamiglia & Van Dijk, 2004, p. 370) and processes of "recontextualization and reformulation" (Ciapuscio, 2003; Gotti, 2014). This study investigates how health-related scientific knowledge is communicated in Portuguese and Chinese health popularisation discourse through a corpus-based comparative approach, contributing to a comparison of health communication practices. The research is based on a bilingual, multimodal macrocorpus of comparable corpora centred on health promotion, comprising: (i) a written subcorpus in Portuguese and Chinese; (ii) an audiovisual subcorpus consisting of health-related programmes in both languages; and (iii) a transcribed oral subcorpus derived from the audiovisual materials. The written corpus constitutes the main basis of the linguistic analysis, while an audiovisual component was incorporated to address the multimodal dimension characteristic of contemporary health communication. The audiovisual subcorpus was analysed using the open-source data annotation software ELAN (Version 7.1, 2026) for handling multimodal data. The data were processed using Sketch Engine (Kilgarriff et al., 2014). Following the principles of comparable corpora construction proposed by Mikhailov and Cooper (2016), variables such as text type, thematic domain, publication period, and corpus size were controlled to ensure cross-linguistic comparability. The analytical framework combines lexical-semantic, discursive, and cognitive dimensions, focusing on explanatory strategies such as analogy, definition, denomination, reformulation and metaphor. The multimodal analysis examines intermodal relations and the articulation between verbal, visual, gestural, and auditory resources. Preliminary analysis of the written corpus indicates extensive use of reformulation, definitional strategies, and lexical variation in textual discourse. The analysis of the audiovisual subcorpus reveals differences in multimodal configurations between Portuguese and Chinese health popularisation videos. Portuguese videos show a higher presence of music, infographics, and verbal-visual combinations, whereas Chinese videos tend to display less resources. Intermodal relations frequently involve oral explanation, written text and visual representations, contributing to clarification and knowledge simplification.

Keywords: *Health popularization discourse; Comparable corpora; Knowledge mediation; Portuguese-Chinese comparison*

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Beneath the Leather: Cultural Identity Transformation of Shoemakers in Portugal and Turkey

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Abstract. This study is a literature review that examines the cultural identity transformation of shoemakers in Portugal and Türkiye from a comparative perspective. The research was prepared within the framework of the Cultural Studies Doctoral Program at the University of Aveiro and is presented under the title "Under the Skin".

The main argument of this study is that the craft of shoemaking has played a decisive role in shaping social and cultural identities for centuries, but that the processes of industrialization and globalization, which accelerated from the 19th century onwards, have fundamentally transformed both the production methods of this craft and the cultural identities of the masters.

The theoretical framework is based on Henri Lefebvre's theories on the social production of space, Doreen Massey's theories on the spatial division of labor, and Michel de Certeau's theories on the practices of everyday life. Within this framework, craft workshops, factories, and cities are conceptualized not merely as physical spaces, but as social areas where identity and memory are produced.

In Portugal, particularly in the case of São João da Madeira, the identity of craftsmanship has been transformed into a hybrid form within industrial production. Traditional knowledge has been passed down to new generations through institutions such as CTCP and CFPIC; and through museums, design collaborations, and industrial tourism, craftsmanship has been both preserved and transformed into economic value. The "Made in Portugal" brand has become a global symbol of quality, blending traditional craftsmanship with contemporary design.

In Türkiye, in centers such as Beykoz, Konya, and Ankara, the master-apprentice relationship has weakened due to the impact of mechanization, and serious disruptions have occurred in the transmission of traditional knowledge. The craft is shifting from "living practice" to the category of "cultural heritage" and is at risk of extinction.

The comparative analysis reveals the crucial role of institutional mediation capacity in the sustainability of craft identity. For Turkey, it is recommended to develop educational programs, design collaborations, industrial heritage narratives, and effective policy mechanisms, drawing inspiration from the Portuguese model.

Keywords. *Craft identity; Cultural transformation; Shoemaking; Industrial heritage; Intergenerational transmission*

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Variação de registo e tradução para português: estudo de *corpus* multilingue

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Abstract. Esta comunicação apresenta os principais resultados da dissertação de doutoramento que finalizámos recentemente, desenvolvida em torno de uma pergunta que acompanhou o percurso de investigação: até que ponto é possível descrever perfis de registo em português, inglês e alemão, e interpretar o comportamento de traduções para português, sem as reduzir à equivalência textual ou a um "terceiro código" autónomo? O estudo propôs uma adaptação crítica, a um *corpus* trilingue centrado no português, da abordagem à variação de registo desenvolvida por Neumann (2014).

O *corpus* compilado ultrapassa o meio milhão de tokens e reúne textos originais nas três línguas contempladas, traduções do inglês e do alemão para português e *subcorpora* de referência, distribuídos por quatro registos: ficção, textos instrucionais, divulgação científica e *TED Talks*. A análise combina interpretação funcional e procedimentos quantitativos, com dados extraídos através de *pipelines* desenvolvidos em *Python* e aplicados à anotação automática em *Universal Dependencies*. Os perfis de registo são reconstruídos a partir das variáveis *Field*, *Tenor* e *Mode*, operacionalizadas em subdimensões como domínio experiencial, orientação para o objetivo comunicativo, autoridade, nível de especialização, distância social, papel da linguagem e *medium*. O estudo articula três níveis de comparação: a descrição intralinguística dos registos originais face a *corpora* de referência internos; a comparação interlinguística dos originais por desvios relativos às respetivas linhas de base; e a análise das traduções portuguesas em relação aos originais portugueses, aos textos de partida e às expectativas registais do sistema de chegada.

Os resultados sugerem que os quatro registos formam perfis funcionais distintos, embora raramente por meio de um único indicador. A comparação entre línguas mostra zonas de forte convergência funcional, mas também diferenças de grau, realização formal e organização textual. No caso das traduções, os resultados não sustentam a existência de um português traduzido entendido como registo autónomo e homogéneo. Apontam antes para ajustamentos localizados, dependentes do registo e da língua de partida, em indicadores como recorrência lexical, padrões coesivos, modalidade, referência pronominal e densidade estrutural. Assim, a tese entende a tradução como uma zona de variação condicionada pela configuração do texto de partida, pelas expectativas de registo em português e pela composição de cada *subcorpus*.

Keywords. *Estudos de corpora; variação de registo; estudos de tradução com base em corpus; linguística sistémico-funcional; linguística computacional*

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Padrões lexicais e prosódia semântica em géneros de divulgação científica em saúde: análise de um *corpus* português-chinês

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Abstract. Divulgação científica ocupa atualmente um lugar central na circulação social do conhecimento, especialmente em ambientes digitais, onde textos, imagens e recursos semióticos se articulam na construção do sentido. Situada numa zona intermédia da linguagem para fins específicos (Valério & Takata, 2025), a divulgação científica em saúde integra géneros diversos de mediação do conhecimento científico dirigidos a públicos não especializados. Nesse contexto, compreender mecanismos linguísticos que tornam o discurso científico acessível, credível e socialmente significativo constitui uma questão relevante.

Este projeto investiga a relação entre padrões lexicais recorrentes e construção discursiva em géneros de divulgação científica em saúde, com atenção à colocação e à prosódia semântica, no âmbito da linguística de *corpus* inspirada em Sinclair (1991, 2004). A escolha do português e do chinês justifica-se pela relevância de analisar contextos linguísticos e culturais distintos, nos quais a mediação terminológica pode mobilizar estratégias de proximidade, credibilidade e reformulação discursiva. Assim, procura compreender que padrões caracterizam cada contexto e que semelhanças e diferenças emergem na divulgação científica para públicos não especializados

Partindo da perspetiva de McEnery e Hardie (2012) sobre a importância dos corpora, o projeto propõe a construção de um *corpus* paralelo especializado, construído por géneros digitais de divulgação científica em saúde em português e chinês, procurando identificar padrões lexicais, colocações e prosódia semântica. O estudo insere-se num eixo contrastivo português-chinês pouco explorado, articulando de forma interdisciplinar linguística de *corpus*, linguagem para fins específicos e divulgação científica em saúde, considerando a dimensão multimodal como enquadramento complementar da análise discursiva.

Reconhecendo limitações inerentes à dimensão do *corpus*, diversidade de géneros textuais e enquadramento institucional dos materiais recolhidos, o estudo pretende aprofundar a compreensão das estratégias linguísticas mobilizadas nos conhecimentos científicos, favorecer práticas de tradução mais eficazes, a comunicação intercultural e a literacia científica em contextos multilingues.

Keywords. *Padrões lexicais; prosódia semântica; divulgação científica em saúde; linguística de corpus; análise do discurso*

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Hate speech: representations of the Chinese community in the Portuguese media context

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Abstract. This study investigates representations of the Chinese community in Portuguese media, with a particular focus on implicit manifestations of hate speech in user comments on news items about this group. It is based on the premise that news framing may influence discourses in comment sections. Specifically, the analysis addresses two research questions: (1) How is implicit online hate speech targeting the Chinese community discursively and pragmatically constructed? (2) How do news framing and user comments interact in the production and circulation of implicit hate speech targeting the Chinese community? Methodologically, the study adopts a Corpus-Assisted Discourse Studies framework, integrating Corpus Linguistics and Discourse Analysis. The interpretation of results is informed by Critical Discourse Studies, focusing on how discursive practices may reproduce or reinforce power relations, processes of racialisation, ideological formations, and social inequalities in the Portuguese context. The research draws on corpora comprising news articles published by major Portuguese media outlets and corresponding user comments collected from social media platforms, covering the period from 2019 to 2026. Using a detailed, multi-dimensional annotation scheme, the study identifies key linguistic, discursive, and pragmatic patterns associated with implicit hate speech targeting the Chinese community in Portugal. A comparable corpus focusing on the Brazilian community will also be compiled and annotated, serving as a contrastive case. Whereas the framing of the Chinese community is shaped largely by global geopolitical dynamics, the Brazilian community shares deep socio-historical and linguistic ties with Portugal. This comparison facilitates the identification of othering mechanisms and discursive patterns that are more specific to representations of the Chinese community. By analysing news texts and user comments as interconnected components of a shared discursive environment, the study offers an integrated account of how media representation and audience responses interact in the production and circulation of implicit hate speech. It addresses a gap in research on online hate speech targeting the Chinese community in Portugal and contributes to a broader understanding of implicit hate speech, discursive recontextualisation, and interactional dynamics in Portuguese digital media. Overall, the study advances a more nuanced understanding of hate speech as a discursive, socially situated phenomenon, and provides linguistic resources that may support future research on the automatic detection of online hate speech in Portuguese.

Keywords. *Online hate speech; Chinese community; Corpus-Assisted Discourse Studies; Critical Discourse Analysis; Implicit hate speech*

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Acquisition of Mandarin Intonation by European Portuguese Speakers

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Abstract. This study, grounded in Boundary Tone Theory, investigates how native speakers of European Portuguese (EP) acquire Mandarin Chinese (MC) intonation, with particular focus on the perception and production of declarative and yes/no interrogative distinctions. EP is an intonational language in which intonation plays a central role in conveying phrasal meaning, whereas MC is a tonal language in which lexical tones coexist and interact with sentence-level intonation. This interaction renders sentence-type distinctions in MC particularly challenging for second-language learners. The study involves beginner and intermediate Portuguese learners of Mandarin, native Mandarin speakers, and an EP control group with no prior exposure to Mandarin. It comprises two main tasks: (i) a perception experiment examining participants' ability to distinguish declarative and yes/no interrogative intonational patterns through accuracy rates and reaction times; and (ii) a production experiment investigating acoustic parameters such as fundamental frequency (F0), pitch range, duration, tonal slope, and voice-quality measures in order to compare proficiency levels and identify deviations from native production. The study is guided by four hypotheses: (H1) Portuguese learners of Mandarin will distinguish declarative and yes/no interrogative intonational patterns at rates above chance level, although their performance will remain below that of native Mandarin speakers; (H2) intermediate learners will demonstrate greater sensitivity to declarative–interrogative intonational contrasts than beginners, as reflected in higher accuracy rates and shorter reaction times; (H3) increasing Mandarin proficiency will be associated with more native-like realizations of sentence-final intonational patterns, reflected in acoustic parameters such as pitch range, tonal slope, duration, and F0 movement; and (H4) learners with greater perceptual sensitivity to Mandarin intonational contrasts will demonstrate more native-like production patterns, indicating a positive relationship between perception and production abilities. By integrating perception and production findings, this study aims to advance our understanding of L2 Mandarin intonation acquisition by EP speakers and to provide empirical evidence for the development of pedagogical approaches to Mandarin intonation instruction. More broadly, it seeks to contribute to research on second-language phonetic acquisition and to offer practical implications for Mandarin language teaching, future phonetic studies, and digital pronunciation-learning platforms.

Keywords. *L2 production; L2 perception; intonation; teaching Mandarin as a foreign language; European Portuguese*

[DBI] Thesis project defense in business innovation

Regulatory Innovation in Hospital Governance: Audit and Oversight as Determinants of Quality and Professional Capacity Building in the Angolan National Health System

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Abstract. Health systems in middle-income countries face persistent challenges in assuring the quality of care and building professional capacity, in a context where audit and oversight have evolved from administrative control instruments into strategic mechanisms of organisational learning. In the Angolan National Health System, the regulatory function operates under severe constraints: health coverage below 52%, limited inspection capacity (811–910 inspections per year, restricted to 5 of 18 provinces during the pandemic), the absence of an integrated information system, of hospital accreditation and of a transversal quality regulator, and a virtually non-existent citizen–regulator accountability channel — only 7 formal complaints in 2020 and zero in 2021, in a country of 33 million inhabitants. The core problem lies in the disconnection between supervision and institutional learning, which confines audit to punitive compliance. This doctoral project reconceptualises audit and oversight as instruments of regulatory innovation, in the sense given to process and organisational innovation by the Oslo Manual, through a conceptual model that articulates the Donabedian structure–process–outcome framework with institutional absorptive capacity as mediator and regulatory innovation as moderator, complemented by an adapted regulatory pipeline used to locate bottlenecks along the supervisory chain. The study adopts a sequential explanatory mixed methods design, with a quantitative phase followed by a qualitative phase: a survey of health professionals and hospital managers ($n \geq 150$), using scales adapted from validated instruments and testing four hypotheses through partial least squares structural equation modelling; semi-structured interviews with key informants ($n \geq 20$) subjected to thematic content analysis; and documentary analysis, in public hospital units in Luanda and at least two additional provinces. Expected results include a maturity mapping of audit and oversight mechanisms, empirical evidence on the relationship between supervisory practices and hospital quality, the identification of viable regulatory innovations, and a policy brief with recommendations for the Angolan Ministry of Health.

Keywords. *Absorptive capacity; Donabedian framework; Mixed methods; Hospital accreditation; Sub-Saharan Africa*

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AI governance in Nigerian financial services: board frameworks for ethical and legal oversight

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Abstract. The rapid adoption of artificial intelligence (AI) solutions in Nigerian financial services continues to outpace existing governance frameworks. Despite growing global attention to AI governance, empirical research on board-level oversight of AI risk in developing economies remains limited, and few if any published studies address the specific regulatory and institutional context of Nigerian financial services. This study examines how Nigerian boards could redesign their structures for effective ethical and legal oversight of AI risk in financial services. The research addresses four questions: what AI-specific fiduciary duties and liabilities company directors currently face under Nigerian law; the extent to which existing corporate governance codes, principles and regulatory guidelines address AI risk and governance in financial services; what key competencies (e.g. AI literacy, risk and ethics awareness, data governance capabilities) boards increasingly require for effective algorithmic oversight; and how selected international standards - the European Union (EU) AI Act (2024), AI governance principles and guidelines issued by the Organisation for Economic Co-operation and Development (OECD 2019, revised 2024), the International Organisation of Securities Commissions (IOSCO, 2021), the European Insurance and Occupational Pensions Authority (EIOPA, 2021) - may be safely adapted to the local context. The study employs Insider Action Research (IAR) methodology [1], drawing on the researcher's concurrent board memberships in deposit-money banking, insurance and capital markets. Evidence will be drawn from case studies, semi-structured interviews, documentary analysis, and comparative legal and ethical analysis. The study ultimately proposes a governance framework that adapts international AI risk principles locally, embeds capacity-building imperatives, and provides practical board-level guidance for effective AI oversight in Nigerian financial services.

Keywords. *Algorithmic accountability; Board competency; Regulatory gap analysis; Insider action research; Developing economy regulation;*

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From awareness to action: a business game approach for initiating digitalization in sme production and intra-logistics

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Abstract. SMEs in manufacturing and intra-logistics continue to lag behind larger enterprises in digitalization — not for lack of technologies, but for lack of an actionable pathway from awareness to implementation. Research has extensively documented adoption barriers, yet no tool guides SME decision-makers through the cognitive and motivational steps required to initiate such projects; to the best of the author's knowledge, no comparable solution yet bridges this gap.
This doctoral project proposes a purpose-built business game as the missing link, grounded in an SME-specific digitalization framework derived through a systematic literature review, informed by two decades of experience with hands-on business gaming, and building on an Industry 4.0 learning factory in which participants progressively digitalize a small physical production line. Targeting SME owners and operational managers and drawing on ambidexterity theory, the game simulates the tension between exploiting current operations and exploring new digital pathways. A tangible operational layer coupled to a hidden performance-and-results engine renders the experienced improvement in the profit-and-loss language leadership uses to justify investment, transferring knowledge and decision-making motivation together. Success is defined behaviourally: whether participants leave with a committed, concrete plan to begin — initiation rather than full execution.
The research follows a three-paper design (systematic literature review, game design, and empirical validation), the expected contribution being a novel, evidence-based intervention spanning SME management, technology adoption, and game-based learning.

Keywords. *Organizational ambidexterity; Technology adoption; Systematic literature review; Knowledge transfer; Managerial decision-making*

References.

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From Hardware to Systems: Enabling Cyber-Physical Innovation

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Abstract.

The rise of Cyber-Physical Systems (CPS) has fundamentally increased industrial product complexity, compelling legacy hardware firms to adopt systems engineering and integrated development practices. Yet persistent failures—prolonged time-to-market, late integration issues, fragmented architectures, and weak user experiences—suggest that applying systems thinking at the engineering level alone is insufficient. This dissertation argues that these failures originate upstream, in the business and product strategy phases where system definitions and value propositions are first established.

Systems engineering offers mature methods for decomposing complex systems once requirements exist, but comparatively little attention has been paid to how system concepts are formulated beforehand. In many legacy organizations, early product framing remains driven by hardware capabilities and component roadmaps rather than system-level market and user outcomes. When component-centric inputs enter development, even rigorous engineering struggles to compensate, generating downstream inefficiencies.

This research examines the relationship between common CPS development failures and the absence of explicit system definition during the earliest phases of product strategy. Focusing on the pre-development period, the study investigates how system outcomes are articulated, how product concepts translate into feature sets, and how these strategic decisions shape subsequent engineering. It pays particular attention to contrasts between legacy hardware firms and digitally native companies, which characteristically define products as coherent systems of user outcomes before undertaking technical decomposition.

Using a qualitative multi-case methodology—drawing on in-depth case studies, expert interviews, and internal analysis guided by grounded theory—the research will identify recurring patterns through which weak strategic system framing propagates into engineering complexity, organizational misalignment, and market underperformance. The primary contribution is a conceptual framework linking market- and user-oriented system outcome definition with systems engineering and agile development practices. By repositioning systems thinking as a strategic, pre-design activity, the dissertation offers a framework for enabling integrated cyber-physical innovation in legacy hardware firms.

Keywords. *Cyber-physical system; Systems Thinking, Hardware-Software Integration; Development Failures; Early Stage Development; Integrated Product Development, Digital Innovation,*

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AI-driven workforce transformation in UK accounting firms: a human capital and organisational change perspective

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Abstract. Artificial Intelligence (AI) is playing an increasingly important role in the organisation, provision and management of accounting services. In the United Kingdom (UK), the use of AI is revolutionising how accounting firms operate, with applications that boost productivity, automate mundane tasks, assist in decision-making, and optimise service delivery. These changes, however, present key labour issues including meeting the skills requirement, redesigning roles, ensuring employee readiness, exercising professional judgment, and implementing the organisational change necessary to successfully and responsibly deploy AI. While many current studies on the use of AI in accounting concentrate on technological capabilities and efficiency, there has been less emphasis on the human and organisational aspects of integrating AI. The aim of this research is to examine the impact of AI adoption from a human capital and organisational change perspective and to fill that gap. The study considers the following aspects of the AI implementation process in companies: developing employee talent, reshaping job roles, addressing employee resistance or readiness, and fostering sustainable change. A qualitative research methodology will be employed, using semi-structured interviews with accounting professionals, managers, and decision-makers across UK firms. Patterns of organisational experience, management and reaction to AI-driven change will be drawn from a body of organisational case evidence and thematic analysis. Both practical and theoretical contributions are expected, enabling accounting firms, professionals and academics to understand how to implement AI to improve organisational performance and the productivity of human resources without undermining their employees' capabilities, engagement and motivation, or responsible organisational transformation.

Keywords. *Workforce transformation; Reskilling and upskilling; Automation in accounting; Organisational change; Human capital.*

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LLM-assisted Decision Support System for Tenant Screening: A Governance Framework under the EU AI Act and GDPR

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Abstract. As large language models are advancing, new capabilities emerge in classification, explanation generation, and decision support. This makes them increasingly attractive for high-risk automated decision-making across domains such as housing access decisions, credit scoring, and job applicant evaluation. In the European Union, however, this potential is constrained by strict regulation under the EU AI Act [1] and the GDPR [2] which impose requirements for transparency, fairness, traceability, robustness, human oversight, and data protection. The research literature has developed along two separate tracks. Regulatory researchers analyse what the law demands without addressing how these systems operate in practice, whereas technical researchers focus on the technical requirements of the models without accounting for regulation as an additional dimension, thus, creating a gap at the intersection of the fields.

This thesis addresses this gap through a sequential multi-method design comprising three studies. First, a systematic literature review explores how current research interprets the EU AI Act and GDPR constraints for AI-augmented decision-making, identifies proposed governance and technical frameworks, and analyses to what extent these have been empirically validated along compliance-relevant evaluation dimensions. Second, an empirical benchmarking study, informed by the systematic literature review, compares two decision architectures using real anonymised rental applicant data from a German operator: a conventional scoring system and a large language model-based system with a human-in-the-loop configuration. Third, drawing on both previous studies, an operational governance framework is developed through a design science approach, extending existing proposals if sufficient foundations exist, or designing a novel architecture where gaps remain. As a result, this thesis aims to propose an empirically validated framework for the compliant usage of large language model-based decision systems under EU regulation.

Keywords. *Large Language Models; AI Governance; Compliance-by-Design; AI Benchmarking; Tenant Screening*

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Acknowledgements. The authors acknowledge the support of Snova GmbH in enabling this research, and rentcard GmbH for providing access to an anonymised tenant screening dataset used in the empirical context of this study.

Licença social para operar e protocolos de consulta: diretrizes para empresas atuarem com comunidades tradicionais no mar

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Abstract. Esta tese analisa de forma aprofundada o conceito de licença social para operar (LSO), fundamental para garantir a sustentabilidade dos projetos com elevado impacto nos territórios e comunidades onde se inserem. Através de uma revisão sistemática de literatura com mais de 180 artigos publicados desde 2012, evidencia-se o avanço crítico e desenvolvimento de modelos de LSO [1]. Contudo, identificam-se poucas iniciativas elaboradas em parceria com as comunidades tradicionais [2], apontando para um déficit de representatividade nos modelos existentes e estudos que ofereçam às empresas um guia claro sobre como atuar nesses contextos.

Assim, a tese baseia-se em uma pesquisa empírica com coletivos caiçaras, colônias de pescadores artesanais e associações de maricultores em zonas de expansão portuária marítima no estado de São Paulo, Brasil. Utilizando entrevistas semiestruturadas em grupos focais e cartografia social [3], o trabalho aprofunda as relações territoriais, identificando atores, impactos e oportunidades de melhoria na interação com comunidades tradicionais. Primeiramente são comparados protocolos de consulta caiçaras aos modelos de LSO. Em seguida é analisada a percepção dessas comunidades sobre as práticas de grandes empreendimentos no que diz respeito à LSO. Então discute-se o impacto das leis de proteção aos povos indígenas na LSO. Por fim é apresentada uma proposta inovadora de diretrizes para as empresas fundamentadas nas necessidades e resultados do estudo de campo, nas normas e literatura existentes.

O fortalecimento da LSO é essencial para garantir o respeito aos direitos territoriais e participação ativa das populações nos processos decisórios dos projetos. As diretrizes propostas, através da escuta das comunidades tradicionais, visam orientar as empresas no relacionamento comunitário, contribuindo para prevenção de riscos, redução de conflitos, reforço da legitimidade social dos projetos e construção de relações mais estáveis e transparentes com as comunidades, além de promover maior equidade, justiça social e sustentabilidade em territórios tradicionais.

Keywords. Social license to operate; Traditional people and communities; Maritime territory; Social mapping; Community engagement.

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Interactive narrative architecture: restoring narrative coherence in digital journalism

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Abstract.
News consumption among young adults increasingly occurs within digital environments characterized by algorithmic mediation, incidental exposure, and the atomized circulation of content. In Portugal, this trend is reflected in the youth's preference for social networks, mobile platforms, and short-form audiovisual formats, coupled with a decreasing reliance on traditional journalistic sources [1], [2]. This shift poses a fundamental challenge to digital journalism: how to reconstruct narrative coherence, informative depth, and civic relevance in an ecosystem where news is frequently encountered as dispersed fragments? To address this problem, this research discusses the framework of an Interactive Narrative Architecture (INA) applied to digital journalism. The proposal is grounded in the distinction between Fact and Event: the former is conceptualized as a verifiable occurrence, while the latter is understood as a discursive, contextual, and interpretative construct produced by journalism. Within this framework, the INA organizes the news experience through a three-layered modular structure: L1, dedicated to the knowledge of the Fact; L2, oriented toward the understanding of the Event (including causes, consequences, voices, and perspectives); and L3, focused on evidence, data, sources, and verification. This organization dialogues with the distinction between "knowledge" and "understanding" in news narratives [3] and with the ongoing discussion regarding interactive architectures in online journalism [4]. The methodological approach follows an Exploratory Sequential Mixed Methods design, articulated with Design Science Research. It encompasses a qualitative exploratory phase, a subsequent prototype design phase, and a final empirical validation phase. At this stage of the research, the outcome is primarily conceptual: clarifying how the INA can address informative fragmentation without reverting to traditional news linearity. Based on this premise, narrative coherence emerges as a multidimensional property, resulting from the interactor's interpretation across the dimensions of context, chronology, and theme, which the INA seeks to restore by articulating factual stabilization with interpretative progression.

Keywords: *Digital Journalism; Interactive Narratives; Narrative Coherence; Informative Modularity; Young Adults; User Agency; Narrative Architecture*

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Participatory Design of a Digital Educational Game for Preschool SEL

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Abstract. Preschool years are foundational for children's social and emotional development, supporting long-term mental health and school readiness, yet digital educational games rarely offer balanced support for Social Emotional Learning (SEL) competencies or meaningfully involve children in their design. This doctoral research investigates how a participatorily designed digital educational game can promote SEL in preschool education using an Educational Design Research (EDR) approach. The project combines a systematic literature review of empirical SEL-focused digital games with a qualitative content analysis of commercial socio-emotional minigames to identify current design patterns, pedagogical gaps, and accessibility strategies. Findings to date reveal a significant asymmetry between the competencies emphasized in literature, which heavily prioritize self-management, and those implemented in widely available platforms, which focus primarily on basic emotion recognition and social interpretation rather than emotional regulation. Furthermore, results indicate a critical methodological gap: despite a long tradition in participatory design, child participation in educational technology research remains limited to traditional testing or user roles rather than active design partnership. To address these findings, the project will next transition from analytical studies to field-based participatory co-design sessions and iterative prototype development directly involving children, educators, caregivers, and multidisciplinary specialists. This research contributes both a practical, inclusive preschool digital game prototype and a set of evidence-based design guidelines aimed at balancing pedagogical goals with meaningful stakeholder collaboration. Ultimately, this project seeks to advance early childhood digital game-based learning environments by providing young children with more agentive forms of social action, emotional regulation, and inclusive representation.

Keywords. *Early childhood education; Digital game-based learning; Participatory design; Educational Design Research*

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Textual affective design in ai agents to support university students

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Abstract. The recent evolution of artificial intelligence, especially generative systems, has driven a paradigm shift in Human-AI Interaction. In university contexts, conversational agents are increasingly used to support academic activities and are no longer perceived only as functional tools, but also as socially interpretable agents that may assume roles such as tutor or partner. In this scenario, textual affectivity becomes a relevant design dimension, as it may modulate how students interpret the agent, respond to its guidance, and engage with academic tasks. Despite the growing use of AI in educational contexts, there is still limited understanding of how different levels of textual affectivity interact with agent role framing and students' behavioral engagement. This research aims to explore how neutral, moderate, and high levels of textual affectivity are associated with university students' behavioral engagement when the AI agent is framed as a tutor compared to a partner. Behavioral engagement will be examined through observable indicators of participation, persistence, clarification, and agency-related behavior, measured by the number of interaction turns or student messages, time on task, task completion, help or explanation requests, and accepted, modified, or rejected agent suggestions. The research adopts an exploratory sequential mixed-methods design. The first phase involves a literature review and a focus group with students to map needs, expectations, and critical moments in the interaction. The second phase consists of building a text-based prototype with six experimental conditions, resulting from a 2 x 3 design: tutor/partner role framing and neutral, moderate, or high textual affectivity. The third phase will conduct an exploratory comparative evaluation using behavioral logs and post-task questions. The expected outcome is to identify patterns, trends, and trade-offs that can inform design guidelines for educational conversational agents that are more calibrated, transparent, and appropriate for learning contexts.

Keywords. *Human-AI interaction; Affective design; Conversational agents; Role framing; Behavioral engagement; Student agency.*

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Identifying artificial intelligence literacy gaps among higher education teachers in a portuguese university: a multidisciplinary study

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The rapid growth of generative artificial intelligence (GenAI) is reshaping teaching, learning, and research in higher education, yet institutional support often develops faster than teachers' confidence, literacy, and discipline-specific guidance. This study investigates perceived gaps in AI literacy among higher education teachers at a Portuguese university, with a particular focus on how academics from different disciplinary areas understand, use, and guide the use of GenAI. Informed by recent UNESCO guidance on teacher AI competencies and rights-based AI in education, semi-structured interviews were conducted with 15 professors from multiple fields. The interview protocol explored participants' knowledge of GenAI, awareness of how researchers in their disciplines are using AI, current uses of AI in teaching and learning, strategies for advising students on appropriate GenAI use, use of AI in research activities, awareness of emerging AI technologies, and perceptions of available institutional support. Participants were also asked what forms of support they need, whether the university is doing enough, and what recommendations they would make for future provision. Interview data will be pseudoanonymized and analysed using qualitative content analysis as part of a doctoral research project. The study is expected to identify practical and discipline-sensitive AI literacy needs, including pedagogical integration, ethical and transparent use, student guidance, research workflows, and access to training or policy support. By foregrounding professors' experiences and expectations, the findings will inform recommendations for more targeted institutional support, helping universities develop professional learning opportunities aligned with human-centred, responsible, and inclusive approaches to GenAI literacy.

Keywords. Generative artificial intelligence; Academic staff development; Digital competence; Content analysis; Institutional support

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Youth, News, and Politics in the Age of Social Media

New media have transformed how young people consume information and communicate, reshaping news consumption and political participation (Bengtsson & Johansson, 2021). Rather than questioning whether youth consume news, current research focuses on how this occurs, as exposure increasingly happens incidentally through social media (Ohme et al., 2022; Russmann & Hess, 2020). Although young people report greater trust in traditional media, social media have become their main source of news, where informational content is embedded within entertainment and social interactions (Pérez-Escoda et al., 2021; Peters et al., 2022). This environment creates new vulnerabilities, including exposure to misinformation and declining institutional trust, while also fostering new forms of political mobilization (Herrero-Diz et al., 2021; Kaskazi & Kitzie, 2023).

This quantitative study analyses news consumption and political participation among Portuguese youth aged 15–29. Data were collected through a questionnaire survey using validated and expert-reviewed scales. The final sample included 1547 participants and is representative of the Portuguese youth population by age group according to the 2021 Census.

Results show that social media are the preferred source of news, with more than half of participants accessing news daily through these platforms. Instagram emerged as the dominant platform, reflecting preferences for visual and concise formats. News consumption was associated with multiple sources, including traditional media, influencers, and amateur creators, alongside participatory practices based on content sharing within peer networks.

Political orientation influenced trust and participation patterns. Supporters of far-right parties reported lower trust in traditional media and institutions, but higher trust in social media and influencers, combined with intense online political activity. In contrast, supporters of moderate parties expressed greater trust in traditional media. Family context also emerged as a key predictor of media practices and political participation, as individuals raised in households with regular news consumption and political discussion showed higher levels of civic engagement.

Impacts of a virtual cycling tourism intervention among older adults in long-term care facilities: a research proposal

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Abstract. The recent demographic revolution is increasing the relevance of healthy ageing, defined by the World Health Organization (WHO) as the process of developing and maintaining the functional ability that enables well-being in older age [1]. The need for innovative solutions for the older population is particularly demanding among those living in long-term care facilities. In Portugal, more than half of these residents have moderate to high levels of dependency [2], a reality aggravated by a lack of regular physical activity and cognitive stimulation [3]. Aiming to address this issue, this doctoral research proposal focuses on the development and evaluation of a technological solution that employs immersive virtual reality to foster healthy ageing. The Virtual Cycling Tourism program combines physical activity and leisure by allowing older adults to exercise on a stationary bicycle or pedal exerciser while watching 360-degree videos of cycling tourism routes through a head-mounted display (HMD). The project is structured over a three-year duration around two complementary axes. The first year involves a Development Research (DR) approach to produce a video series specifically tailored for the program and its integration into a digital platform. The last two years will be dedicated to an interventional study based on a longitudinal quasi-experimental pre-post design with a control group. The sample will comprise 80 individuals aged 60 years or over (40 per group), with no contraindications for cycling and no severe cognitive impairment, who will participate in weekly 30-minute sessions using a pedal exerciser over 12 months. Assessments will be quarterly through instruments such as the Short Physical Performance Battery (SPPB), the WHOQOL-BREF scale for measuring Quality of Life, study-specific questionnaires, semi-structured interviews, and structured observations. It is expected that this solution can increase adherence to a physical activity program, and contribute to improvements in physiological and emotional well-being indicators.

Keywords. *older adults; long-term care facility; virtual reality; 360-degree video; cycling tourism; virtual cycling*

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Research Summit 2026
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Toward design guidelines for eye-gaze interaction in musical applications for children with cerebral palsy

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Abstract.
Children with Cerebral Palsy (CP) often face limited access to music education due to motor impairments [1, 2]. Although eye-gaze-based applications exist to support musical performance, none are currently available to assist with musical writing [3]. The design of applications with eye-gaze interaction remains an underexplored area [4]. This project aims to develop design guidelines for programmers and designers working with eye-gaze interfaces. In collaboration with a Music Conservatory, this work will create design patterns for this domain, validated through an accessible educational application to support music learning for children with CP. The research follows the Educational Design Research methodology, structured in three phases: (1) identifying key challenges through a Systematic Literature Review and an evaluation of existing eye-tracking music software; (2) developing and evaluating alternative prototypes using small-sampled, within-subjects comparison, together with co-design of the inclusive musical application; and (3) consolidating the design guidelines for similar applications and validating them a final program intended for classroom use. Currently, the first phase has been completed, and the second phase is underway. Qualitative data is being analyzed using the webQDA software. This project will contribute to the field by offering concrete design guidelines for the development of eye-gaze-based musical educational tools, as well as an application to support children with CP or other motor impairments in their musical education, thereby addressing a gap in the current literature.

Keywords: *Eye Tracker; Accessibility; Music; Design; Motor limitations; Human-computer interaction*

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Aprendizagem de piano a distância com estudantes iniciantes

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Abstract. De acordo com a literatura, o acesso ao Ensino Artístico Especializado de Música (EAEM) em Portugal continua condicionado por desigualdades regionais na oferta educativa, pelo número limitado de vagas e por restrições na idade de ingresso. A Aprendizagem de Piano a Distância (APD) apresenta-se como uma resposta potencial às limitações de acesso ao EAEM, desde que apoiada por práticas pedagógicas estruturadas e recursos tecnológicos adequados. Apesar de algum ceticismo por parte da comunidade educativa decorrente do Ensino Remoto de Emergência durante a pandemia de COVID-19, vários estudos indicam que a aprendizagem instrumental a distância pode ser eficaz, ou mesmo a melhor alternativa, em contextos de oferta educativa limitada. Perante o número reduzido de estudos longitudinais sobre APD com alunos iniciantes, este estudo analisou de que forma práticas pedagógicas estruturadas e tecnologias economicamente acessíveis contribuíram para um desenvolvimento musical eficaz dos estudantes, de acordo com os conteúdos programáticos dos Conservatórios Públicos de Música em Portugal.

A investigação qualitativa assumiu a forma de estudo de caso múltiplo, envolvendo quatro alunos iniciantes, dos 9 aos 16 anos, acompanhados durante aproximadamente um semestre, sendo o investigador também o professor. Estruturado em quatro fases, o estudo recorreu à observação participante, diários de bordo, grelhas de observação, vídeogravações de aulas e entrevistas a alunos e encarregados de educação.

Os resultados da primeira fase revelaram progressos consistentes nas competências musicais e técnico-performativas dos estudantes. Destacou-se ainda a importância da preparação tecnológica e da mediação pedagógica para a eficácia da APD. O uso de múltiplas câmaras, vídeos tutoriais e pistas pedagógicas favoreceu igualmente a autonomia e o envolvimento dos alunos, sustentando uma futura implementação metodológica de investigação-ação no próximo ano letivo.

Keywords. *Educação a distância; Iniciação instrumental; Recursos tecnológicos; Práticas pedagógicas, Ensino formal de música*

Invisible cities: gamified augmented reality experiences on the migratory phenomenon

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Abstract

International migrations constitute one of the most complex social phenomena of the 21st century: according to the UN, in 2024 there were 304 million international migrants worldwide, almost double the figure recorded in 1990 [1]. Beyond its economic and political dimensions, this phenomenon is a process of profound identity reconfiguration: it involves not only learning to inhabit urban space, decode new cultural codes and build networks of belonging, but also brings social isolation, loss of identity and difficulty integrating into the host community.

Despite the growing body of academic research on migrant integration, there is a deficit of approaches that articulate locative technology, participatory design, gamification and the symbolic representation of the migratory experience. This project therefore investigates how gamified Augmented Reality (AR) experiences, anchored in real urban spaces, can mitigate social isolation and foster support networks between migrants and local communities.

Since the migratory phenomenon is an experience that for the most part takes place outdoors, in the streets, the project takes as its narrative and conceptual framework Italo Calvino's *Invisible Cities* [2], a work that explores the city as a system of signs and the experience of dwelling as a subjective and shared act. This makes it possible to treat urban space as an interface and walking as a method of meaning-making, focusing on memory, space and narrative rather than on statistical data or stereotypes.

The research adopts Design-Based Research as its methodological paradigm, combined with the Double Diamond model. The process includes interviews with migrants and residents, co-design sessions and participatory validation with the groups involved. The augmented reality prototype will function as a research instrument enabling exploration of, and response to, the project's central questions, producing design guidelines and theoretical contributions on the role of gamified locative media in the integration of migrant populations.

Keywords: *Augmented Reality; Migration; Locative Media; Gamification; Design-Based Research; Social Integration; Urban Space*

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Rethinking human-AI communication frameworks: the role of generative AI in enhancing academic advising

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Abstract. This research investigates how deepened narrative design can optimize communication between humans and generative AI conversational agents by informing the development of a Human-AI Communication framework for academic advising. Grounded in contemporary approaches to narrative cognition, social presence, and human-centered AI, the project examines how conversational agents can be designed as transparent, bounded, and role-governed communicative entities rather than merely functional information systems. Narrative theory and narrative neurobiology suggest that stories shape human cognition, emotion, and interpretation [1], while social presence explains how mediated or artificial agents may be experienced as socially meaningful interlocutors through coherent, responsive, and context-sensitive interaction [2]. Building on these foundations, the proposed framework uses narrative personas to define the agent's role, voice, behavioural consistency, emotional range, institutional limits, and referral logic. The context of application is academic advising, where students often require not only procedural information, but also clarity, reassurance, and guidance adapted to their situation. In this context, AI conversational agents may offer timely and personalized support, provided that they remain complementary to human advisors and aligned with principles of human control, transparency, and ethical design [3,4]. Methodologically, the project follows a Design-Based Research approach, involving members of the University of Aveiro community through exploratory diagnosis, prototype development, iterative testing, real-world interaction cycles, and qualitative feedback to examine perceived empathy, social presence, clarity, satisfaction, trust, and appropriate redirection to human support. The expected outcome is a transferable Human-AI Communication framework for integrating narrative-driven conversational agents into institutional communication contexts.

Keywords. *Human-AI Interaction; Generative Artificial Intelligence; Persona; Conversational Agent; Communication; Academic Advising*

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Privacy-Aware User Experience Design for Agentic AI Companions Used by People with Disabilities

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Abstract. Can privacy-aware user experience design empower people with disabilities to understand and control their data when interacting with agentic AI companions? AI chatbots promise significant benefits ranging from medical adherence to social connection, and mental health. These conversational companions collect extensive personal data through natural dialogue, creating unique privacy risks. Current privacy self-management frameworks assume users can navigate and act on complex legal texts and privacy settings. This challenge is particularly acute for people with disabilities who may face visual, cognitive, motor, and other limitations. As a result, this research frames the problem as a design failure. The privacy burden should not be left to users alone. To address this gap, this research investigates how privacy-aware user experience (PAUX) design can empower people with disabilities to understand and control their data when interacting with agentic AI companions. A mixed-methods approach will be adopted, consisting of focus groups, surveys, and semi-structured interviews with people with disabilities and relevant experts. These methods will identify privacy barriers mapped to design features, which will inform a set of validated PAUX design guidelines that address both comprehension and user control. Expected outcomes will help designers in anticipating privacy harms and improving digital autonomy for people with disabilities as AI becomes ubiquitous.

Keywords. *Privacy; User Experience; Agentic AI; People with Disabilities; AI Companions*

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Evaluation of musical applications based on eye-tracking challenges: an usability test

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Abstract.
Children with Cerebral Palsy (CP) frequently encounter barriers to accessing music education due to motor limitations [1,2]. While eye-gaze technologies have been developed to facilitate musical performance, there is currently a lack of tools designed to support music notation and creation through this form of interaction [3]. In addition, research addressing the design of eye-gaze-controlled applications remains limited [4]. The present study investigated the accessibility of music-related applications by examining three common challenges associated with eye-gaze interaction: *Midas Touch*, gaze inaccuracy, and visual fatigue. User perceptions were collected through Likert-scale questionnaires combined with an open-ended question after interaction with five different applications. Qualitative responses are currently undergoing analysis using the *webQDA* platform. Findings suggest that interface elements with larger dimensions and greater spacing help minimize unintended selections, whereas adaptable layouts may improve usability. Nevertheless, the evaluated applications still rely heavily on external support, limiting independent use. Scrolling mechanisms were reported as difficult to operate and frequently led to interaction errors, making them unsuitable for this context. Among the identified challenges, *Midas Touch* and gaze inaccuracy emerged as the most recurrent issues, while visual fatigue appeared to intensify the cognitive demands of interaction. Participants with musical backgrounds highlighted the need for tools better suited to composition and creative work, a requirement that was not fully met by any of the applications assessed.

Keywords: *Eye Tracker; Music; Application; Multimedia; Human-Computer Interaction*

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Design optimization of e-books to disseminate scientific content: the DigitalOBS experience

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Abstract. E-books can make scientific knowledge more accessible and engaging for wider audiences by combining rapid publication cycles with continuous updating, an advantage in fast-moving research fields [1,2]. They also support richer visual and interactive design, which can improve comprehension and attention in digital contexts [3].
In 2023, DigitalOBS—an observatory at the University of Aveiro dedicated to analyzing the impact of digital media on society—adopted e-books as a strategy to disseminate research on communication and digital media (https://digitalobs.pt/booklets/) [2]. With students' involvement through the Students@DigiMedia initiative, the team established an initial design framework and produced several editions. In the third year of developing the DigitalOBS e-books, new technological capabilities enabled a complete rebranding of the materials' design and the incorporation of artificial intelligence (AI) tools.
As adapted in the second edition, the project continued to use Figma, but this new version has enhanced visual consistency, continuity between pages and chapters, and color use, whilst maintaining coherence with the DigitalOBS and DigiMedia brand identity. After testing several AI tools, the decision was made to use Napkin AI, which enabled the creation of infographics based on scientific content.
As an example of the new visual identity, the booklet: Informed Supplementation, Protected Reproductive Health was developed using AI tools to assist with visualization and make scientific findings easier to understand. In addition to incorporating these elements, this edition also marks the collaboration between research in communication and digital media and other scientific fields, in this case, the field of health.
This project, through a collaborative environment, brought together researchers and students, encouraging joint efforts to develop materials for disseminating scientific content in digital format (e-books) to be shared with the general public.

Keywords. *Scientific communication; E-books; DigitalOBS; AI tools*

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Let the microorganisms have a day off

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Abstract. Science communication remains a critical yet complex challenge, particularly in disciplines such as microbiology, where public awareness often lacks scientific relevance. The 'Let the microorganisms have a day off' project, conducted under the Students@DigiMedia#05 initiative, explores visual creativity and methodological rigor to enhance the communication of microbiological concepts to non-specialist audiences, while also addressing a frequently overlooked dimension: the evaluation of impact.

The first phase of the project involved conceptualizing and developing an original scientific illustration to highlight the fundamental roles microorganisms play in sustaining life on Earth. The resulting product, a strip cartoon, follows a fictional scenario in which microorganisms decide to go on a general strike, interrupting the essential functions they perform across ecosystems, human health, industry, and the environment. Through humorous narrative and engaging visuals, the cartoon introduces viewers to various groups of microorganisms and the services they provide, while illustrating the societal and environmental consequences that would result from their absence. This format serves a dual purpose: to inform and to enhance memorability by using narrative and affective engagement.
In parallel, the second phase of the project focused on developing practical tools to evaluate the effectiveness of science communication initiatives, which were pilot-tested and refined for broader applicability.
'Let the microorganisms have a day off' is the result of a collaboration between students and researchers from different backgrounds, from natural sciences to design, showing that when biologists and media specialists join forces, the results can be unexpectedly lively.
Altogether, this work aligns with DigiMedia's and CESAM's missions: to combine creative media, scientific content, and empirical evaluation for more effective and meaningful science communication practices.

Keywords. *Science communication; Comics; Visual storytelling; Microbe–environment interactions*

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Assessing empathy towards fictional characters in digital games: development, translation, and validation of the FCECA scale

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Abstract.
This work presents the development and validation of the Fictional Character Empathy Communication Assessment (FCECA), a psychometric scale designed to assess players' empathic responses toward fictional characters in digital games. Built on a programme of research into gamer psycho-social profiles [1], playable character aesthetics and gender identity preferences [2], and the multidimensional variables of empathy in gaming contexts [3], the FCECA represents a theoretically grounded and empirically informed iteration of previously validated English-language instruments. Rooted in Davis' [4] multidimensional empathy framework as operationalised in the Interpersonal Reactivity Index, the scale addresses the specific relational dynamics between players and game characters across four sub-dimensions: Character Perspective (CP), Reactive Fantasy (RF), Character Empathic Concern (CEC), and Personal Character Distress (PCD).
The scale was developed within the scope of a student research initiative under the DigiMedia project, combining quantitative psychometric methods with qualitative ethnographic approaches. The validation process involved content and linguistic review by specialist panels ensuring construct validity in both English and Brazilian Portuguese (PT-BR).
Alongside the psychometric work, the research team conducted digital ethnography within private gaming communities on Discord and Reddit. Following Kozinets' [5] ethnographic framework and Boellstorff et al.'s guidelines for virtual world ethnography, this fieldwork served a dual purpose: to observe naturalistic player-character engagement in authentic gaming contexts, and to build community trust and participation for broader scale dissemination and future data collection [6]. Immersive observation of gamer discourse provided qualitative grounding that informed item refinement and contextual interpretation of empathy constructs.

Keywords. *Empathy; Scale Validation; Fictional Character Empathy Communication Assessment; Ethnography.*

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Mapeamento dos efeitos da colaboração humano-IA em tarefas de produção escrita no pensamento crítico e criativo de estudantes do ensino superior – conclusões preliminares de uma revisão integrativa da literatura

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Abstract. Paralelamente ao entusiasmo generalizado sobre o potencial da IA generativa (IA Gen) no acesso ao conhecimento e ao incremento da produtividade individual, impõem-se desafios ao nível da integração da IA Gen em contexto de ensino superior. Estudos recentes alertam para os perigos do "cognitive offloading" [1], um fenómeno típico de tarefas que convocam o recurso a competências de raciocínio de ordem superior e, no âmbito das quais, o ser humano tende a demitir-se do uso dessas habilidades em prol do desempenho das ferramentas de IA Gen. Para além do impacto desta prática, a longo prazo, em competências como o pensamento crítico e criativo, levantam-se questões éticas ligadas à originalidade e propriedade intelectual, com efeitos incontornáveis na avaliação de estudantes no ensino superior [2, 3]. O estudo aqui apresentado procura, assim, atuar em três grandes objetivos: i. caracterizar, com base em evidências científicas recentes, o estado da arte, no que diz respeito aos efeitos do uso de ferramentas de IA Gen em tarefas que convocam o recurso a competências de raciocínio de ordem superior (especificamente a produção escrita), por estudantes de ensino superior, no pensamento crítico e criativo; ii) identificar estratégias promotoras da agência destes utilizadores de ferramentas de IA Gen, tendo em vista uma integração ética e criticamente adequada das mesmas em contexto académico; iii) sensibilizar a comunidade académica e contribuir para a criação de políticas de integração da IA Gen no ensino superior que privilegiem a agência humana, o rigor e a propriedade intelectual. Com base num corpus de 99 artigos científicos, os resultados preliminares sugerem a ausência de estudos longitudinais sobre as questões em foco e a dualidade dos efeitos resultantes da colaboração humano-IA – por um lado, a constatação da melhoria imediata da qualidade das tarefas executadas, por outro o eventual comprometimento do grau de envolvimento humano nessas tarefas, quando não auxiliadas por IA Gen (a nível cognitivo – em termos de atividade neuronal, linguística e comportamental; e emocional, pela redução dos níveis de motivação intrínseca).

Keywords. *IA Generativa; Estudantes de ensino superior; Tarefas de produção escrita; Pensamento crítico e criativo; Revisão de literatura*

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Moving together in dementia: the MOVEDEM project website development

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Abstract. In 2025, approximately 238,401 people were living with dementia in Portugal, representing 2,29% of the total population [1]. People living with dementia (PLwD) and their caregivers often struggle to access community-based support services and interventions. A growing body of research highlights the potential benefits of physical exercise for both PLwD and their informal caregivers [2]. Dyadic physical exercise interventions, where caregivers and PLwD participate together, have shown promise in improving health outcomes and enhancing social participation [2,3]; nevertheless, lack of information about its benefits may hinder adherence. Health professionals and informal caregivers play a key role in facilitating PLwD participation on community-based physical exercise programs [4], particularly those who are users of online platforms to look out for information and support. Reliable, accessible and appealing virtual resources are therefore needed to adequately share scientific outcomes, communicate with potential participants and facilitate a project's promotion. The MOVEDEM project is a community-based physical exercise program for PLwD and informal caregivers that takes place at the sports facilities of the University of Aveiro. The bi-weekly exercise sessions started on May and will run until July 2026, and the ongoing pilot study is expected to inform future long-term interventions and allow the project's replication in other contexts. The MOVEDEM project's website was developed with the collaboration with DigiMedia@students to create a user-friendly and original platform (https://movedem-project.vercel.app/#/), developed as a single-page application through *Vue.js* and *Vite*, with a stylization in *Tailwind CSS,* to adequately share information and promote consolidation of the project's image. The editorial content management is done through a headless management system (*Contentful*). This is the first step into making MOVEDEM a recognizable project and promote its dissemination. This collaboration demonstrates how multidisciplinary work can strength dementia care by bringing together expertise from health and digital media to improve accessibility and support for PLwD, caregivers and professionals.

Keywords. *Physical exercise; community-based intervention; informal caregivers; science communication; web platform*

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The creathon experience: a human-centred approach to designing an intensive challenge-based learning framework for european higher education

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Abstract. Challenge-Based Learning (CBL) is increasingly recognised as a powerful pedagogical approach for engaging students, educators, and external stakeholders in addressing real-world societal challenges. However, the diversity of roles, expectations, and experiences involved in intensive, short CBL events — such as Creathons — remains poorly documented, limiting the design of effective, inclusive, and scalable frameworks. With the aim of developing a flexible Creathon model and toolkit for European Higher Education Institutions, grounded in participatory design methods, we adopted a human-centred design process, focusing specifically on the development of personas and User Journey Maps (UJM) for the three core stakeholder groups of a Creathon: the student, the Teamcher (a hybrid educator-facilitator role), and the Challenge Provider (an external entity). Drawing on empathy-based research techniques — including stakeholder interviews — three representative personas were developed. For each persona, a structured UJM was produced, spanning the six phases of a Creathon: Pre-Creathon, Onboarding, Engage, Investigate, Act, and Post-Creathon. Each map captures goals, thoughts, actions, pain points, opportunities, touchpoints, and emotional states across the full participant journey. The UJMs reveal significant differences in expectations, motivation, and friction points across the three roles, particularly at transition moments between phases. The Teamcher role, in particular, surfaces unique tensions between pedagogical facilitation and event management responsibilities. The maps also highlight shared opportunity areas — notably around onboarding clarity, feedback loops, and post-event reflection. UJM proved to be a valuable tool for surfacing multi-stakeholder complexity in the design of a Creathon event. The resulting personas and UJMs now serve as a foundation for the UX writing leading to the Creathon Toolkit's user stories, ensuring that the model is responsive to the lived experiences of all participants. This work contributes to a broader understanding of how human-centred design methods can strengthen the development of pedagogical frameworks in European higher education.

Keywords. *Challenge-Based Learning (CBL), Creathon, Human-Centred Design, User Journey Map, Higher Education Pedagogy*

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Utilização de inteligência artificial generativa na universidade de aveiro

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Abstract. A investigação e o desenvolvimento de tecnologias com Inteligência Artificial (IA) têm uma trajetória de várias décadas; contudo, com a emergência e a rápida disseminação da IA generativa (IAGen), ganharam maior centralidade nas discussões, nomeadamente no contexto educativo [1], [2].

Para que as reflexões sejam sustentadas na realidade, desenvolveu-se um estudo de natureza quantitativa, com o objetivo de compreender as formas de utilização da IAGen pelos membros da comunidade académica da Universidade de Aveiro (UA), recorrendo a um inquérito por questionário aplicado a estudantes, docentes, investigadores e técnicos de administração e gestão (N=366), com questões de resposta fechada e aberta.

Os dados recolhidos permitiram concluir que 89% dos inquiridos são utilizadores de IAGen, dos quais 69% o fazem com frequência. Esta utilização é mais frequente nos processos de ensino e de aprendizagem (35%), no uso pessoal (28%) e na investigação (26%). É utilizada para pesquisas e esclarecimento de dúvidas (93%), compreensão e análise de informações (86%), exploração de ideias (76%), escrita e revisão de textos (81%), tradução (65%) e criação de conteúdos (58%). O planeamento, a análise e a organização de atividades apresentaram um nível de concordância inferior a 50%. Os inquiridos referem que não verificam os conteúdos gerados quando exploram ideias (46%) ou executam tarefas de baixo risco (39%) e apenas 7% leem superficialmente e confiam no resultado. Apenas 38% receberam formação em IA e a maioria dos inquiridos considera-se autodidata (75%).

Este estudo integra um estudo alargado que envolveu outras sete instituições de ensino superior, pelo que os resultados completos serão apresentados posteriormente, em publicações científicas. Espera-se que contribua para compreender melhor as práticas atuais de utilização na UA, embora a amostra seja pequena, e que apoie a definição de estratégias institucionais de formação, orientação e utilização responsável da IAGen.

Keywords. *Comunidade académica; Inteligência artificial generativa; Frequência de utilização; Finalidades de utilização; Ensino superior.*

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Interactive music video in virtual reality:
viewer agency in spatialized narrative

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Abstract. Historically, music videos have served as a powerful space for audiovisual experimentation. Currently, this format has found a new dimension in Virtual Reality (VR), allowing viewers to step out of the observer role and fully immerse themselves within the audiovisual experience. However, translating classical cinematic language into VR presents constraints, as traditional editing techniques can disorient the user and disrupt immersion. To address the scarcity of research on interactive music videos in VR, this study adopts a Practice-Based Research methodology by developing an interactive Cine-VR music video that replaces traditional editing with viewer agency. Through a retrospective analysis of a 44-work music video portfolio, consolidated aesthetic and technical patterns are identified. The research hypothesizes that eliminating pre-established editing mitigates visual disorientation, granting the audience control over pacing through spatial navigation and branched narratives. The resulting VR music video will be subject to conceptual evaluation, through interviews with professionals, and empirical evaluation, through user testing.

Keywords. *Music video, Interactive, Virtual Reality, Cine-VR, Practice-Based Research.*

[GEOBIOTEC] Geosciences and the SDGs: vision and action

O aproveitamento de geomateriais como matéria-prima para a proteção costeira em Moçambique

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Resumo. Nos últimos tempos, têm vindo a ganhar relevância as questões relacionadas com as alterações climáticas que afetam a natureza de diversas formas, e uma delas é a subida do nível médio das águas do mar, com influência direta no recuo das linhas costeiras. A erosão, como um dos agentes da geodinâmica externa, representa um dos principais desafios ambientais enfrentados pelas zonas litorais, que é acentuada pela subida do nível médio do mar, mudanças climáticas, e intensificação de eventos extremos. As zonas costeiras moçambicanas representam importância em 4 dimensões, designadamente geoclimáticos, geopolíticos, sociais e económicos [1]. Dentro deste contexto, a vulnerabilidade costeira, principalmente das zonas sul e centro [2], e os impactos causados pela erosão, têm reforçado a necessidade de desenvolvimento de soluções de proteção costeira sustentáveis e tecnicamente viáveis. Pretende-se, com base na literatura e em técnicas laboratoriais, explorar o potencial de geomateriais como os rejeitos de mineração e/ou do balastro, como materiais alternativos e úteis na proteção de sistemas costeiros. Coloca-se em questão a necessidade de abordar a implementação de medidas de mitigação inovadoras, recorrendo a material já aplicado na indústria extrativa e de construção civil, evidenciando a sua eficiência e sustentabilidade como alternativa às práticas existentes, ou então, como reforço às mesmas. Para este fim, serão realizados ensaios de caracterização mecânica, geoquímica, textural e mineralógica à luz das normas vigentes, visando avaliar propriedades como estabilidade, drenagem, resistência e compatibilidade ambiental dos materiais. Espera-se com os resultados deste estudo, promover simultaneamente a valorização de resíduos mineiros e a redução da exploração de recursos naturais, em alinhamento com os Objetivos de Desenvolvimento Sustentável 9 (inovação e infraestruturas), 11 (cidades e comunidades sustentáveis), 12 (produção e consumo responsáveis), 13 (combate a ação climática), e 17 (parcerias para o desenvolvimento).

Palavras-chave. *Sustentabilidade; Erosão; Proteção costeira; Geomateriais; Subida do nível médio das águas do mar*

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Ceramic production technologies and cultural transformations in central portugal (3rd–11th centuries ad): a geoarchaeological approach

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Abstract. This research investigates cultural and technological transformations in central Portugal between the 3rd and 11th centuries AD by studying ceramic artefacts from the Rabaçal Roman Villa and the São Simão archaeological sites (Penela municipality). This period, marked by the transition from the Roman Empire to the early Middle Ages and the emergence of Islamic influence, saw profound social, economic, and cultural changes reflected in material culture. Using a geoarchaeological approach, the study employs multi-proxy archaeometric analyses, combining petrographic, mineralogical, morphological, and geochemical methods to identify raw material sources, reconstruct firing technologies, and distinguish local from imported ceramic production. Previous investigations at the nearby Conimbriga archaeological site demonstrated the exploitation of diverse geological resources for ceramic manufacture and highlighted the persistence of regional production traditions and trade networks throughout Late Antiquity. However, the ceramics from Rabaçal and São Simão remain poorly characterised from a geoarchaeological perspective, despite the archaeological significance of both sites. Located along the eastern edge of the Sicó Massif and associated with varied carbonate and siliciclastic geological units, these contexts provide an important opportunity to investigate resource procurement strategies, technological choices, and ceramic production systems over time. A comparative analysis with Conimbriga materials will contribute to understanding regional interactions, continuity, and change in ceramic traditions. Beyond its scientific contribution, the research will also support local museum initiatives by generating new datasets and technical knowledge relevant to heritage management, territorial identity, collection interpretation, and the valorisation of archaeological heritage.

Keywords. *Ceramic production; Archaeometry; Roman-Medieval transition; Promotion of cultural heritage*

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[GOVCOPP] Competitiveness, innovation and sustainability

Beyond adoption: how organisations create value from artificial intelligence through readiness, use, and human-AI interaction

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Abstract. Artificial Intelligence (AI) has become a major driver of digital transformation and is widely considered closely linked to Organisational Performance (OP) gains. However, emerging evidence suggests that not all organisations may excel in incorporating AI into their operations, due to the lack of necessary organisational capabilities, and insufficient AI-governance mechanisms, considering the effects of AI on employees. This research highlights a potential managerial paradox: while AI may increase OP in the short term, over-reliance on cognitive outsourcing may weaken the human capabilities supporting long term differentiation, reinforcing the need for managers to better understand when their organisations are ready to adopt AI, potential risks associated with AI usage, and how to effectively mitigate these risks, while managing resulting organisational dynamics. To address these challenges, this study adopts a multi-level, multi method approach. It first proposes the construction of an AI Readiness Index, designed to assess whether a company is prepared to adopt AI, and test its role as a moderator factor in the relationship between AI adoption and OP. Subsequently, the study examines Human-AI interactions at the individual level, focusing on how AI use influences cognitive effort and, in turn, affects different dimensions of OP. By integrating both levels, this research moves beyond traditional approaches that treat AI as a conventional technology, capturing its unique impact on human cognition. Ultimately, this study contributes to the literature by proposing a comprehensive framework linking AI readiness, adoption, interaction, and OP, and offering practical guidance for AI governance. It provides actionable insights for managers seeking to foster OP, while preserving the cognitive and strategic capabilities necessary for long-term sustainable competitive advantage in digital ecosystems.

Keywords. *Artificial Intelligence; AI-Readiness; AI adoption; Organisational Performance; Human-AI interactions;*

ESG performance and stock returns: does national culture matter?

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Abstract. In recent years, environmental, social, and governance (ESG) concerns have become increasingly relevant for both firms and financial markets, with rating agencies assigning ESG scores to evaluate corporate sustainability performance. The literature has produced mixed evidence regarding the relationship between ESG performance and stock returns, depending on context-specific factors such as time period, geographic region, and industry. In this sense, this study examines whether the relationship between ESG and stock market performance varies across countries and whether such variation is related to cultural characteristics, namely Hofstede's six cultural dimensions (Individualism, Power Distance, Masculinity, Uncertainty Avoidance, Long-Term Orientation, and Indulgence), thereby extending the literature on ESG pricing by incorporating cultural dimensions as cross-country moderating factors. The analysis is conducted within a multilevel empirical framework that explicitly accounts for cross-country heterogeneity. A key contribution of this study is that it shows that national cultural dimensions systematically moderate the ESG–stock returns relationship in an international multilevel setting. To this end, data from 4,853 firms across 49 countries over the period 2014–2023 are used, employing a linear mixed-effects model which is particularly suited to capturing unobserved heterogeneity across firms and countries in a hierarchical data structure. The results indicate that the impact of ESG scores on stock returns is positive, suggesting that ESG is priced differently depending on institutional and cultural contexts, although its economic magnitude is small. This effect is more pronounced in countries with higher power distance and higher uncertainty avoidance, while it weakens in more individualistic cultures. No significant moderating effects are found for the remaining cultural dimensions. These results are particularly relevant for investors, who may better understand in which cultural contexts ESG ratings are more relevant in equity analysis, but also for corporate decision-makers, who may identify contexts in which investing in ESG practices is more value-relevant, as well as for regulators and policymakers, highlighting the importance of accounting for cultural heterogeneity in global ESG investment strategies.

Keywords. *ESG performance; Stock returns; Sustainable finance; Cross-country analysis; Hofstede cultural dimensions*

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Fatores determinantes da competitividade em redes de valor complexas em condições VUCA: uma revisão sistemática da literatura

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Resumo. O propósito deste estudo é identificar e analisar os determinantes da competitividade que influenciam o desempenho das redes de valor em contextos VUCA (Volatilidade, Incerteza, Complexidade e Ambiguidade), oferecendo uma perspetiva integrada sobre a competitividade em ecossistemas organizacionais instáveis e caracterizando a evolução do conceito VUCA na literatura.

Foi realizada uma revisão sistemática da literatura (RSL) com base no protocolo PRISMA 2020, complementada por uma análise bibliométrica (VOSviewer) e por uma análise temática do conteúdo. A pesquisa nas bases de dados Scopus e Web of Science identificou 818 itens contendo o acrónimo VUCA no título, palavras-chave ou sumário, dos quais resultou um conjunto final de 60 artigos após o processo de triagem. A revisão limitou-se a publicações em língua inglesa.

No conjunto inicial de artigos foram identificados cinco grupos temáticos. No corpus principal, três dimensões estratégicas emergiram como pilares da competitividade: Capacidades Organizacionais [1], Capital Humano e Tecnologia [2]. A eficácia tecnológica depende da assimilação pelo capital humano e do empenho da gestão. A literatura é fragmentada, geograficamente concentrada na Índia, nos EUA e na China, e revela escassa validação empírica, particularmente em contextos africanos.

A eficiência operacional, por si só, não é suficiente; os gestores devem integrar tecnologia, pessoas e colaboração. Uma liderança flexível e orientada pela inteligência deve substituir os modelos de planeamento estáticos. Nos mercados emergentes, a sustentabilidade e a segurança operacional surgem como fatores críticos para a competitividade. O estudo integra as dimensões operacional, relacional e tecnológica da competitividade num quadro VUCA, destacando lacunas significativas na investigação em contextos africanos e em outras regiões sub-representadas.

Palavras-chave: *VUCA; Redes de valor; Competitividade; RSL; Resiliência da cadeia de abastecimento; Capacidades dinâmicas; Agilidade organizacional.*

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Peer-to-peer energy trading between smart homes inside renewable energy communities

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Abstract- This paper presents an optimization-based framework for modeling Peer-to-Peer (P2P) energy trading among households participating in a Renewable Energy Community (REC). The proposed approach enables each household to minimize electricity expenses through the optimal scheduling of controllable appliances, Electric Vehicle (EV) charging, and battery storage operation, while determining whether energy should be exchanged with neighboring households or grid [1]. The framework explicitly represents the economic interactions between power grid prices, different Energy tariffs, and bilateral P2P trading prices that may differ across households. The problem is formulated as a Mixed-Integer Linear Programming (MILP) model that guarantees operational feasibility and satisfies the technical constraints of residential energy resources [2]. By encouraging local renewable energy sharing and coordinated Home Energy Management System (HEMS) operation, the proposed method enhances collective self-consumption and decreases dependence on the main grid. Simulation results highlight the effectiveness of the coordinated scheduling strategy in lowering household electricity costs and improving renewable energy exchange among diverse households [3]. Simulation results confirmed the feasibility of bilateral energy exchanges and significant economic benefits. Compared to the base case, electricity costs decreased by 46.32% under ideal P2P trading and by 37.06% under the real P2P scenario studied in this paper. The results highlight improved self-consumption capability, reduced grid dependence, and the potential of coordinated scheduling to support efficient, flexible, and consumer-centric decentralized energy systems.

Keywords: Home Energy Management System, Renewable Energy Community, Peer-to-Peer.

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Challenges for Competitiveness and Business Sustainability in the Precious Metals Market

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Abstract

Gold price volatility has gained increasing economic and financial relevance, particularly affecting sectors that intensively use gold as a raw material, such as the jewellery industry (Chiang, 2022). The present study aims to empirically analyse the relationship between gold price volatility, financing conditions, time pressure, and innovative performance in SMEs operating in the jewellery sector. The study adopts a quantitative methodology, combining primary and secondary data. Secondary data are obtained from the ORBIS database, allowing the collection of financial indicators related to liquidity, indebtedness, solvency, and economic performance. Primary data are collected through a questionnaire administered to companies in the jewellery sector, with the objective of measuring perceived time pressure and innovative performance. Statistical analysis is conducted using SPSS software, applying descriptive statistics, correlation analysis, and regression models. The literature suggests that gold price volatility operates as a structural cost shock, increasing pressure on margins, inventories, and operational decisions (OECD, 2024). Recent research demonstrates that excessive time pressure negatively affects creativity, experimentation, and innovative performance, particularly in industries dependent on technical precision and product differentiation (Song et al., 2023). The study concludes that gold price volatility and financial constraints may intensify time pressure in jewellery SMEs, negatively affecting firms' innovative performance. The research reinforces the importance of financial management, access to financing, and organisational capabilities as critical factors for competitiveness, resilience, and innovation in the jewellery sector (Hussain et al., 2025).

Innovation Management under ISO 56007: Participatory Design for CTM Platform Development in University-Industry Collaboration

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Abstract. Digital product development increasingly requires organisations to combine innovation speed with stronger governance, user alignment, and evidence-based decision-making. This challenge is particularly relevant during the front end of innovation, where early product decisions strongly shape downstream cost, schedule, and solution fit [1]. In regulated digital contexts, such decisions must also remain traceable, testable, and auditable. In university–industry collaborations, however, the translation of heterogeneous stakeholder inputs into prioritised, documented, and governable requirements often remains fragmented and difficult to justify [2].

This research investigates how an ISO 56007-aligned participatory design process can strengthen the identification, prioritisation, documentation, governance, and translation of user needs into requirements during the front end of innovation of a Clinical Trial Management platform developed within a university–industry collaboration [3]. It focuses on the governed front-end innovation process through which participatory inputs from heterogeneous stakeholders are elicited, reformulated, clustered, prioritised, and transformed into traceable requirement artefacts within this empirical setting.

Methodologically, the research adopts a qualitative-dominant sequential mixed-methods single-case design. Data are generated through participatory design workshops, semi-structured interviews with CTM stakeholders and software development actors, a stakeholder survey used for requirements identification and prioritisation, and the analysis of project artefacts and decision documentation. Mixed-method integration is operationalised through an explicit evidence chain that traces how stakeholder inputs from participatory design workshops, semi-structured interviews, and the survey inform opportunity and idea decisions and are subsequently translated into documented requirement records across front-end innovation decision points.

The expected results include a prioritised requirements baseline, a traceability-oriented evidence chain, and a processual framework explaining how governed participatory front-end work can improve requirement quality, decision legitimacy, and cross-stakeholder coordination. By connecting participatory design, requirements engineering, and ISO 56007-based innovation governance, this research contributes to competitiveness, innovation, and sustainability through more transparent, efficient, and user-informed digital product development [2,3].

Keywords. ISO 56007; Participatory Design; Front-End of Innovation; Requirements Identification; Clinical Trial Management Platform; University–Industry Collaboration

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Gender inequality as a structural constraint in European aquaculture

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Abstract. Gender inequality in the EU aquaculture sector is widely recognized as a social justice issue; however, existing studies on gender issues in the EU aquaculture sector often focus either on women's labour experiences or on policy development, while few studies provide a comprehensive analysis linking women's barriers and policy responses. This study adopts a narrative review approach to synthesise existing academic literature and policy reports on women's participation, labour conditions and governance issues in the EU aquaculture sector. Based on the Harvard Analytical Framework (HAF), the review examines four dimensions: activity profiles, access and control over resources, barriers faced by women, and policy and governance integration. The review aims to shed additional light in the gap between policy frameworks that continue to adopt gender-neutral approach, while gender-specific measures remain limited and are not fully implemented on the ground. In addition, the review expects to identify two major gaps in current data systems: the lack of gender-disaggregated data and the limited statistical visibility of women's contributions across the EU aquaculture sector and related activities. By integrating academic literature with European policy and governance reports, this work contributes to a more comprehensive understanding of gender inequality in the EU aquaculture sector and highlights the need for more gender-sensitive policies, labour statistics, and organizational practices. The results of this work will be integrated into a larger framework of a PhD thesis looking at how gender norms and structural inequalities shape the development and economic performance of the European aquaculture sector.

Keywords. *Gender inequality; EU aquaculture sector; Harvard Analytical Framework; policy and governance*

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Organizational dynamic capabilities and circular economy implementation: the role of external pressures and resource commitment in sustainable firm performance

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Abstract.
Major challenges in adopting the circular economy (CE) for sustainable performance include high upfront costs, inadequate infrastructure, lack of supportive regulatory frameworks, low consumer awareness, insufficient technological expertise, insufficient research and innovation and hesitant organizational cultures. This research examines how CE practices combined with dynamic organizational capabilities and a circular dynamic environment align with sustainable development goals and contribute to sustainable performance within the context organization. This study examines the integration of social, economic, and environmental pillars of the CE to support sustainable performance. The theoretical foundation forms a triangulation of the Dynamic Capabilities (DCs) Theory, Resource-Based View (RBV), and Triple Bottom Line (TBL) Theory. It explores the effects of regulatory pressure and green innovation on the adoption of Circular Economy Practices and achieving sustainable performance. Additionally, the study investigates the effects of responsible research and innovation (RRI) and resource commitment on the implementation and adoption of Circular Economy practices and assesses whether these practices contribute to enhanced sustainable performance. This study poses a primary research question framed within the context of circular economy practices that "How and why do external pressures and the implementation of circular economy practices encounter obstacles in the process of achieving sustainable performance?". This study will employ a quantitative, cross-sectional research design using structured questionnaires to collect data from key stakeholders, such as sustainability managers, environmental engineers, and academic researchers, who are directly involved in sustainability-related practices within their organizations. The study aims to statistically analyse these relationships through Structural Equation Modelling (SEM). The study contributes both theoretically and practically, bridging the gap between DCs and CE practices and implementation, and it offers actionable insights to enhance sustainable performance. Ultimately, it provides guidance on management strategies that are technologically supported and socially inclusive facilitating sustainable innovation in organizations and enabling their growth.

Keywords. *Circular Economy, Dynamic Capabilities, Sustainable Performance, Resource Commitment, Responsible Research and Innovation (RRI)*

Empowering youth digital entrepreneurship: higher education institutions and online learning communities as support ecosystems.

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Abstract. This research project explores the role of Higher Education Institutions (HEIs) and online learning communities in supporting digital entrepreneurship initiatives, particularly among Generations Y and Z.
As digitalization is reshaping entrepreneurship, the study examines how academic ecosystems and online platforms enhance young entrepreneurs' digital skills and know-how, improve access to resources and address their challenges. Using a pragmatic, mixed-method approach, it aims to evaluate support structures in academia, identify motivations and obstacles for young digital entrepreneurs, and assess existing strategies within university-based entrepreneurial ecosystems (UBEEs). This research aims to deliver actionable insights, a strategic framework and a prototype for an online platform to support digital entrepreneurship, tested at the University of Aveiro's (UA) STEP UP strategy.
By bridging education and online communities, it deepens the theoretical understanding of generational motivations, institutional support and strategies shaping academic digital entrepreneurship ecosystems, while analyzing the integration of collaborative learning and digital technologies into entrepreneurship education. As such, this research adds a contribution to the current knowledge, helping to strengthen the existing theory on entrepreneurial support ecosystems and education.
The implications of this work extend beyond academia, providing directions for HEIs to strengthen their role in fostering young digital entrepreneurs, assessing current support initiatives, student needs, and proposing a framework to enhance digital entrepreneurship support in practice.

Keywords. *Digital Entrepreneurship; Entrepreneurship Education; UBEEs; MOOCs; Online Learning Communities*

Acknowledgements: The authors acknowledge the support given by the University of Aveiro, University of Minho, University of Beira Interior, UA COOPERA and GOVCOPP. This work was developed within the scope of the University of Aveiro's STEP UP Strategy. The corresponding author expresses his gratitude to the institution for funding his research under its PhD Scholarship Program.

[GOVCOPP] Decision support systems

COASTA: advancing HIDRALERTA as a policy-support tool for local coastal risk management in Portugal

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Abstract. Coastal communities are increasingly exposed to wave overtopping, flooding and erosion, pressures expected to intensify under climate change [1]. Effective early warning systems therefore require not only monitoring, forecasting and risk assessment, but also public communication, institutional uptake and integration into local planning and civil protection instruments [2]. In Portugal, HIDRALERTA, developed and operated by the National Laboratory for Civil Engineering (LNEC), provides forecasting, warning, and risk assessment for wave-induced hazards in coastal and port areas [3]. However, its operational use remains mainly restricted to technical and institutional users, limiting its potential as a public-facing tool and as a direct support system for local coastal risk governance.

The doctoral project COASTA – Aware, Safe and Technologically Active Coastal Communities – addresses this scientific and operational gap by proposing the evolution of HIDRALERTA from a specialised decision-support system into a more accessible, validated and policy-relevant coastal early warning infrastructure. The pilot case is Praia da Vitória, Terceira Island, Azores, where HIDRALERTA, video-monitoring capacity and municipal civil protection structures are already in place.

Methodologically, the project will combine user-needs assessment, risk perception and trust analysis, real-time video-monitoring for validation and calibration of HIDRALERTA alerts, and machine-learning procedures for image-based detection and classification of overtopping and flooding events. It will also design and test a public digital interface for real-time alerts, safety protocols and risk communication. Expected results include an operational and institutional model for opening HIDRALERTA outputs to wider public use, while supporting their formal integration into municipal planning, civil protection, and territorial management instruments, such as local emergency plans and municipal master plans. The project is expected to strengthen evidence-based coastal governance and provide guidelines for replication in other exposed coastal territories.

Keywords. *Early warning systems; Wave overtopping; Public risk communication; Risk perception; Civil protection.*

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Acknowledgements. This work is funded by the Portuguese Foundation for Science and Technology (FCT), through the doctoral research grant 2025.01605.BDANA. The authors also acknowledge the LIFE-GARACHICO Project (LIFE20 CCA/ES/001641) as a partner project in the Praia da Vitória case study. Finally, the authors gratefully acknowledge the support and collaboration of the Municipality of Praia da Vitória and its Municipal Civil Protection Office.

Air pollution, health, and macroeconomic dynamics in Portugal: economic costs and the role of environmental policies

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Abstract. Air pollution constitutes one of the main contemporary challenges for public health and economic performance. The present document proposes an investigation into the relationships between this risk factor, health, and the economy in Portugal, in which the aim is to conceptualize it as an adverse shock to the Aggregate Demand (AD) and Aggregate Supply (AS) curves, likely to affect the equilibrium in the goods, money, and labor markets. The analysis is divided into three papers. The first paper focuses on the effects of pollution on healthcare expenditure and labor productivity in health. The second paper analyzes the role of the latter two as transmission channels of the shock to the macroeconomic sphere, particularly with regard to changes in output, price levels, and employment. In the third paper, the effectiveness of environmental taxes in mitigating these impacts is assessed within the established conceptual model. Methodologically, a hybrid and sequential strategy is employed. Two Structural Vector Autoregressive (SVAR) models are estimated to identify the causal effects of pollution health burden on health expenditure and labor productivity, and to analyze the respective dynamic propagation. A Computable General Equilibrium (CGE) model is constructed, calibrated using previously obtained elasticities, to model the dynamics of the shock's transmission and quantify its repercussions. By extending this model, the effectiveness of environmental taxes in mitigating these effects is assessed. By quantifying the economic costs of pollution in an integrated manner and evaluating counterfactual and policy scenarios, this investigation contributes to the necessary findings given the evident health costs that have not been addressed in the national context, as well as for the foundation of environmental policies as strategic investments for economic resilience.

Keywords. *Air pollution; Labor productivity; Healthcare expenditure; Economic impact; Environmental taxation*

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Beyond General Financial Literacy: Domain-Specific Competencies and Financial Decision-Making in Portugal

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Abstract. Financial literacy has predominantly been treated in the literature as a homogeneous construct, measured through classical questions on interest, inflation, and diversification [1]. This doctoral thesis, currently under development at the University of Aveiro, argues that this approach is insufficient in a financial ecosystem shaped by the digitalisation of services [2] and the integration of ESG criteria into investment decisions [3[. I contend that financial literacy is best understood as a set of domain-specific competencies whose relevance depends on the type of decision at stake, requiring an explicit distinction between *participation* in financial markets and the *qualitative orientation* of that participation.

The empirical evidence draws on microdata from the 5th Survey on Financial Literacy and Investment Behaviour conducted by the Portuguese Securities Market Commission (CMVM, 2024), comprising approximately 2,663 respondents from the Portuguese university community. Objective knowledge-based indices are constructed for the traditional, digital, and sustainable components of financial literacy, and OLS, logit, and ordered logit models are estimated, complemented by robustness tests addressing measurement overlap.

Three sets of results structure the thesis. First, the determinants of financial literacy operate heterogeneously across dimensions: age strongly penalises digital literacy, suggesting a generational divide, while formal education weighs more heavily on traditional literacy; gender gaps and income gradients are transversal and persist after controls. Second, regarding participation in emerging digital markets, both traditional and digital financial literacy are positively associated with cryptocurrency ownership, with digital literacy displaying a substantially larger effect on participation probability and emerging as the only robust predictor of exposure intensity. Third, in the context of sustainable financial behaviour, general financial literacy shows limited or ambiguous explanatory power, whereas domain-specific literacy retains a positive incremental effect under conservative specifications that remove conceptual overlap with the dependent variable.

Taken together, the evidence suggests that general financial literacy is relevant for entering financial markets but insufficient for guiding decisions in specialised domains such as crypto-assets or ESG investing. The policy implications point towards domain-specific and demographically targeted interventions, rather than generic financial education programmes [4].

Keywords. *Financial literacy; Digital financial literacy; Sustainable financial literacy; Cryptocurrency; Sociodemographic determinants; Portugal*

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Built environment and heritage as an educational space: memory and projection in a gentrified city

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Abstract. This study examines possible relationships among educational territories, built heritage, and gentrification. The aim is to explore mechanisms towards the promotion of built heritage as an educational space, drawing on the territory's educational functions and UNESCO's guidelines. It seeks to relate contemporary urban challenges and phenomena to the strategic valorisation of built space/heritage as a resource in the design of public education and urban regeneration policies, on the path toward *"degentrification"* in the context of downtown Aveiro.

The theoretical framework on urban dynamics that has affected heritage and its educational potential – promoting social exclusion and reducing the accessibility of the space to local communities – highlights its relevance for developing new educational responses and policies to engage with complex, co-constructed social spaces. The specific objectives include the analysis of i) the role of heritage in preserving cultural and social identity, collective memory, and intergenerational learning; ii) the need to adapt heritage spaces for inclusive and accessible educational uses; and iii) the appropriation of heritage by residents and new populations, fostering sociocultural diversity.

Methodologically, this study is exploratory and includes: i) a literature review to understand the Sustainable Development Goals for education and the role of non-formal and informal education in local communities; ii) mapping elements of the built heritage of the city of Aveiro and testing AI tools in the recreation of historical images; and iii) the analysis of elements of the built environment and paths that enable its enjoyment, the study of gentrification indicators, and the potential consultation of people/establishments with historical significance.

The study proposes a critical approach, viewing built heritage as an educational resource for mitigating phenomena such as gentrification and for developing the Territory's educational perspective.

Keywords. *Educational territories; Built heritage; Gentrification; City of Aveiro.*

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Machine learning fails to improve discretionary accruals: evidence from european restatements

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Abstract. This study examines whether machine learning methods improve the estimation of discretionary accruals, the dominant empirical proxy for earnings management despite longstanding concerns regarding their construct validity. Prior research argues that nonlinear machine learning methods can overcome the restrictive assumptions embedded in conventional linear accrual models and thereby produce more informative measures of earnings management. We empirically evaluate this claim by comparing discretionary accrual estimates generated from machine learning methods, such as Random Forests, Support Vector Machines, and Neural Networks, with those obtained from traditional linear Jones-type accrual models. To assess the validity of these measures, we use regulator-enforced financial restatements as a direct and observable proxy for financial misreporting. The sample comprises 1,191 European listed firms over the period 2012–2022. The findings yield two main results. First, machine learning-based discretionary accrual models do not outperform conventional linear accrual models in identifying firms subject to enforcement actions. Second, neither machine learning-derived nor traditional discretionary accrual measures exhibit a statistically significant and robust positive association with the underlying restatement benchmarks. This finding suggests that firms reporting higher levels of discretionary accruals are not more likely to experience regulator-enforced restatements, irrespective of whether discretionary accruals are estimated using machine learning or conventional linear methods. This study contributes to the earnings management literature by questioning the widespread assumption that discretionary accruals constitute a reliable proxy for financial misreporting across research settings. The study further contributes to the emerging literature on machine learning in accounting by showing that greater methodological flexibility does not necessarily improve measurement quality when the target variable is itself a noisy proxy. These findings call for a reassessment of the continued reliance on discretionary accruals in archival earnings management research and highlight the importance of externally validated measures of financial misreporting.

Keywords. *Earnings management; Discretionary accruals; Machine learning*

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Dilemmas of territorial cohesion in Portuguese border regions: from evidence to policy action

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Abstract. This study examined the dilemmas of territorial cohesion in Portuguese border regions, understood as situations of structural irresolvability between the objectives of territorial convergence promoted by European and national policies and the persistence of processes of peripheralisation, marginalisation and depopulation in borderland territories [1]. The study universe comprised 39 municipalities bordering Spain, integrated within 11 Intermunicipal Communities (CIMs) and distributed across 4 NUTS II regions. The methodological strategy combined a systematic literature review guided by the PICOC and PRISMA 2020 protocols, documentary analysis of territorial policy instruments affecting border regions, multivariate statistical analysis of municipalities through principal component analysis and cluster analysis, and, at a later stage, multi-criteria analysis applied to the Intermunicipal Communities. Preliminary results confirmed the existence of marked territorial asymmetries across the Portuguese border space. The ageing index ranged from 181 to 716, municipal gross value added varied from under 15 to approximately 1,400 million euros, and tourist overnight stays from under 1,500 to more than 240,000 per municipality. The multivariate analysis identified differentiated municipal typologies, distinguishing profiles of greater structural vulnerability, intermediate profiles, and municipalities with greater functional consolidation. The systematic literature review equally confirmed the limited representation of these territories in the international scientific literature, with only 24 articles specifically identified. The results demonstrated that the border condition in Portugal did not constitute a homogeneous reality, but rather an internally differentiated territorial mosaic, requiring territorially sensitive public policy instruments and multilevel governance models tailored to the institutional capacities of the Intermunicipal Communities [2,3].

Keywords. *Territorial inequalities; Portuguese border municipalities; Intermunicipal Communities; peripheralisation; multi-criteria analysis*

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Designing ProVisio: a generative-AI-augmented BI artefact for SME decision-making — a design science thesis-progress report

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Abstract. Dashboards promise managers a clear view of their business, and generative large language models now add what dashboards never had: a narrative that explains what the numbers mean. Yet in small and medium-sized enterprises that promise is largely untested — rigorous evidence of how a dashboard-plus-LLM artefact changes real decisions is scarce, especially outside Anglo-Saxon settings. This communication traces the first design cycle of a doctoral project that follows Design Science Research [1,2] to build and evaluate ProVisio, a business-intelligence artefact that wraps canonical dashboards in an LLM-generated narrative layer. That narrative is deliberately structured — 20% data, 60% interpretation, 20% recommended action — and kept within Responsible AI limits (EU High-Level Expert Group guidance, EU AI Act, ISO/IEC 42001), so that guidance never outruns accountability. The artefact is studied through an embedded multi-case design. Only one case is live today: the host organisation itself, where ProVisio is already in use as a self-monitoring pilot; three further sites — an education provider, a direct-to-consumer retailer and a further small enterprise — are targeted as validation cases, none yet secured. A PRISMA-screened review grounds the theory, and evaluation follows the Framework for Evaluation in Design Science [3] across formative and pre-summative cycles. Early results, drawn solely from the host organisation, are encouraging: gains in cost-efficiency and decision support, and three recurring themes — narrative as a lever for action, traceability as the precondition for trust, and bounded LLM autonomy as an unprompted, welcome surprise. A twelve-month summative evaluation and, once access is secured, replication across the external sites are planned. The contribution is twofold: a reproducible BI-plus-LLM artefact for SME decision-making, and an early process model linking AI-generated narrative to documented managerial action.

Keywords. *Business intelligence; Decision support systems; Design science research; Generative AI; Small and medium-sized enterprises*

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Housing policies in Portugal: social justice, multilevel governance, and public policy evaluation

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Abstract. What do housing policies, social justice, multilevel governance (MLG) and public policy evaluation have in common? These dimensions demonstrate convergence in housing policies focused on promoting access to decent and adequate housing. At the same time, the formulation and implementation of these policies occur within the context of MLG, involving multiple levels of decision-making and multiple actors, which create coordination challenges in setting priorities and responding to identified needs. In this context, policy evaluation, despite the difficulties inherent in its implementation, becomes essential for understanding the alignment between objectives, instruments and outcomes.

The Portuguese case, which has yet to be fully explored regarding the interplay between these dimensions, provides a relevant analytical context. Thus, this study, based on semi-structured interviews with key stakeholders in housing policy in Portugal (e.g. mayors, municipal officials, current and former government officials, and experts), seeks to: i) understand the complexity underlying the incorporation of social justice principles into housing policies; ii) identify potential, challenges and opportunities for improvement arising from the formulation and implementation of policies under the MLG framework; and iii) present recommendations that contribute to a more consistent and comparable evaluation of these policies.

The preliminary findings, drawn from around 20 interviews, reveal differences in perceptions of the problems, solutions, and future direction of policies, as well as constraints related to coordination between stakeholders and decision-making levels, and to insufficient funding. It is also worth noting the varying levels of municipal capacity, which influence the formulation, implementation, and outcomes of policies. Finally, there is a clear difficulty in designing and evaluating fair housing policies, due to the subjectivity of concepts of justice, the absence of universal indicators and the scarcity of human and financial resources.

Keywords. *Evaluation; Housing policy; Multilevel governance; Portugal; Social justice*

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When persistence becomes a trap: Adaptive and maladaptive entrepreneurial persistence among female founders in Germany

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Abstract. Female founders in Germany operate in a structurally constrained environment: receiving only a minimal percentage of available venture funding, they face conditions in which failure carries disproportionate personal and financial costs. Under such pressure, the decision to persist is rarely a free strategic choice — it becomes, in many cases, structurally imposed, tipping readily into maladaptivity.
Adaptive persistence (AP) describes how a founder continues despite adversity — through flexibility and adjustment. Maladaptive persistence (MP), by contrast, reflects continuation without adjustment, despite clear counterevidence. This distinction between adaptive and maladaptive persistence is absent from entrepreneurship scholarship as well as studies on the causes of a shift from AP to MP. Female founders and the German context are similarly underrepresented.
Across three sequential papers — a systematic literature review, qualitative interviews and a synthesising conceptual framework — this dissertation draws on psychological coping theory to introduce the adaptive/maladaptive distinction, examine what causes a shift from AP to MP or vice versa, surface gender-specific persistence factors, and generate actionable insights for policy and support structures.

Keywords. *Entrepreneurial persistence; adaptive persistence; maladaptive persistence; female founders; Start-Ups in Germany*

Multi-criteria decision-making for strategic planning in cardiovascular care

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Abstract. Decision-making in healthcare management involves complex trade-offs among clinical, economic, organizational and equity-related dimensions, often under conditions of uncertainty and resource scarcity [1]. This study is planned to investigate the applicability and feasibility of multi-criteria decision-making (MCDM) methods as structured decision-support tools for investment and planning decisions related to haemodynamics laboratories in Portugal, a context of particular relevance given the significant burden of coronary artery disease on the national cardiovascular care network [2]. Grounded in decision-making theory, stakeholder theory, institutional theory, resource allocation theory and value-based healthcare principles, a cross-sectional, mixed-methods research design was adopted. The methodological approach combines qualitative and quantitative techniques, beginning with the identification and validation of decision criteria through a Delphi process involving key stakeholders, including interventional cardiologists, hospital administrators and healthcare decision-makers. The Analytic Hierarchy Process (AHP) will be then employed to elicit stakeholder preferences through pairwise comparisons, enabling the derivation of priority weights and the systematic evaluation of trade-offs across five core dimensions: financial sustainability, clinical effectiveness, strategic alignment, equity and access, and technological integration [1]. Weighted criteria will be aggregated into composite indicators designed to support informed decision-making and facilitate monitoring of system performance. Sensitivity analyses will be incorporated to ensure methodological robustness. Expected results include a clear priorization of decision criteria, identification of preference heterogeneity across stakeholder groups and the generation of robust, interpretable rankings to support strategic planning [3]. This research aims to enhance transparency, legitimacy and equity in cardiovascular resource planning, contributing both methodological and practical insights to healthcare management and policy decision-making in Portugal and comparable Southern European health systems.

Keywords. *Multi-criteria decision-making; Decision-support; Cardiovascular resource allocation; Delphi method; Analytic Hierarchy Process*

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[GOVCOPP] Public policies, institutions and innovation

A capacidade de influência das onga nas reservas da biosfera transfronteiriças de portugal

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Abstract. A literatura tem cada vez mais indícios de que as organizações não governamentais de ambiente (ONGA) oferecem um contributo significativo para a criação e gestão de áreas protegidas, desempenhando um papel fundamental nas políticas de conservação. Embora existam amplas evidências de que as ONGA influenciam as decisões políticas relativas à proteção e gestão dos recursos naturais, pouco ainda se sabe sobre as estratégias e mecanismos que utilizam para exercer essa influência [1].
Quando de trata de contextos em que essas áreas protegidas estão em zonas transfronteiriças, o desafio é ainda maior. Esses são territórios com necessidades de governança específicas, já que estão sujeitas à sobreposição de diferentes jurisdições normativas e dinâmicas sócio políticas muitas vezes opostas [2].
Assim, o objetivo central desta investigação é compreender a capacidade de influência política destas organizações na governança transfronteiriça nas Reservas da Biosfera (RB) em Portugal. Para isso, será realizada uma análise documental a partir de partir de fontes secundárias, como notícias, planos de ação e outros documentos oficiais disponíveis no website e rede sociais oficiais das três Reservas da Biosfera existentes em Portugal: Gerês-Xurés, RB da Meseta Ibérica e RB do Tejo-Tajo Internacional. Esta análise irá tentar identificar a capacidade de influência das ONGA através de três categorias de evidências: citação direta dos textos ou posições das ONGA em documentos, redirecionamento do discurso público e político sobre as causas ambientais ligadas a estes territórios e introdução de temas sugeridos pelas ONGA nas pautas políticas locais.
Com o uso de uma abordagem metodológica baseada em análise documental, pretende-se aprofundar o entendimento sobre o impacto político das ONGA nestas três áreas protegidas.

Keywords. *Capacidade de influência; Governança transfronteiriça; Governança ambiental; Áreas protegidas*

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Envelhecimento populacional em Portugal continental: evidências territoriais e as políticas públicas do cuidado

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Resumo. O envelhecimento populacional constitui uma das transformações demográficas centrais do século XXI, impulsionada pelo aumento da esperança de vida, melhoria da saúde e redução da renovação geracional. Nos países desenvolvidos, coloca desafios às políticas públicas, sobretudo à sustentabilidade financeira e à provisão de cuidados sociais e de saúde. Em Portugal, assume particular intensidade, refletindo uma estrutura envelhecida e fraca renovação populacional. O país está entre os mais envelhecidos da União Europeia [1] e poderá figurar entre os mais envelhecidos do mundo em 2050 [2].
Este estudo analisa a relação entre envelhecimento populacional e assimetrias territoriais na distribuição de equipamentos sociais de apoio à população com 65 ou mais anos em Portugal continental [3]. Procura-se compreender se os padrões locais de envelhecimento estão alinhados com as respostas sociais municipais.
A análise desenvolveu-se em duas etapas. Primeiro, utilizaram-se cinco indicadores demográficos — índice de envelhecimento, dependência de idosos, longevidade, sustentabilidade potencial e proporção da população com 65 ou mais anos — para caracterizar o contexto nacional e territorial. Segundo, aplicou-se o Índice de Dissimilaridade [4] para avaliar disparidades entre 278 municípios, com base na distribuição dos equipamentos sociais para pessoas idosas, em 2015 e entre 2020 e 2024.
Os resultados evidenciam disparidades territoriais na afetação dos serviços face à pressão demográfica. Revelam dinâmicas de segregação espacial, em que territórios em despovoamento e mais envelhecidos podem enfrentar maiores barreiras no acesso a respostas adequadas. Identificam-se perfis territoriais distintos, apontando para cuidados diferenciados e mecanismos de redistribuição que mitiguem iniquidades.
Conclui-se que a evidência territorial georreferenciada é essencial para apoiar um planeamento público equitativo, territorializado e eficaz, em particular no desenho de infraestruturas sociais e políticas de envelhecimento. Ao relacionar pressão demográfica e oferta de cuidados, a análise contribui para políticas públicas mais sensíveis ao território e ajustadas às necessidades de uma população envelhecida.

***Palavras-chave**. Política Pública; Envelhecimento; Território; Rede de Equipamentos Sociais; Municípios.*

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Digital-age persuasion: how short-form media frames influence young adults' right-leaning political judgements

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Abstract. Recent elections highlight a significant rightward shift among Generation Z and Millennial voters in Europe and Portugal [1]. Macro-level accounts point to cultural threat, economic insecurity, and political dissatisfaction, yet they rarely explain how political cues become persuasive in fast-paced digital environments. This doctoral project examines how short-form media frames influence young Portuguese adults' receptivity to right-leaning political messages. Building on neuropolitics and political psychology [2], the study connects threat/loss framing, opportunity/gain framing, leader-related cues, and motivational predispositions [3,4]. Methodologically, it proposes a quantitative online survey experiment with Portuguese voters aged 18–35, using a 2 × 2 between-subjects design that crosses message framing with leader-cue salience. Participants will be exposed to fictional right-leaning social media stimuli, and receptivity will be measured through perceived credibility, agreement, emotional resonance, identification, and willingness to engage. The project aims to clarify how digital political communication may shape young voters' rapid political judgements and contribute to evidence-based civic communication and media literacy.

Keywords. n*europolitics; youth voters; political communication; digital media*

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A política tem-se vindo a basear cada vez mais em estratégias agressivas (Nai et al., 2022). O crescimento mundial dos níveis de polarização afetiva - tendência para apoiantes partidários desgostarem e desconfiarem dos que pertencem a outro partido (Druckman et al., 2021) é reflexo desta mudança. Isto origina comportamentos agressivos que não emergem de divergências entre posicionamentos (Mason, 2018) e estão associados à incapacidade de responsabilização dos representantes (Iyengar et al., 2012), diminuição do capital social (Iyengar & Westwood, 2015), descontentamento com instituições (Druckman & Levendusky, 2019), e fomentação de protestos violentos que incluem até os cidadãos menos politizados (Iyengar et al., 2019). Portugal destaca-se por apresentar grandes variâncias entre períodos analisados. Seria de esperar que o seu contexto político conduzisse a um nível crescente de polarização afetiva – dado que é fomentada por desacordos entre partidos, dificuldades de coligação e cooperação entre partidos, soluções de governo instáveis (Reiljan, 2020), entrada de novos partidos no parlamento nacional, e crescimento de partidos populistas, nomeadamente de extrema-direita (Torcal & Comellas, 2022). Contudo, isto não corresponde aos dados existentes, colocando-se a hipótese de que as variáveis atualmente utilizadas para estimar os níveis de polarização afetiva em Portugal não são suficientemente explicativas. Assim, o presente estudo procura identificar variáveis potencialmente explicativas através de uma análise mais profunda do caso português.

O impacto das políticas públicas nos programas doutorais e na investigação científica em enfermagem

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Abstract. Procura-se compreender de que forma as políticas públicas nacionais influenciaram o desenvolvimento dos programas doutorais e a produção científica em enfermagem em Portugal.
Os resultados da literatura evidenciam progressos relevantes e auspiciosos na evolução da investigação e formação doutoral em enfermagem, com a criação de quatro programas doutorais em enfermagem e a implementação de centros de investigação de amplitude nacional. No entanto, persistem desafios estruturais, nomeadamente: a falta de financiamento contínuo e adequado; carência de docentes doutorados; dificuldades dos profissionais na conciliação da vida familiar e profissional; fraca valorização da investigação em enfermagem.
Resultados da pesquisa já realizada revelam que o "stress e a falta de tempo" são a maior dificuldade sentida pelos estudantes. Este é o fator mais apontado pelos respondentes, seguido do "desgaste psicológico". Verifica-se uma opinião generalizada de que as políticas públicas existentes são desestruturadas e inadequadas face às reais necessidades dos doutorandos,
Anseia-se pela criação de um quadro de medidas e apoios estruturais adequado e criado em articulação e com a contribuição de todos os intervenientes.
Constata-se que a maior ambição profissional dos estudantes dos programas doutorais em enfermagem é o ingresso na carreira docente, justificável pelos elevados níveis de exigência física e mental da profissão, pela baixa componente salarial, ou pela estabilidade que oferece a carreira universitária.
Apesar de avanços significativos, é necessário continuar a reforçar as políticas públicas que sustentam os programas doutorais em enfermagem, com um aumento do investimento em infraestruturas e na qualificação docente. O fortalecimento da investigação em enfermagem e a valorização da formação doutoral são determinantes para o avanço da disciplina, o reconhecimento da enfermagem como ciência autónoma e interdisciplinar e em última análise para a melhoria dos cuidados de saúde.

Keywords. *Programas Doutorais em Enfermagem; Investigação em Enfermagem; Enfermeiros; Políticas Públicas; enfermagem.*

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Land use impact assessment of bioeconomy strategies: evidence from a systematic literature review

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Abstract. The bioeconomy transition intensifies competition for land resources, generating complex trade-offs within the energy-water-land nexus [1]. Formalized as a European Union's Strategy in 2018 [2], the bioeconomy framework positions sustainable resource management and climate mitigation as central policy objectives, yet spatial dimensions of land-use impacts remain underexplored in scientific discourse [3]. This study examines how land-use impacts of bioeconomy actions are assessed and reported in the scientific literature, with emphasis on regional and local spatial implications. Drawing on the five spatial planning core themes established by Grossauer & Stoeglehner [3] (land-saving development, agricultural priority zones, ecological priority zones, resource-use optimization, and participatory planning) as analytical lenses, a Scopus search combining bioeconomy-related terms with environmental assessment and territorial planning keywords yielded a final dataset of 43 articles, assessed through content analysis. Findings reveal that: i) land-saving development and agricultural or ecological priority zones received minimal attention despite their critical importance for preserving productive land; ii) dominant methodologies focused predominantly on carbon emissions and biodiversity impacts, rarely embedding planetary boundaries or capturing cumulative territorial effects; iii) methodological gaps persist in assessing indirect land-use change, long-term socio-ecological dynamics, and ethical dimensions of landscape transformation. Overall, assessment approaches exhibit technological-economic orientations that neglect territorial integration and land-use conflict mediation, reflecting the governance disconnect between policy ambitions and spatial implementation identified by [4]. Finally, effective bioeconomy land-use impact assessment requires integrated spatial planning frameworks addressing energy-land-water interdependencies, food security trade-offs, and participatory governance in land-allocation decisions.

Keywords. *Spatial planning; Life Cycle Assessment; Land-use change; Environmental Impact Assessment; Territorial governance.*

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A avaliação do desempenho como dispositivo de governação na administração pública portuguesa: uma análise crítica a partir do SIADAP 3

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Abstract. A avaliação do desempenho é um pilar dos sistemas modernos de gestão pública, integrando-se nas reformas da Nova Gestão Pública que procuram introduzir lógicas de eficiência, eficácia e responsabilização na Administração Pública Portuguesa. O SIADAP foi concebido como um mecanismo de alinhamento entre os objetivos estratégicos dos organismos e o desempenho individual dos dirigentes e trabalhadores, promovendo uma cultura de mérito, monitorização e responsabilização.

Apesar da centralidade normativa e institucional, o SIADAP3, subsistema de avaliação do desempenho dos trabalhadores, é percecionado como um processo burocrático, com reduzida eficácia na diferenciação dos desempenhos e limitada integração na gestão estratégica dos organismos.

Neste contexto, emerge uma tensão entre os objetivos estratégicos associados a este sistema de avaliação e às formas concretas da sua operacionalização. Embora exista literatura sobre os efeitos instrumentais do SIADAP3, permanece limitada a compreensão do seu papel enquanto dispositivo de governação, particularmente no âmbito das racionalidades políticas, organizacionais e técnicas.

O objetivo desta investigação é compreender como o SIADAP3 opera enquanto dispositivo de governação, analisando as racionalidades que o configuram e efeitos nas práticas de avaliação, nas perceções dos atores e nos processos de gestão do desempenho. O trabalho empírico, pretende identificar possibilidades de reformulação do modelo vigente, propondo ajustamentos ou um modelo alternativo de avaliação do desempenho.

Metodologicamente, a investigação adota uma abordagem qualitativa, estruturada na análise documental do enquadramento legal do sistema; realização de entrevistas semiestruturadas; e desenvolvimento de *focus groups*. A amostra incluirá diferentes *stakeholders* - trabalhadores, dirigentes, representantes sindicais e decisores políticos - permitindo captar múltiplas perspetivas sobre este sistema. Paralelamente, a análise da implementação do SIADAP3 no Continente e nas Regiões Autónomas procurará identificar diferentes formas de operacionalização do modelo, contribuindo para uma reflexão crítica sobre os desafios da governação do desempenho e identificação de práticas suscetíveis de apoiar a reformulação do sistema.

Keywords. *SIADAP 3; Administração Pública; Avaliação do Desempenho; Governação; Nova Gestão Pública*

Between mobility and permanence: a decade of medical retention policies in Portugal

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Abstract. The retention of physicians in underserved areas represents one of the major challenges facing contemporary public healthcare systems, particularly in contexts marked by persistent territorial inequalities. In Portugal, the establishment of the legal framework for underserved areas in 2015 constituted the first structured attempt to promote physicians' geographic mobility through financial incentives and administrative mechanisms directed at territories experiencing difficulties in recruitment and professional retention. Despite the progressive expansion of these measures, significant challenges remain regarding the sustainable retention of healthcare professionals in underserved regions. [1]

This study analyzes the evolution of Portuguese medical retention policies between 2015 and 2025, focusing on the relationship between physicians' initial placement and long-term institutional permanence in organizations classified as underserved [2]. The research seeks to understand whether these policies effectively contributed to sustainable territorial retention or primarily functioned as temporary mechanisms for redistributing the medical workforce within the National Health Service.

The study combines normative and documentary analysis, an international literature review, and longitudinal analysis of administrative data provided by the Central Administration of the Health System (ACSS) [3]. The empirical dataset includes the professional trajectories of 1,287 physicians recruited into underserved positions throughout the decade under analysis. Additionally, a qualitative component based on semi-structured interviews with physicians working in underserved positions is currently being developed.

Preliminary findings reveal a progressive process of policy expansion and institutionalization, particularly after 2021, accompanied by a substantial increase in the number of positions classified as underserved. However, the data also demonstrates high intra-NHS mobility and a gradual reduction in institutional permanence among cohorts with longer observation periods. The findings suggest that, although the policy facilitated the initial placement of physicians in underserved territories, sustainable retention remains fragile and dependent on broader organizational, professional, and territorial factors beyond financial incentives alone. [4]

Keywords. *medical retention; public policy; underserved areas; physician mobility; National Health Service*;

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Exploring agency features as barriers and opportunities in decision-making processes for urban sustainability transformations

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Abstract. Local action is crucial for achieving societal transformations toward global sustainability. Through individual and collective agency, local actors play unique roles in constraining or enabling urban sustainability transformations (UST). Urban governance tools, such as strategic environmental assessment (SEA), can integrate sustainability and justice into decision-making, serving as an important entry point for UST. SEA is a systematic, strategic, and participatory policy tool that incorporates sustainability from the outset. However, its potential to drive change in urban systems remains underexplored, with limited literature bridging SEA and UST. Additionally, traditional urban governance often perpetuates unsustainable pathways, resulting in ecological degradation and social inequalities. This research aimed to understand how local actors' agency shaped the transformative capacity of decision-making processes for UST. It explored actors' interactions in SEA processes of municipal master plans in Portuguese urban systems, using COMPASS as the analytical framework [1]. COMPASS outlines two conditions for change: community inclusion and empowerment, and diverse, flexible, and reflexive governance. Central to COMPASS are ten agency features, reflecting actors' ways, abilities, and capacities to act, and/or influence urban decision-making processes, namely: 'awareness', 'collaboration and partnership', 'leadership', 'learning, information and knowledge', 'place', 'power', 'resources', 'shared vision', 'legitimacy and trust', and 'willingness and commitment'. We employed deductive content analysis to identify and explore the linkages between municipal administration and citizens by analyzing official documents and information on citizen participation [2]. Additionally, theory-driven thematic analysis of semi-structured interviews with key actors in the SEA processes was conducted. The research underscored how the agency features, along with institutional settings and urban governance arrangements, shaped the decision-making processes, either facilitating or obstructing them. Moreover, the findings provided insight into the perspectives and roles of key actor groups involved in these SEA processes, highlighting the barriers and opportunities for change.

Keywords. *Agency features; Urban transformations; Reflexive governance; Environmental assessment; Citizen participation; Decision-making*

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Conhecimento, atitudes e perceções da comunidade académica acerca das políticas de cannabis

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Abstract. A descriminalização do consumo de substâncias estupefacientes em Portugal assinala, em 2026, 25 anos, reabrindo o debate sobre a legalização da cannabis para uso adulto. A presente investigação analisa esta opção de política pública e procura colmatar uma lacuna na literatura, ao examinar os conhecimentos, atitudes e perceções da comunidade académica portuguesa relativamente às políticas de cannabis. Trata-se de um estudo exploratório e transversal, com abordagem mista. Nesta apresentação, focamo-nos nos dados quantitativos obtidos através de um questionário, aplicado a estudantes, investigadores e docentes do ensino superior público português, numa amostra não probabilística por conveniência. Realizaram-se análises descritivas e inferenciais para explorar diferenças entre grupos e associações entre variáveis. Os resultados indicam que a cannabis é percecionada como uma substância com riscos, frequentemente avaliada por comparação com o álcool e o tabaco (dano relativo). Observa-se maior legitimidade atribuída ao seu uso terapêutico e atitudes globalmente favoráveis a medidas regulatórias, sobretudo quando associadas ao controlo da qualidade e à proteção da saúde pública. Destacam-se preocupações relacionadas com a segurança, em particular com os riscos associados à condução, ao tempo de reação e ao impacto no desempenho. Verificam-se clivagens em função do género, idade e ideologia política, bem como diferenças consistentes associadas à experiência prévia de consumo e à religião. As associações com o posicionamento político apresentam uma magnitude moderada, mantendo, contudo, um padrão consistente, incluindo maior concordância, entre participantes posicionados mais à direita, com a ideia de que a regulação poderá aumentar o consumo entre os jovens. Em conclusão, as implicações incidem na saúde pública, segurança e desenho regulatório. Os resultados sugerem a necessidade de políticas integradas que combinem prevenção e educação, mecanismos regulatórios orientados para a redução de danos e estratégias de comunicação segmentadas por grupos.

Keywords. *Cannabis; políticas públicas de drogas; regulação da cannabis; atitudes e perceções; comunidade académica; saúde pública; Portugal*

Barriers to digital transition in the portuguese justice system

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Abstract. The phenomenon of digital transition in the Portuguese Public Administration has been gaining increasing importance, as the introduction of new digital tools and processes is recognized as bringing efficiency gains to the day-to-day functioning of its services. The Portuguese justice sector has been investing in digital transition, notably through initiatives such as Justiça+Próxima and the Recovery and Resilience Plan (RRP). It is also acknowledged that, in the context of various types of change, resistance tends to emerge. Thus, the present study aims to understand the main factors underlying resistance to digital transition in the Portuguese justice sector, through the triangulation of a systematic literature review, a survey of justice service employees, and interviews with change managers. Initial findings point to the existence of factors identified in the literature and confirmed by the survey, such as lack of trust in the use of digital tools, divergence of objectives, short-term focus, and the lack of perceived value in digitalization. On the other hand, the interviews suggest additional issues not directly addressed in the literature, such as insufficient training of employees, lack of human resources in justice services, and the excessive workload to which these professionals are subjected. This study therefore contributes to a better understanding of the main drivers of resistance, helping to inform how future public policies can be adapted to the realities of these services. The analysis of successful policies in other countries may also support the transfer of best practices to the justice sector, as well as to Public Administration as a whole.

Keywords. *Digital Transition; Digital Literacy; Efficiency; Portuguese Justice Sector; Resistance to Change*

Transformational leadership and psychosocial factors in cardiac sonographer performance: an individual-level analysis

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Abstract. Echocardiography is a highly operator-dependent diagnostic field in which cardiac sonographers directly influence image quality and diagnostic accuracy. Despite their critical role in clinical decision-making, the psychosocial and organizational determinants of cardiac sonographer performance remain underexplored. This study examines the influence of transformational leadership [1] on individual performance among cardiac sonographers working in team-based settings. It focuses on the mediating role of three psychosocial factors: psychological safety [2], self-perception of performance [3] (operationalized as occupational self-efficacy), and job crafting [4]. Despite extensive research on leadership in healthcare, existing evidence is largely based on nursing populations and often overlooks underlying psychosocial mechanisms.
A mixed-methods explanatory sequential design is adopted. Quantitative data will be collected from cardiac sonographers in public hospitals in northern Portugal using validated instruments, alongside objective performance indicators such as examination volume and expert-rated image quality. Patient-reported experience will be used as a contextual measure. Subsequently, a qualitative focus group including sonographers, cardiologists, and managers will provide deeper insight into the findings. Transformational leadership is expected to positively influence these psychosocial factors, enhancing communication, proactive adaptation, and self-regulation in autonomous healthcare roles. The proposed relationships are grounded in Transformational Leadership Theory, Social Cognitive Theory, Psychological Safety Theory, and the Job Demands-Resources Model. Together, these frameworks explain how leadership shapes psychosocial processes and individual performance in specialized healthcare settings. By focusing on cardiac sonographers, an under-researched allied health profession, this study extends leadership and psychosocial research beyond the nursing populations that dominate existing healthcare literature. It also contributes by integrating transformational leadership, psychosocial mechanisms, and objective performance indicators within a single explanatory framework. The findings are expected to inform leadership development and organizational strategies aimed at improving diagnostic quality and team performance in echocardiography services.

Keywords. *Allied health professionals; Echocardiography; Job crafting; Psychological safety; Self-perception of performance*

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[GOVCOPP] Tourism and development

Senior lifestyle mobilities in rural territories

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Abstract. As longevity increases and societies face the joint challenges of healthy ageing, territorial imbalance, and welfare sustainability, rural destinations are confronted with depopulation and a renewed appeal to lifestyle-oriented visitors. Building on life-course theory [1] and the mobilities paradigm [2], this thesis investigates how seniors' lifestyle mobilities — understood as a spectrum from short stays through long-stay tourism, second-home use, and permanent or return migration — can be leveraged as an opportunity for rural destinations.

The thesis develops through three studies. The first study systematically reviews the body of knowledge on seniors' lifestyle mobilities and maps it against Ritchie & Crouch's destination competitiveness model [3]. Two conceptual contributions emerge: a mobility spectrum that reflects increased commitment to the destination, and the identification of dimensions such as healthcare and community integration as senior-specific attractors largely absent from classical competitiveness models. The second study is planned to test the demand side empirically for the relevance of the identified dimensions. The third and final study will focus on auditing the supply side, including economic agents and destination marketing organizations (DMOs) on their availability and preparation towards the senior lifestyle opportunities.

The thesis offers i) contributions to the theory, as they extend destination competitiveness frameworks for the senior segment, ii) hypotheses testing for a growing segment, and iii) provides DMOs and economic agents with perspectives that may open new business models. All in all, it aspires to help add years to life, life to years, to both seniors and rural territories.

Keywords. *Senior Segment; Lifestyle Mobilities; Mobility Spectrum; Rural Territories; Destination Competitiveness*

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Tourist as a main character: how cocreation impacts tourist experiences in rural areas

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Abstract. This article investigates tourist behavior in rural contexts, focusing on the role of co-creation in shaping tourist experiences and its effects on memorability and destination loyalty. The aim is to understand how tourists' active participation in value-creation processes influences the quality of the experience, the formation of lasting memories, and subsequent behaviors, such as revisiting and recommending the destination. The research adopts a mixed-methods approach, combining a quantitative component, using surveys of tourists to model the relationships among the dimensions of the co-created experience; with a qualitative component, using semi-structured interviews with industry stakeholders to explore co-creation practices, motivations, and challenges. By integrating theoretical and empirical contributions, the study aims to advance scientific knowledge on rural tourism and generate practical implications, offering organizations strategies to create more engaging, personalized experiences capable of strengthening lasting relationships with tourists.

Keywords. *Cocreation; Tourism Experience; Rural Tourism; Memorability; Loyalty; Motivation*

The role of aesthetics in shaping tourist emotional and cognitive engagement and intentions - A neuromarketing approach to rural tourism

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Abstract. Aesthetic experiences are central to rural tourism, particularly in accommodation settings where natural surroundings, atmosphere, authenticity and sensory elements shape tourists' emotional, cognitive and behavioural responses. This ongoing doctoral research aims to examine how aesthetic dimensions influence aesthetic judgements, emotions and tourist behavioural intentions in rural tourism accommodations. The study follows a four-phase mixed-methods design. Phase 1 consists of an online survey using a within-subject design, in which participants evaluate different accommodation stimuli presented in randomised order. This phase aims to validate the structure of aesthetic dimensions and test a conceptual model including mediation and moderation effects, using exploratory factor analysis and structural equation modelling. Phase 2 involves a laboratory experiment designed to examine how aesthetics operate through attention, emotion, engagement and arousal, combining eye-tracking, electroencephalography, electrocardiography, electrodermal activity, self-reported measures and semi-structured interviews. Phase 3 consists of an on-site experiment in real rural accommodation environments, aiming to validate aesthetic and emotional responses in lived experience contexts through biometric, self-report and qualitative data. Phase 4 assesses the enduring effects of the aesthetic experience after the stay, focusing on satisfaction, loyalty, electronic word-of-mouth and memory, complemented by sentiment and emotion analysis of online reviews. The research considers aesthetic judgement, intention to visit and willingness to pay in phase 1 and aesthetic judgement, satisfaction, loyalty and memory in phase 4 as key outcomes, while also exploring the roles of personality, tourist motivations, aesthetic distance, emotions and perceived experiential value. As an ongoing project, the study is expected to contribute to tourism behaviour and neuromarketing research by clarifying how rural accommodation aesthetics shape tourist responses before, during and after the experience.

Keywords. *tourist behaviour; neuromarketing; rural tourism; biometric measures; aesthetic experiences*

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Creative Tourism as an Evolving Framework: Evidence from Empirical Research

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Abstract. Creative tourism (CT) has undergone conceptual and practical evolution over the past two decades, expanding from a narrowly defined tourism niche into a broader territorial development framework. This study analyzes how the literature presents the evolution of CT's practical application by systematically reviewing 75 peer-reviewed empirical articles published between 2000 and 2026. The analysis was conducted using thematic content analysis within a Human–AI collaborative process, following the protocol proposed by Costa et al. [1]. The findings indicate that CT evolved from a classificatory definition centered on small-scale creative experiences toward a multidimensional concept associated with territorial development, governance, and broader sustainability goals. This evolution reflects three interconnected improvements: from classification to operationalization, from experience provision to policy relevance, and from tourism-centric approaches to territorially embedded perspectives. Rather than replacing previous meanings, the literature demonstrates an accumulative process in which earlier conceptualizations remain valid while new roles and functions are progressively incorporated. Contemporary CT increasingly operates as a platform integrating cultural, social, and economic resources, aligning tourism practices with broader development objectives. In this sense, CT functions less as a descriptive tourism category and more as an instrumental framework that supports place-making processes and territorial strategies. This study contributes to the literature by providing a longitudinal mapping of the conceptual evolution of CT in empirical research, highlighting how the concept has shifted from a workshop-based niche toward a broader place-making and policy discourse.

Keywords. *Creative tourism; Territorial development; Society–centric approach.*

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Collaborative networks in tourism destinations: Insights from accommodation providers and implications for tourists' experience and future behaviour

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Abstract. This study examines the role of collaborative networks in tourist destinations, focusing on accommodation establishments as structural nodes within these networks and as key factors influencing tourists' experiences and future behaviour. The research began with two systematic literature reviews that mapped the conceptual and empirical evolution of tourism networks, identified theoretical fragmentation, and revealed a lack of consistent empirical evidence linking networks, tourist experience, and post-visit behaviour. To address this gap, a third qualitative study is currently being conducted using semi-structured interviews with managers of tourist accommodation establishments, supported by thematic analysis in WebQDA. Preliminary results show that accommodation establishments engage in multiple forms of collaboration, both formal and informal. These collaborations facilitate the integration of resources into the establishments' offer, coordination with other destination stakeholders, and the creation of more comprehensive visitor experiences. The findings support previous evidence on the influence of networks on stakeholder responsiveness [1, 2] and experience quality [3]. The fourth study will focus on the demand side and aims to develop a relational model explaining how collaborative networks initiated within tourist accommodation establishments shape the tourist experience. The fifth and final study will analyse how these networks influence tourists' future behaviour. Overall, this research seeks to contribute to the management, governance, and competitiveness of tourist destinations.

Keywords. *stakeholder collaboration; destination governance; hospitality networks; tourist experience; behavioural intentions*

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Anticipation as lived experience in tourism: towards the anticipated tourist experience (ATE)

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Abstract. This research project examines how tourist experiences may begin before physical travel through digital and immersive media. Traditional tourism research has primarily focused on on-site and post-trip experiences. However, contemporary digital environments increasingly allow individuals to imagine, anticipate, and emotionally engage with destinations prior to departure. This study therefore addresses a conceptual gap by positioning the pre-travel phase as an experiential domain in its own right.

To address this gap, the study builds on the Anticipated Tourist Experience (ATE) framework. The framework conceptualizes anticipation as a future-oriented experience shaped by imagination, affect, and mediated visual engagement. It integrates three core dimensions: (i) the temporality of tourist experience [1], (ii) anticipation as lived experience [2], and (iii) mediated visuality as a condition shaping pre-travel experience formation [3].

Grounded in this framework, the thesis develops and operationalizes a conceptual model to examine how immersive technologies, specifically VR head-mounted displays (HMDs), contribute to the ATE under controlled conditions. Where feasible, eye-tracking complements the research design by supporting the observation of attentional engagement during immersive visual exposure.

Overall, this project seeks to extends tourist experience research beyond the trip itself and to explore immersive technologies as a methodological environment for studying early-stage experience formation in tourism.

Keywords. *Tourist experience; Anticipation; Pre-travel phase; Mediated visuality; Virtual reality*

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Integrating corporate sustainability and territorial analysis for monitoring economic sustainability in coastal tourism destinations

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Abstract. The thesis examines the territorial implications of corporate sustainability in the tourism sector from a spatial and economic sustainability perspective focused on coastal regions. The tourism system is characterised by strong seasonality patterns [1], spatial concentration of economic activities, and uneven distribution of benefits [2], which intensifies socio-economic [3] and environmental pressures [4]. Despite the growing importance of sustainability in tourism, the economic dimension remains underexplored. The main objective of this research is to develop a monitoring tool capable of assessing the economic sustainability of tourism companies in coastal regions by integrating company-level sustainability indicators with territorial analysis. The study aims to identify the most relevant indicators and factors influencing economic sustainability performance, while examining the interactions between tourism business activities and territorial pressures. A mixed-methods approach is adopted, combining quantitative and qualitative methodologies within a pragmatic research philosophy. It combines sustainability indicator analysis with spatial assessment techniques to examine the interaction between tourism companies and territorial pressures in coastal destinations. Therefore, it includes the development and systematisation of sustainability indicator databases; the analysis of existing sustainability models; the spatial assessment of tourism-related economic activities, and the empirical validation through tourism companies and institutional stakeholders. Computational techniques are incorporated to support data analysis and indicator development. The expected contribution of this research is the creation of an operational, practical and spatially informed monitoring framework that supports the evaluation of economic sustainability in tourism regions. The study advances current literature by linking corporate sustainability performance with territorial dynamics and contributes to place-based policymaking and strategic planning for sustainable coastal development, aligned with the Sustainable Development Goals 8, 11, and 13.

Keywords. *Business Sustainability; Coastal Regions; Socio-economic Pressures; Spatial Analysis; Sustainability Indicators.*

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[iBiMED] Biomedicine and rehabilitation sciences

Feasibility and safety of a structured focal vibration dose–response protocol in healthy adults: a double-blind pilot randomized controlled trial

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Background. Focal vibration (FV) is an emerging non-invasive neuromuscular modulation strategy used in rehabilitation, but protocols remain highly heterogeneous [1,2]. This pilot study evaluated the feasibility and safety of a structured, multi-session FV dose-response protocol in healthy adults to inform future larger-scale trials. **Methods.** A double-blind pilot randomized controlled trial was conducted at the University of Aveiro, Portugal. Healthy adults (aged 18 years or older) were randomized (1:1) to active FV or sham groups. Active participants received focal vibration to the Achilles tendon over 10 sessions, exploring combinations of five low and five high frequencies under continuous and intermittent modes across multiple exposure durations. Key feasibility indicators included recruitment capability, participant adherence/retention, data collection completeness, technical implementation, and safety. **Results:** Of the 51 individuals who accessed the online questionnaire, 19 met the eligibility criteria. Sixteen participants were successfully contacted by telephone, of whom 15 scheduled the first assessment session and 13 initiated the study procedures, yielding a recruitment rate of 68.42% (13/19) and a yield rate of 25.5% (13/51). No participants withdrew following study initiation. Operational issues included an early online questionnaire access technical glitch and three equipment malfunctions during data collection that compromised data validity. Regarding safety, three cases of a "sharp" sensation were reported. **Conclusion:** The structured FV dose–response protocol demonstrated acceptable overall feasibility regarding participant participation, study initiation, and safety monitoring. However, the identification of recruitment bottlenecks, protocol time burden, and technical actuator malfunctions underscores the necessary adjustments before implementing future larger clinical neurorehabilitation trials.

Keywords. *Neuromuscular modulation; Pilot study; Participant recruitment; Rehabilitation*

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Investigating peroxisome-dependent antiviral pathways through advanced 3D *in vitro* models

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Abstract. During viral infections, the host cell machinery undergoes extensive remodelling by both the virus and the host immune system. Peroxisomes, intracellular organelles that play crucial roles in multiple metabolic processes, are targeted by different viruses that modulate their dynamics and functions, to either evade the host antiviral responses or facilitate viral replication, particle formation, and propagation [1,2]. However, current knowledge on the mechanistic basis underlying this virus–peroxisome interplay remains only partially understood.

To address this limitation, our group is applying systematic and complementary approaches to uncover novel peroxisome-dependent mechanisms exploited during infection and/or antiviral defence. One of these strategies involves the development of organotypic 3D *in vitro* lung tissue models, generated from genetically modified lung epithelial cells lacking specific peroxisomal proteins. We have established and optimised several analytical pipelines to ensure that these 3D models can be directly compared with our previous findings in 2D cell culture systems. Our results demonstrate that cellular organisation and peroxisomal behaviour in the 3D models closely resemble those observed in 2D cultures, validating their use as physiologically relevant platforms. Moreover, we show that influenza A virus efficiently infects the cells within these 3D structures, confirming their suitability for studying peroxisome-virus interactions in a more tissue-like context. We are now proceeding with specific mechanistic analyses aimed at dissecting peroxisome-dependent pathways during infection. At a later stage, we will also incorporate patient-derived epithelial cells from individuals with rare peroxisome biogenesis disorders to generate equivalent 3D models and perform comparative experimental studies. This will allow us to validate our findings in a more physiologically and clinically relevant context. Ultimately, our goal is to identify novel host cellular targets that can be exploited by a broad range of respiratory viruses, paving the way for the development of host-directed antiviral therapeutics.

Keywords. *Viruses; Peroxisomes; Antiviral response; Peroxisome biogenesis disorders; Organotypic 3D in vitro models*

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Understanding why some neurons regenerate: an early transcriptomic perspective

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Abstract. Spinal cord injury (SCI) remains a major clinical challenge due to poor neuronal regenerative capacity in the adult central nervous system (CNS). Conversely, peripheral nerve injury (PNI) elicits a strong regenerative response, providing a useful framework to uncover molecular mechanisms that support neuronal repair[1,2].

To characterize the early transcriptional events associated with regenerative and non-regenerative responses, we analysed transcriptomic profiles of rat motor and sensory neurons 24h after SCI or PNI. Neurons were isolated using laser capture microdissection, followed by mRNA sequencing to define injury-specific transcriptional signatures.

Differential expression analysis revealed striking differences between injury paradigms, with PNI inducing a substantially broader and more dynamic transcriptional response than SCI. More than 1,600 differentially expressed genes (DEG) were identified following PNI, whereas SCI triggered regulation of only approximately 150 genes, indicating a comparatively limited early response. To identify conserved and cell type-specific mechanisms, we examined DEG shared between motor and sensory neurons after PNI and identified 133 commonly regulated genes. Functional enrichment analyses showed that both neuronal populations activated pathways linked to stress and inflammatory responses, intracellular signalling, transcriptional control, lipid metabolism, and reactivation of developmental programs associated with regeneration. However, sensory neurons exhibited a stronger transcriptional response than motor neurons, with more than 1,400 DEG compared with roughly 300 in motor neurons. Particularly, sensory neurons showed prominent regulation of genes related to neurodevelopment, neurite outgrowth, and cytoskeletal remodelling, processes largely absent in motor neurons. Among the genes commonly regulated after PNI, 111 were exclusive to this regenerative condition, highlighting a focused group of potential therapeutic targets. Several transcription factors and membrane receptors from this set were selected for downstream functional validation.

Overall, these findings provide a characterization of the early molecular programs that distinguish regenerative from non-regenerative neuronal responses and identify promising candidates for strategies aimed at enhancing CNS repair.

Keywords. *Spinal Cord Injury; Peripheral Nerve Injury; neuroregeneration; regeneration-associated genes; transcriptomics*

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The use and implementation of Electronic Health Records in physiotherapy practice: a scoping review

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Abstract.

Introduction. Electronic Health Records (EHRs) are reliable tools for managing data in various healthcare settings, and their adoption has been shown to improve the quality of care and patient outcomes (1). Currently, physiotherapy lacks real-world data, which is essential for evaluating and urgently improving services (2). In this regard, EHRs have the potential to bridge the existing gap (3). **Purpose.** To map the evidence on the multiple uses of EHRs in physiotherapy, to better understand their development and applicability in this field. **Methods.** PubMed, Scopus, ScienceDirect, Web of Science and two grey literature databases were searched to identify original studies on the development and assessment of EHRs in physiotherapy contexts. Studies written in English, Portuguese, or Spanish were included from 2010 onwards. The screening of articles and the extraction of relevant data were performed independently by two reviewers. Data extracted included information on EHRs' characteristics, implementation strategies, outcomes and outcome measures, and the impact of EHRs on physiotherapy services. Findings were analysed using inductive and deductive approaches, aggregated by categories, narratively described and displayed in tables and charts. **Results.** Ten studies met the eligibility criteria and were included. Six studies mentioned specific EHRs, while four studied aspects of general EHR implementation. Most EHRs were used in physiotherapy clinics and hospitals for patient registration and monitoring. Barriers included performance, behavioural or institutional challenges. Facilitators included adequate leadership and resources, and user involvement. Eight frameworks, 45 implementation strategies and five implementation outcomes were identified, but implementation effectiveness and impacts on physiotherapy services were little addressed across the studies. **Conclusions.** This review maps the evidence on current EHRs characteristics, implementation and uses and stresses the need for further exploration of their impact on clinical practice, the most effective implementation models, and the specific conditions for improving care delivery and health outcomes.

Keywords. *Electronic Health Records; Electronic Medical Records; EHRs; Health Outcomes; Physiotherapy.*

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Phenotypic remodeling of mature TNBC spheroids under prolonged $CoCl_2$-induced hypoxic stress

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Abstract.
Hypoxia is associated with aggressiveness, therapy resistance and poor prognosis in breast cancer (BC), wherein patients with HIF1α-positive tumors have an increased risk of recurrence and BC death [1]. Hypoxic tumor microenvironments have been implicated in programming disseminated tumor cells toward dormant phenotypes that may persist at distant sites and contribute to disease relapse. As tumors grow, oxygen and nutrient diffusion become increasingly limited, leading to the establishment of a hypoxic core, a feature recapitulated in 3D spheroid models. Adaptation to hypoxia is primarily regulated by HIF1α, a transcription factor that is rapidly degraded upon reoxygenation, making hypoxic responses difficult to study *in vitro*. Cobalt(II) chloride ($CoCl_2$) is widely used as a hypoxia mimetic agent and has been shown to reproduce key hypoxic features in MDA-MB-231 triple negative breast cancer (TNBC) spheroids. However, its effects on morphology and long-term behavior of mature spheroids remain poorly characterized [2]. Here, we investigated the phenotypic remodeling of mature MDA-MB-231 spheroids during nine days of continuous $CoCl_2$ exposure under prolonged culture conditions. Spheroids were generated by seeding 3750 cells per well in ultra-low attachment plates, and were allowed to mature for five days before treatment with 0, 50 or 100 μM $CoCl_2$. Brightfield images were acquired throughout the treatment period to monitor morphological changes. $CoCl_2$-treated spheroids exhibited statistically significant, dose-dependent growth inhibition, characterized by reduced size and elongation, and diminished protrusive morphology. These changes indicate substantial structural remodeling consistent with cellular responses to prolonged $CoCl_2$-induced hypoxia-like stress, which has previously been associated with the acquisition of dormant-like phenotypes in MDA-MB-231 cells. Collectively, these findings demonstrate that prolonged $CoCl_2$ exposure significantly alters the phenotype of mature TNBC spheroids, manifested by changes in spheroid growth and morphology, providing a useful model for studying cellular adaptation to sustained hypoxia-like stress in the tumor microenvironment.

Keywords. *3D in vitro model; Spheroid; Triple negative breast cancer; Hypoxia; Tumor microenvironment;*

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Exploring the interaction between STING & PERK in an interferonopathy disease

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Abstract. Stimulator of interferon genes (STING)-associated Vasculopathy with onset in Infancy (SAVI) is a rare autoinflammatory disease characterized by early appearance of skin lesions, vasculopathy and lung damage. Gain-of-function mutations in the *STING1* gene have been associated with the disease, causing uncontrolled activation of the STING pathway which leads to an abnormal production of interferon (IFN) by immune cells. Most of SAVI patients exhibit elevated Integrated Stress Response (ISR), triggered by the endoplasmic reticulum stress sensor PERK [1]. Interestingly, one particular SAVI patient carrying both a mutation in *STING1* and *PERK* revealed a distinct immune signature and atypical clinical features, including systemic lupus erythematosus-like symptoms [1]. Recently, PERK activation has been shown to be required for STING-mediated IFN production while conversely, the induction of IFN production upon activation of PERK by ER stressors requires STING signaling [2]. Using the human monocytic cell line THP-1, we found that the identified PERK mutation (P649T) affects STING signaling and cell function, highlighting the critical role of PERK in shaping STING-driven immune responses. These observations support the necessity to understand in more detail the crosstalk between the PERK and STING pathways in a cell population that is highly relevant in interferonopathies due to their capacity to produce high amounts of type I interferon, the plasmacytoid Dendritic Cells (pDC). By characterizing the effects of STING V155M and PERK P649T mutations in a cell model of plasmacytoid Dendritic Cell (pDC), our project aims to understand how the STING and the PERK pathway may influence each other in pDCs function. We are currently developing a human pDCs CAL-1 cell line with the identified mutations to study their behavior in detail, and test whether ISR interfering drugs might attenuate the SAVI phenotype in altered pDCs.

Keywords: *SAVI; STING; PERK; ISR; UPR*

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Technical heterogeneity in physiotherapist-led thoracic ultrasonography: a scoping review

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Abstract. Thoracic ultrasonography (TUS) is increasingly used by physiotherapists for respiratory assessment[1-4]. However, image acquisition and interpretation would benefit from profession-specific guidance and technical procedures standardisation, which are currently lacking. This scoping review mapped existing protocols conducted by physiotherapists to inform future standardisation. This review followed the Joanna Briggs Institute (JBI) methodology and was reported using the PRISMA-ScR guidelines. Five databases were systematically searched for peer-reviewed original studies involving TUS performed by physiotherapists in adults. Data were extracted on study characteristics, technical procedures, including anatomical references, patient positioning, probe selection, image acquisition and window visualisation, and physiotherapists' training in TUS.
The search strategy yielded 1959 potentially eligible articles; 33 were included for data extraction. Diaphragm assessment was the most frequently reported (n=23, 70%), followed by lung evaluation (n=13, 39%). For diaphragm imaging, linear probes were used for thickness and thickening fraction (n=8, 100%), whereas convex probes were selected for excursion measurements (n=16, 69%). Procedures in lung ultrasound protocols involved semi-recumbent positioning at 30° (n=5, 39%) with 12 lung zones (6 per hemithorax) inspected (n=5, 39%). Only five (15%) studies reported on depth range, and none reported gain settings. Also, details regarding training in TUS (n=9, 27%) were poorly reported. Physiotherapist-led TUS shows marked technical variability and incomplete technical reporting and training, underscoring the need for profession-specific recommendations to standardise protocols, improve reproducibility, and support safe clinical implementation.

Keywords. *thoracic ultrasound, methodologic approaches, POCUS, respiratory physiotherapy, ultrasonography.*

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Peroxisomes on the frontline of cellular antiviral response: insights into morphology, metabolism, and organelle crosstalk

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Abstract. Upon viral infection, host cell organelles become a dynamic battlefield targeted by both the virus and the immune system. Peroxisomes have recently been recognized as critical platforms in antiviral defense, owing to the localization of the mitochondrial antiviral signaling protein (MAVS) at their membranes. Upon detecting cytosolic viral RNA via RIG-I-like receptors (RLRs), MAVS activation at both peroxisomes and mitochondria triggers a signaling cascade, driving the production of interferons (IFNs) and interferon-stimulated genes (ISGs) [1,2].

Different viruses have evolved strategies to modulate peroxisome dynamics to evade the cellular antiviral response and/or promote their propagation. 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. Despite these observations, the molecular mechanisms underlying virus-peroxisome interactions and their functional outcomes remain poorly understood. To explore the role of peroxisomal biogenesis in antiviral immunity, we manipulated peroxisome elongation and fission by altering the expression of key regulatory proteins via RNA interference, overexpression, and knock-out approaches. Using a viral RNA mimic, we observed that peroxisome proliferation and distribution are crucial for mounting an effective peroxisome-dependent immune response.

We further identified that the structural tethering between peroxisomes and the endoplasmic reticulum (ER), mediated by the acyl-CoA binding domain-containing protein 5 (ACBD5), is essential for a robust antiviral response. Disrupting this peroxisome-ER tether in cells with enhanced peroxisomal fission revealed that ER crosstalk is a prerequisite for the immune-enhancing effects of peroxisome proliferation.

Altogether, our findings highlight the importance of peroxisome morphology, biogenesis, and inter-organelle communication in shaping the innate antiviral landscape. These insights shed light on organelle-specific immune mechanisms and reveal potential new avenues for antiviral therapeutic strategies.

Keywords. *Peroxisome; Antiviral signaling; Viruses*

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Assessing the needs of informal carers of adults with chronic respiratory diseases: a systematic review of available tools

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Abstract. Informal carers (ICs), i.e., relatives, friends, or neighbours who provide unpaid support[1], play a central role in supporting people with chronic respiratory diseases (CRD) and often experience unmet needs related to their roles[2,3]. Several tools have been developed to assess their needs. However, they remain dispersed across the literature, limiting their consistent use in research and clinical practice and the development of tailored support strategies for ICs. This systematic review aimed to identify and map the available tools used to assess the needs of ICs of adults with CRD.

The review protocol was registered in PROSPERO (CRD42024573309). PubMed/MEDLINE, Web of Science Core Collection, Scopus, and ProQuest were systematically searched from inception to February 2026. Eligible studies reporting tools assessing needs of ICs of adults with CRD were included. A framework analysis was conducted to map identified tools across six domains: informational/health literacy, practical, social, psychological/emotional, spiritual, and preparedness needs.

A total of 146 studies were included, identifying 119 assessment tools, comprising 57 quantitative and 62 qualitative approaches. The most frequently reported instrument was the Supportive Care Needs Survey–Partners and Caregivers (n=14). Most tools were applied in ICs of people with lung cancer (n=62), followed by chronic obstructive pulmonary disease (n=46), interstitial lung diseases (n=19) and asthma (n=10), across different disease stages and healthcare settings. No tools found assessed the needs of ICs of people with bronchiectasis. “Informational/health literacy needs” was the most frequently addressed domain (91 tools), whereas “preparedness” was the least represented (37 tools).

Although numerous tools are available, many do not comprehensively address the multidimensional needs of ICs and are unevenly applied across CRD. These gaps highlight the need for more comprehensive and standardised assessment approaches and may limit accurate needs assessment and the development of tailored support strategies for ICs of people with CRD.

Keywords. *Informal care; Chronic Obstructive Pulmonary Disease; Lung cancer; Needs assessment tools*

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Changes in the inhaler medication after an asthma exacerbation in Dutch primary care

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Abstract.
Background: Asthma exacerbations should prompt a review of inhaler therapies. However, evidence from real-world studies on prescribing practices following these events is limited. This study aimed to describe changes in pharmacological treatment after asthma exacerbations managed in Dutch primary care.
Methods: This retrospective cohort study included adults with a first general practitioner (GP)-treated asthma exacerbation after diagnosis from the PHARMO Data Network. Patients were required to be followed by the GP from diagnosis until at least 12 months after the first exacerbation. The second event, occurring within 12 months of the first, was also identified. An exacerbation was defined as a GP visit with a prescription for prednisolone or prednisone (≥30 mg/day, 5–14 days). Pre- and post-exacerbation treatments were based on prescriptions issued by the GP within 90 days before and after each event.
Results: A total of 14,419 adults with asthma were included (64% female; median age 54 [IQR 41, 66] years). After the initial exacerbation, ICS-containing therapy was prescribed to 2,303 (44.2%) patients with no prior respiratory treatment, 206 (46.2%) who had previously received long-acting bronchodilators, and 1,180 (55.2%) who had previously received short-acting bronchodilators. Switching to an ICS-containing therapy after an exacerbation was associated with lower odds of a subsequent exacerbation [OR 0.72 (95% CI 0.64, 0.80)]. Of the 14,419 adults with asthma, 3,456 were treated for a second exacerbation within 12 months of the first. Among these, changes to ICS-containing therapy were more frequent after the second event, regardless of whether they had previously been prescribed short-acting bronchodilators [206 (43.0%) vs 228 (57.3%)], long-acting bronchodilators [46 (35.7%) vs 60 (48.4%)], or no respiratory medication [490 (40.8%) vs 626 (48.9%)].
Conclusion: A significant proportion of adults with asthma were not prescribed ICS-containing therapy after an exacerbation, indicating a possible missed opportunity to reduce future risk.

Keywords. asthma; exacerbation; primary care; drug therapy

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Measurement properties of the European Portuguese versions of the Canadian Occupational Performance Measure (COPM) and Pulmonary Functional Status and Dyspnea Questionnaire - modified version (PFSDQ-M) in interstitial lung disease

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Abstract. The COPM [1] and PFSDQ-M [2] are patient-reported outcome measures to assess functional performance. However, evidence of their measurement properties in ILD remains limited. This study aimed to evaluate the reliability and validity of the COPM and the PFSDQ-M in a Portuguese cohort with ILD. Internal consistency (Cronbach's α), test-retest/intra-rater and inter-rater reliability (intraclass correlation coefficients [ICC2,1[95%CI]]) and standard error of measurement (SEM), minimal detectable change at 95% confidence level (MDC95) and Bland-Altman analysis were assessed. Floor/ceiling effects were evaluated. Construct validity was explored through correlations: convergent validity of PFSDQ-M used the London Chest Activity of Daily Living (LCADL), Checklist of Individual Strength (CIS-8), Six-minute walk test (6MWT), and One-minute sit-to-stand test (1-minSTS); divergent validity of both instruments used age and lung function. Convergent validity was not evaluated for the COPM due to its individualised nature. A total of 334 individuals with ILD (67.0[55.0–75.0] years; 51% female; FVC: 85.0[68.0; 99.0]%predicted, and DLCOSB: 59.1[45.0; 78.5]%predicted.) participated. The COPM showed moderate test-retest/intra-rater and inter-rater reliability (ICC2,1=0.68[0.57-0.77]–0.72[0.63-0.80]), with SEM=1.08-1.42 and MDC95=3.00-3.94, and no floor/ceiling effects. The PFSDQ-M demonstrated excellent internal consistency (α=0.90–0.96) and good test-retest and inter-rater reliability (ICC2,1=0.80[0.74-0.85]–0.92[0.89-0.94]), with SEM=15.80 and MDC_{95}=43.80 for total score. Bland-Altman analysis showed no systematic bias for the COPM and a small bias for the PFSDQ-M test-retest. Moderate-to-strong correlations with LCADL/CIS-8 and weak-to-moderate with 6MWT/1-minSTS supported convergent validity for PFSDQ-M. Negligible-to-weak correlations with age and lung function for both instruments supported divergent validity. The European Portuguese COPM and PFSDQ-M are reliable and valid tools for assessing functional performance in ILD.

Keywords. *interstitial lung disease; patient-reported measures; measurement properties; functional performance.*

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FITME: Formulating individualised exercise prescription in COPD

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Abstract. Chronic obstructive pulmonary disease (COPD) is a highly prevalent chronic respiratory condition and a major cause of mortality, morbidity, societal and economic burden worldwide .(1) Moderate-intensity physical activity is key to its daily management.(2) However, uncertainty in identifying exercise intensities (a structured, planned and repetitive physical activity form) exists due to cardiorespiratory, metabolic and musculoskeletal constrains in COPD, which may limit adherence and compromise outcomes.(1) Currently, exercise in COPD is commonly prescribed following the exercise intensity domains proposed by the American College of Sports Medicine (ACSM-EID)(3) and field tests (i.e., six-minute walking test).(4) Nevertheless, growing evidence from various populations suggests that exercise responses observed at the first metabolic threshold (biomarker that establishes the transition from light to moderate intensity), which could be detected with the gas exchange threshold, often differ from those defined by the ACSM-EID, raising concerns about exercise prescription accuracy.(5) The FITME study seeks to enhance exercise prescription methods for individuals with COPD by advancing a more accurate, individualised, and clinically meaningful approach to determining cardiorespiratory training intensity. The project will comprise three tasks. Task 1 will consist of performing a scoping review on cardiorespiratory exercise intensity prescription methods in COPD. Task 2 will be a cross-sectional study to compare exercise responses at gas exchange threshold, exercise based on ACSM-EID and exercise based on field tests. Task 3 will focus on comparing pulmonary rehabilitation programmes based on gas exchange threshold with standard pulmonary rehabilitation programmes (based on peak work rate or on field tests). Findings have the potential to shape future exercise prescription guidelines for COPD, influencing research and clinical practice, both nationally and internationally, ultimately enhancing care and patient-centred outcomes.

Keywords. *Physical activity; Metabolic threshold; Ventilatory threshold; Gas exchange threshold; Pulmonary rehabilitation.*

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Understanding Optix/SIX3 role in regulating cellular response to oncogenic stimuli

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Cancer development is driven by genetic and epigenetic alterations; however, identical oncogenic signals can trigger distinct cellular responses depending on cell identity and developmental state. Using *Drosophila melanogaster* as a model system, we observed that more differentiated cells are highly susceptible to oncogenic activation by Yorkie (Yki), whereas naïve progenitor cells from the same lineage display resistance to Yki-induced overgrowth.
We hypothesized that progenitor-specific transcriptional programs modulate cellular susceptibility to oncogenic signals.
To address this, we performed transcriptomic profiling of progenitor cells and identified genes selectively enriched in this population. A CRISPRa-based overexpression screen subsequently identified *optix* as a regulator of Yki-driven oncogenic growth.
Functional analyses demonstrated that Optix activity is both dose- and context-dependent. Ectopic expression at near-physiological levels suppresses Yki-induced hyperplasia in differentiating cells, whereas higher expression promotes tumor expansion. Interestingly, these genetic interactions appear to be cell-state specific, as both increased and reduced Optix levels in intermediate differentiating cells at the morphogenetic furrow enhance Yki-induced overgrowth. Furthermore, *in silico* analyses suggest a potential direct interaction between Optix and Yki, supporting a mechanistic link between these regulators.
Overall, this work demonstrates that the impact of oncogenic signals is strongly influenced by cellular differentiation programs and the nuclear landscape, providing insight into how developmental regulators modulate cancer susceptibility.

Keywords. *Oncogenesis, Cell differentiation, Progenitor cells, Optix, Drosophila eye epithelium.*

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Chromatin priming during differentiation generates intermediate states liable to oncogenic transformation

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Abstract. Oncogenesis involves genetic and epigenetic changes that transform normal cells into cancerous ones. Remarkably, oncogenic signals can promote transformation in some cell types while remaining innocuous in others [1]. We hypothesize that this differential response is dictated by the epigenetic landscape of each cell type.

To explore how epigenetic states modulate the cellular response to oncogenic signals, we used the Drosophila eye imaginal disc. This single-layer epithelium contains three distinct cell populations at progressive stages of differentiation derived from a common origin[2]. Using in vivo genetic approaches, we analysed how different epigenetic states modulate the response to strong proliferative signals. Paradoxically, cells at later stages of differentiation exhibited higher proliferative responses to the conserved Hippo pathway transcriptional regulator Yorkie (Yki) than undifferentiated precursor cells.

Molecular profiling of each cellular state revealed changes in chromatin accessibility at motifs recognized by the pioneer factor Grainy head (Grh), correlating with Yki-driven overproliferation. Moreover, genetic interaction analyses uncovered a synergy effect between Grh activity and Yki-induced proliferation in responsive regions. Notably, forced Grh expression can restore proliferation and partially rescue cell identity in regions where Yki overexpression impaired both processes.

However, the mechanism regulating Grh activity remains unknown. To identify Grh partners and regulators, we employed a proximity-labelling approach followed by LC–MS analysis to characterize the Grh interactome. We expect that the identification and subsequent validation of Grh regulators will allow the characterization of the molecular mechanism underlying the clear correlation between Grh pioneer activity and the cellular response to oncogenic signals.

Overall, our findings support a model in which genome-wide epigenetic changes mediated by pioneer factors during differentiation create intermediate cellular states that become permissive to oncogenic transformation.

Keywords. *Epigenetic regulation, Pioneer factors, Grainy Head, Oncogenic transformation*

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Changes in inhaler therapy after COPD exacerbations in primary care

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Abstract.
Background: Exacerbations in chronic obstructive pulmonary disease (COPD) contribute significantly to disease burden, progression, and the risk of future events[1-3]. These episodes should prompt reassessment and adjustment of inhaled therapy; however, real-world evidence on treatment changes following exacerbations remains limited. This study evaluated changes in inhaled therapy after the first general practitioner (GP)-managed exacerbation following COPD diagnosis and after a subsequent exacerbation within 12 months.
Methods: A retrospective cohort study using Dutch primary care data (2010–2021) included individuals aged ≥40 years with a coded COPD diagnosis and a first GP-treated exacerbation. Changes in inhaler therapy, identified through GP-issued prescriptions using second-level Anatomical Therapeutic Chemical (ATC) code R03, were assessed in the 90 days before and after exacerbations defined by outpatient GP visits with concomitant systemic corticosteroid prescriptions (≥30 mg/day for 5–14 days). Treatment categories included no respiratory prescriptions (R03), reliever-only therapy, long-acting beta agonist (LABA) or long-acting muscarinic antagonist (LAMA) monotherapy, LABA–LAMA dual therapy, LABA–inhaled corticosteroid (LABA–ICS) therapy, triple therapy (LABA–LAMA–ICS), and "other". Treatment patterns before and after the first and a possible second exacerbation within 12 months were described.
Results: A total of 13,500 individuals with COPD experienced a first GP-treated exacerbation, of whom 4,344 (32.2%) had a second exacerbation within 12 months. Approximately 30% were prescribed an ICS-containing inhaler therapy prior to their first GP-treated exacerbation. No change in inhaler therapy was the single most frequent transition after both the first and second exacerbations across all treatment categories. Approximately 24% remained without long-acting maintenance therapy even after recurrent exacerbations within the same year.
Conclusion: Inhaler therapy was often not modified after GP-managed exacerbations in COPD, highlighting the need for re-evaluation of inhaler therapy following an exacerbation.

Keywords. *Chronic obstructive pulmonary disease; Primary health care; Drug prescriptions*

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Turning Thought into Action: A Virtual Reality Brain–Computer Interface for Spinal Cord Injury Rehabilitation

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Abstract. Brain–computer interfaces (BCIs) enable real-time control of external devices by decoding ongoing brain activity[1]. They have shown considerable promise in neurorehabilitation. In individuals with spinal cord injury (SCI), BCIs combined with immersive virtual reality (VR) have been associated with improvements in sensorimotor function[2]. These effects are thought to arise from the reactivation of functionally silent neural pathways and the promotion of neuroplastic reorganization[3]. However, the specific brain network changes underlying these functional gains remain insufficiently characterized. This study aims to investigate both the clinical outcomes and neurophysiological mechanisms associated with a VR-based BCI rehabilitation protocol in SCI. In a pilot study, a participant with chronic SCI (AIS A, T4) completed 35 BCI sessions. Each session involved controlling a virtual avatar's gait through motor imagery in an immersive VR environment with audiovisual and tactile feedback. Sessions included two blocks of 40 trials (20 walk, 20 rest): the first was used to train the classifier, and the second to decode motor intention in real-time. Sensorimotor function was assessed at admission and discharge using ISNCSCI, while pain and user experience were recorded each session. EEG was used to monitor brain activity. A continuation study is evaluating this protocol in 10 individuals with subacute SCI. Following the intervention, the participant reported decreased pain and improved perceived quality of life. Although ISNCSCI scores remained unchanged, rhythmic, non-spastic lower limb movements resembling gait emerged during motor imagery. EEG spectral analysis revealed modulation across multiple frequency bands, including changes associated with pain perception and shifts in the delta/alpha ratio. Ongoing data collection in the larger cohort integrates neurophysiological and molecular markers. Preliminary findings suggest that sustained VR-based BCI training may reduce pain, enhance quality of life, promote motor-related activity, and contribute to identifying neural correlates relevant for SCI rehabilitation.

Keywords: *Brain-computer interface, Spinal cord injury, Neuroplasticity, Clinical research*

Healing the spinal cord: the next breakthrough in repair

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Abstract. Spinal cord injury (SCI) remains a major neurological challenge due to the limited capacity for regeneration and functional recovery [1]. Successful recovery largely depends on axonal regeneration; however, current therapeutic strategies are insufficient to effectively promote this process. This study aims to develop a controlled drug delivery biomaterial for in situ implantation to enhance targeted axonal regeneration following injury.

Chitosan was selected as the matrix due to its biocompatibility and biodegradability, and widespread use in SCI research [2]. Membranes were fabricated by solvent casting, incorporating a plasticizer and a cross-linking agent to improve mechanical properties and control degradation behavior. Initially, zinc oxide nanoparticles were explored, because of their potential anti-inflammatory and antioxidant effects. In parallel, a pro-regenerative drug was encapsulated through oil-in-water homogenization followed by ionotropic gelation, producing nanoparticles. Different surfactants and cross-linker concentrations were evaluated to optimize nanoparticle formation and performance. These nanoparticles were subsequently incorporated into the chitosan-based biomaterial to promote axonal growth and support functional recovery.

The developed biomaterials demonstrated good processability and could be tunable through nanoparticle incorporation, exhibiting suitable mechanical properties together with *in vitro* biocompatibility and non-toxicity. Additionally, both the type of surfactant and the cross-linker concentration significantly affected nanoparticle properties, including particle size. In spinal cord injury models, these nanoparticles promoted neurite outgrowth, reduced lesion size, and enhanced the expression of regeneration-associated proteins.

Overall, this work describes the development and optimization of a novel drug delivery system with promising potential to enhance the regenerative effectiveness of current pharmacological treatments for spinal cord injury.

Keywords. *Spinal cord injury, Neural regeneration, Drug delivery system, Nanoparticle, Chitosan*

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"The testis remembers": aerobic exercise and dietary correction mitigate ob esity-induced subfertility despite of early-life testicular metabolic memory

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Abstract. The increasing prevalence of childhood obesity has been associated with worse reproductive and metabolic health in adult males, thus it is important to mechanistically assess how early-life obesity impacts testicular morphology, function, and metabolism [1-3]. We used a *Mus musculus* model divided into five groups: control (CTRL), fed control diet with baseline activity for 200 days; diet-induced obesity (DIO), fed lifelong high-fat diet (HFD) with baseline activity for 200 days; diet-induced obesity with dietary correction (DIOc), fed HFD for 60 days followed by control diet to day 200; diet-induced obesity with aerobic exercise (DIO_EX), lifelong HFD with treadmill exercise from day 60 to 200; diet-induced obesity with dietary correction and aerobic exercise (DIOc_EX), fed HFD for 60 days followed by control diet and treadmill exercise from day 60 to 200. Body weigh was longitudinally recorded. Testicular, adipose, and muscle weight, glucose homeostasis (ipGTT and ipITT), hormonal profiles (estradiol-to-testosterone (E_2/T) ratio via ELISA), and testicular histology were assessed at sacrifice. Finally, untargeted ^{1}H-NMR metabolomics characterized shifts in testicular metabolome and in specific metabolites. DIO significantly increased body weight, disrupted glucose homeostasis, and elevated E_2/T. While all targeted lifestyle interventions mitigated these systemic impairments, diet-based interventions (DIOc and DIOc_EX) were the most effective. DIO worsened all sperm parameters, which were most comprehensively rescued by exercise-based interventions (DIO_EX and DIOc_EX). Intriguingly, multivariate analysis revealed that the testicular metabolome of all intervention groups remained clustered with the DIO group, refractory to weight loss. This "testicular metabolic memory" was characterized by the irreversible depletion of key energy and antioxidant metabolites. The combined lifestyle intervention of DIOc_EX displayed the most transversal systemic and local improvements acting on a Two-Hit model of recovery, establishing multimodal non-pharmacological therapies as a mechanistically superior framework for treating obesity-related subfertility.

Keywords. *Male Infertility; Metabolic syndrome; Lifestyle interventions; Sperm parameters; High-fat diet*
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The evolutionary impact of non-standard CUG translation in *Candida albicans*

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Abstract. Translation ambiguity (mistranslation), once considered purely deleterious, is now recognized as a driver of proteome diversity that can enhance adaptive potential under environmental stress. *Candida albicans* provides a unique model to study this phenomenon due to its non-standard decoding of the CUG codon, which is ambiguously translated as either serine (Ser) or leucine (~3% Leu incorporation under standard conditions). This study investigates how varying levels of mistranslation shape the evolutionary trajectory of *C. albicans*. We conducted experimental microevolution over 200 generations using three strains: T0 (control, ~3% Leu), T1 (~20% Leu), and T2 (~67% Leu). Longitudinal monitoring of mistranslation levels showed that T0 and T1 remained stable, whereas T2 exhibited a significant decrease in Leu incorporation (from ~62% to ~31%), suggesting a physiological threshold for tolerable translation ambiguity. Genomic analyses revealed that strains with elevated CUG ambiguity (T1 and T2) accumulated extensive structural variation, particularly affecting chromosomes I, III, and VII, regions harbouring genes involved in morphogenesis, adhesion, and biofilm formation, while T0 remained genomically stable. Transcriptomic profiling showed that the number of differentially expressed genes (DEGs) increased proportionally with CUG ambiguity, with T2 exhibiting a disproportionate impact on CUG-rich genes. Weighted gene co-expression network analysis (WGCNA) identified modules associated with sulphur metabolism and oxidative stress responses specifically in T1, suggesting strain-specific adaptive strategies. Structural analyses further demonstrated that non-standard CUG translation in Als3, Lmo1, and Rlm1 promotes protein stabilization and enhances protein–protein interaction potential, indicating that serine-to-leucine substitutions may modulate adhesion, aggregation, and stress-response pathways. Collectively, these results demonstrate that mistranslation drives coordinated genomic, transcriptomic, and structural remodeling, shaping evolutionary trajectories in *C. albicans*.

Keywords. *Candida albicans; codon ambiguity; mRNA mistranslation; experimental evolution; genome sequencing; transcriptional profiling; RNA-sequencing; LOH; aneuploidy*

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Impact of pyruvate availability and ER-stress in plasmacytoid dendritic cells: insights into fibrosis in Systemic Sclerosis

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Abstract. Systemic sclerosis (SSc) is a rare autoimmune disease characterized by immune dysregulation, vasculopathy, and fibrosis. Recent studies indicate that plasmacytoid dendritic cells (pDCs) are key players in fibrotic progression in SSc [1], and pDCs from patients with SSc have been reported to exhibit altered ER-stress responses [2]. Previous work done in our lab has shown that CAL-1 pDCs co-cultured with IMR-90 fibroblasts and activated by SubAB, an ER stress inducer, promoted fibroblast activation [2]. In addition, pDC metabolism has been suggested to play a role in the context of SSc [3]. Moreover, pyruvate availability is crucial for optimal IFN response in human pDCs, suggesting a potential regulatory role of immunometabolism in pDC functions [4]. Here we used a human pDC cell line (CAL-1) and a human lung fibroblast line (IMR-90) to study the role of metabolism in mediating pDC – fibroblast interactions. CAL-1 cells were either pre-treated with HA-15 (BiP/GRP78 inhibitor) before co-culturing with IMR-90, or cultured together with IMR-90 and in the presence of HA-15. To assess the impact of metabolic modulation in these cultures, experiments were done with or without pyruvate supplementation, or in the presence of the metabolic modulators 2-Deoxyglucose (2-DG) or Dichloroacetate (DCA) to modulate glucose/pyruvate metabolism. Expression and production of fibronectin, α-SMA and FAP (fibroblast activating protein) were analyzed by qPCR (24h) and Western Blot (48h). In the presence of pyruvate, HA-15-induced ER-stress resulted in a clear increase in protein and mRNA levels of fibronectin, α-SMA and FAP. However, pyruvate deprivation in itself promoted a fibrotic phenotype in co-cultures, even without ER stress induction, affecting particularly α-SMA expression and production. Simultaneously, 2-DG and DCA treatment also promoted an increase in mRNA levels of fibronectin and α-SMA. These results confirm that induction of ER stress in co-cultures of CAL-1 pDCs and IMR-90 fibroblasts can promote fibrosis and indicate that pDC–fibroblast interactions are metabolically regulated, with pyruvate availability and pharmacological modulation of glucose/pyruvate metabolism shaping the outcome of these cultures. Currently we are further characterizing the cells' metabolic profile under the different treatments to map the molecular pathways involved, and thus identify potential new targets against tissue fibrosis.

Keywords. *Systemic Sclerosis; Fibrosis; Immunometabolism; ER-Stress; Pyruvate*

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Matrix stiffness and ER stress modulate pDC-driven profibrotic signalling in systemic sclerosis

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Abstract. Systemic sclerosis (SSc) is a rare systemic autoimmune rheumatic disease (SARD) marked by immune dysregulation, vasculopathy, and progressive fibrosis of the skin and internal organs[1]. Among SARDs, SSc has particularly high morbidity and mortality, largely due to interstitial lung disease that often progresses to pulmonary fibrosis[2]. Plasmacytoid dendritic cells (pDCs) are innate immune cells specialised in producing large amounts of type I interferon (IFN-I) with a key role in SSc pathogenesis[3]. They infiltrate affected tissues, contribute to the strong IFN-I signature, and their depletion alleviates fibrosis in murine models. pDCs from SSc patients exhibit dysregulated ER stress, which has been linked to fibroblast activation[2]. Moreover, increased matrix stiffness can dampen IFN-I responses under TLR stimulation in pDCs[4]. However, the interplay between ER stress, tissue stiffness, and pDC-mediated fibrosis in SSc remains unclear. To explore this, we established an *in vitro* co-culture system using a pDC cell line (CAL-1) and a lung fibroblast cell line (IMR-90) on substrates with different stiffness levels, replicating healthy (1kPa) and fibrotic tissue (50kPa). Mono- and co-cultures were exposed to the ER-stress inducer HA15 (a synthetic thiazole benzenesulfonamide) and the TLR7 agonist CL307. In CAL-1 cells, HA15 increased IFN-I at both stiffness levels, particularly with TLR7 co-stimulation. In fibroblasts, ER stress inhibited α-smooth muscle actin (α-SMA) expression, an effect reversed in co-culture with pDCs. Fibronectin also increased in the presence of pDCs under ER stress conditions. Combining ER-stress induction with TLR7 stimulation did not further increase extracellular matrix (ECM) markers. Interestingly, stiffer substrates enhanced both IFN-I and ECM-related changes induced by HA15 in the co-cultures. Altogether, our results suggest that ER stress enhances pDC-fibroblast crosstalk in a stiffness-dependent manner, potentially driving fibrosis progression in SSc. Ongoing experiments using primary cells will further explore these mechanisms and may uncover novel therapeutic targets to mitigate fibrosis in SSc.

Keywords. *Fibrosis; Systemic Sclerosis; ER stress; Mechanosensing; plasmacytoid Dendritic Cells; Interferonopathies*

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Exploring manual facilitation in physiotherapists with different levels of Bobath education: preliminary findings from a qualitative study

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Abstract. Manual facilitation is considered a core component of neurological physiotherapy practice within the Bobath concept [1,2]. Yet little is known about how different levels of Bobath education may shape physiotherapists' conceptualization and clinical application of facilitation [3]. This study explored similarities and differences in how physiotherapists with Basic and Advanced Bobath education conceptualize and integrate manual facilitation into neurological physiotherapy practice. Using an interpretive description methodology, sixteen physiotherapists with postgraduate Bobath education were purposively recruited and grouped according to level of training: Basic Bobath Group (BBG, n = 8) and Advanced Bobath Group (ABG, n = 8). Each participant completed a video-recorded treatment session with a person post-stroke, followed by a stimulated-recall interview. Videos, interview transcripts, and field notes were analysed using reflexive thematic analysis supported by descriptive video coding. Physiotherapists in both groups described manual facilitation as central to neurological physiotherapy practice. Participants from the BBG primarily described facilitation as providing sensory input to guide movement performance, optimize alignment, and reduce compensatory movement patterns. In contrast, participants from the ABG described facilitation as an embodied, bidirectional sensory-perceptual process in which assessment and intervention occurred simultaneously through ongoing clinical reasoning to support movement exploration and motor learning. Preliminary findings suggest that advanced Bobath education may be associated with a more integrated and context-sensitive conceptualization of manual facilitation, reflecting the development of clinical expertise in neurological physiotherapy.

Keywords. *Bobath concept, Clinical practice, Facilitation, Hands-on, Education.*

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Exploring fibroblast's metabolism towards effective cell-based heart regenerative strategies

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Abstract. Cardiovascular diseases (CVDs) are the world leading cause of mortality with 17.9 million deaths annually, with estimated 23.6 million deaths projected to annually by 2030 (1). Following a cardiac injury, such as myocardial infarction, cardiomyocytes (CMs) are irreversibly lost (2). Despite conventional treatments, which are mainly symptomatic, there remains an urgent need for novel and efficient cardiac regenerative therapies. The discovery of cell reprogramming provided unprecedent opportunities for regenerative medicine and heart repair, including the use of induced pluripotent stem cells (iPSCs)-derived CMs for restoring heart function (3) and the direct cardiac conversion (DCC) of fibroblasts into induced cardiomyocytes (iCMs) (4). Despite the potential, several barriers, including metabolic and age-associated, limit the use of cell-based therapies for heart regeneration and the identification of key molecular players in cell lineage conversion is warranted. Therefore, the aim of this work is to investigate how the metabolic state of fibroblasts influences direct reprogramming and iPSCs-derived cardiac regeneration using state of the art cellular and metabolic assays. Preliminary results enabled the identification of candidate small molecules that enhance DCC in inducible reprogrammable fibroblasts and their subsequent functional validation through molecular and imaging-based analyses. In parallel, studies using fibroblasts from high-fat diet-exposed mice revealed alterations in metabolic and reprogramming-related cellular features, further supporting a link between fibroblast metabolic state and cardiac reprogramming efficiency. Overall, this work is expected to provide new insights into the metabolic mechanisms regulating fibroblast's plasticity driving somatic and direct reprogramming for cardiac conversion, supporting the development of more efficient regenerative approaches for heart repair.

Keywords. *Cardiac regeneration; Cellular reprogramming; Cardiac fibroblasts; Metabolism; 3D cardiac models*

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Impact of endoplasmic reticulum stress on STING signaling

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Abstract. The cGAS–STING pathway is a central mediator of innate immune responses to cytosolic DNA and is closely associated with endoplasmic reticulum (ER) function. Once activated, the stimulator of interferon genes (STING) translocates from the ER to the Golgi and initiates a signaling cascade through interferon regulatory factor 3 (IRF3), leading to the production of type I interferons. STING signaling also activates the nuclear factor of kappa light-chain enhancer of B cells (NF-κB) and autophagy pathways [1]. Regulators such as tax1-binding protein 1 **(**TAX1BP1) and deubiquitinating enzyme A20 (TNFAIP3) help to manage the inflammation by limiting NF-κB and interferon signaling. Although STING signaling has been linked to ER stress responses, the impact of ER stress on STING activation and the reciprocal consequences of STING activation on ER stress remain incompletely understood. In particular, it has been suggested that cyclic guanosine monophosphate–adenosine monophosphate (cGAMP)-bound STING interacts directly with the ER stress sensor protein kinase RNA-like endoplasmic reticulum kinase (PERK) through specific domain interactions [2]. Using the human plasmacytoid dendritic cell line CAL-1, we investigated the relationship between ER stress and STING signaling. Stimulation with the cyclic dinucleotide ligand cGAMP did not activate the PERK arm of the unfolded protein response (UPR). However, induction of ER stress with thapsigargin, a calcium (Ca^{2+}) mobilizing agent[3], [4], produced a synergistic effect when combined with cGAMP-mediated STING activation. Surprisingly, this synergy is independent of the different individual signaling branches of the UPR or protein synthesis inhibition. However, we observed the direct recruitment of A20 to STING during activation. These findings suggest that ER stress enhances STING signaling through mechanisms that may involve Ca^{2+} signaling and ubiquitin-mediated regulation rather than direct activation of PERK. Ongoing studies aim to define the roles of TAX1BP1, A20, and Ca^{2+} signaling in modulating STING activity under ER stress conditions.

Keywords. *cGAS–STING; ER stress; Ca^{2+} signaling; A20 (TNFAIP3); PERK*

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Mercury exposure, lifestyle factors and IVF outcomes in infertile couples: a pilot cohort study

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Abstract. Among environmental risk factors, mercury (Hg) is of particular relevance in countries with high fish consumption, such as Portugal, which ranks sixth globally in per capita intake of fish and seafood (59.41 kg/year) [1;2]. Although the neurodevelopmental toxicity of Hg is well established, increasing evidence indicates that Hg may also adversely affect reproductive health. In men, Hg exposure has been associated with abnormal sperm morphology, reduced motility, increased sperm DNA damage, and dysregulation of the hypothalamic–pituitary–gonadal axis [3]. These alterations contribute to reduced fecundability and, at the couple level, have been linked to higher rates of early pregnancy loss [4]. In women, Hg exposure has been associated with reduced fecundability, an increased risk of spontaneous abortion, higher incidence of preterm birth, and endocrine disruption [5]. Within assisted reproduction settings, Hg exposure has additionally been linked to poorer ovarian responsiveness to gonadotropin-releasing hormone stimulation, lower antral follicle counts, and reduced numbers of retrieved and mature oocytes [6].

This prospective pilot cohort study investigated whether mercury exposure was associated with lifestyle factors and in vitro fertilization (IVF) outcomes in infertile couples, potentially contributing to infertility. Fifty couples undergoing fresh homologous IVF cycles between 2023 and 2024 were enrolled. Participants completed standardized questionnaires addressing demographics, lifestyle, and dietary habits, while Hg concentrations were quantified in hair, seminal plasma, and follicular fluid using a Direct Mercury Analyser. Associations between Hg exposure, lifestyle variables, and reproductive outcomes were evaluated using correlation and regression analyses across exposure quartiles. Mercury exposure was common, with mean hair Hg concentrations of 1.08 µg/kg in men and 0.90 µg/kg in women; 42% of men and 30% of women exceeded established international reference values. Hg concentrations were strongly correlated between partners, indicating shared environmental and lifestyle exposure patterns. Fish consumption—including fresh, frozen, and canned fish—was the primary dietary predictor of Hg levels. Notably, Hg was detectable in both seminal plasma and follicular fluid, supporting exposure at the level of the gametes and the periconceptional microenvironment. Higher Hg concentrations were associated with longer infertility duration and a greater number of previous IVF cycles. In men, elevated Hg levels in hair and seminal plasma were associated with increased use of intracytoplasmic sperm injection, suggesting a potential impact on male reproductive competence. Although limited by sample size, these findings underscore the relevance of environmental exposures during the preconception period and support the use of assisted reproduction as a sensitive model for investigating environmental determinants of human fertility.

Keywords. Environmental toxicants; Assisted reproduction; Fish consumption; Preconception exposure; Male factor infertility.

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[ID+] Designing change through evidence

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Talking about Cooperativa Árvore's posters: from interviews to relational content analysis

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Abstract.

This investigation is grounded in the poster collection of Cooperativa Árvore. Still in operation, this Cooperative of Artistic Activities was founded in Porto (1963), as a decentralised alternative for artistic production and cultural promotion.

The risks of archival deterioration and loss of collection integrity were identified, given the absence of prior documentary processing and scholarly research. Acting to protect and unveil cultural memory implies safeguarding the posters but also situating them within an interpretative context.

Following the physical conservation, digitisation and cataloguing of the 3,583 posters, it became clear that 'hearing' part of Árvore's living memory was a methodological step towards interpreting the collection. Accordingly, designers, artists, board members, former staff, printers and other cultural figures were interviewed, forming a network of references that spans the cooperative's entire existence.

To foster a broader understanding of the collection and deepen knowledge of the history of Portuguese graphic design, oral history audiovisual recordings of nine testimonies have already been produced. The conversations cross-reference one another. The interlocutors mention people, places, events, concepts and posters, among other elements. The aim now is to explore the potential for relational visual mapping across this set of interviews.

It was decided to work from the edited transcripts corresponding to the final cut of the video, to maintain a direct correlation between the sources. This textual corpus will inform the Claude AI model, GDPR-compliant, chosen for its capabilities in generating interactive code-based artefacts in 3D (Three.js) from keywords highlighted by a human reader.

The outcome is a series of dynamic, interactive data clouds supporting content analysis and tracking recurring themes, people, institutions, places, events, printing technologies, and graphic supports. It is anticipated that the impact of the audiovisual material will be enhanced by the viewer's interaction with the graphics, which will be made available on a dedicated website.

Keywords. *Portuguese Graphic Design History; Oral History; Cooperativa Árvore poster collection; Interviews; IA Claude*

Visual identity systems and non-specialist adoption: a curricular response through studio pedagogy modelled on collective actor settings

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Abstract. The democratization of graphic design tools is increasingly involving non-specialist actors in implementing visual identity systems (VIS), who, despite possessing technical ability, often lack the systemic knowledge required to sustain cohesive and resilient identities over time. VIS theory has evolved toward flexible models, but its persistent top-down nature means designers are rarely trained to develop systems capable of withstanding non-specialist adoption. Whether design education has produced adequate responses to this reality remains an open question.
To address this, this research establishes empirical and contextual conditions through fieldwork with collective actors and an evaluation of existing VIS studio pedagogy in Portuguese higher education, before conducting an Action Research intervention in studio-based graphic design classes modelled on collective actor settings. The work aims to measure shifts in students' systemic thinking and collaborative adaptability, producing a transferable framework of pedagogical guidelines for integrating collective-actor-modelled studio work into visual identity design curricula.

Keywords. *Visual Identity Systems; Design pedagogy; Collective Actors; Action Research; Studio-based Learning*

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Manuel Reis e a Loja da Atalaia: A valorização do Design de Produto Português nas Décadas de 80 e 90

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Resumo

Esta investigação de doutoramento analisa o papel determinante de Manuel Reis e da Loja da Atalaia na afirmação e consolidação do design de produto em Portugal durante as décadas de 1980 e 1990. O contexto do estudo insere-se na transformação do design português pós-Revolução de Abril e na sua abertura ao mundo com a adesão à CEE. A motivação decorre da escassez de estudos aprofundados sobre este legado, frequentemente remetido a referências pontuais ou considerado um "epifenómeno".

O problema central reside na necessidade de validar a relevância histórica de Manuel Reis como mediador cultural e da Loja da Atalaia como plataforma operativa fundamental para o surgimento do "Novo Design" de cariz autoral. Neste sentido, a investigação estrutura-se em torno da seguinte questão: Qual o papel da Loja da Atalaia enquanto difusora de novos talentos e como espaço de afirmação do design nacional? Procura-se, assim, compreender o modo como esta estrutura contribuiu para a dinamização da cultura visual portuguesa no final do século XX.

Os objetivos centrais incluem a análise da influência de Manuel Reis na projeção do design, a sistematização e catalogação do espólio da loja e o estudo da evolução conceptual do design de produto no final do século XX.

A metodologia adota uma abordagem qualitativa de Investigação baseada na prática (Practice-based Research), utilizando a Tríade Projetual de Francisco Providência (Autoria, Programa e Tecnologia) como modelo analítico. Os procedimentos envolvem investigação bibliográfica, documental em arquivos institucionais e privados, e investigação testemunhal através de história oral com os protagonistas vivos.

O projeto resultará numa exposição, uma publicação e um documentário em formato digital para passar em plataformas online. Espera-se que os resultados permitam agregar a memória fragmentada e adquirir e consolidar novo conhecimento acerca do tema reintegrando estes artefactos na cultura visual contemporânea.

Esta tese procura contribuir para a historiografia do design nacional, oferecendo novos instrumentos de reflexão sobre a identidade do design português atual.

Palvras-chave
Loja da Atalaia; Manuel Reis; Design português; Novo Design; Frágil; design de autor

[ID+] From design research to impact and change

From execution to orchestration: AI-driven role redistribution in new product development teams

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Abstract. The quality of collaboration within new product development (NPD) teams has long been recognized as a determinant of both process efficiency and product outcomes. This collaboration has traditionally been structured around clearly delineated roles: designers are responsible for ideation, aesthetics, and user experience; engineers focus on feasibility, performance, and manufacturability. Generative AI is now putting pressure on this division: recent evidence shows that professionals working with AI can match the performance of two-person teams, accessing cross-domain expertise previously requiring human collaboration [1]. This paper examines how generative AI is reconfiguring the roles of designers and engineers in NPD teams: how those roles are shifting, and what this implies for team organization and collaboration. A literature review was conducted using the keyword combinations spanning generative AI technologies (e.g., "generative AI," "machine learning") and product development terminology (e.g., "new product development," "product design") across Scopus, Web of Science, and ACM Digital Library, covering publications from 2020 to 2026. Searches were conducted between September 2025 and June 2026, applying inclusion criteria of peer-reviewed English-language publications addressing AI applications in the product development process.
Designers are increasingly less focused on generating form and concept from scratch, shifting toward directing, evaluating, and refining AI-generated outputs [2]. Engineers, meanwhile, spend less time on direct execution and more on validation, checking feasibility, safety, and compliance in contexts where getting it wrong is costly and hard to reverse [3].
However, this redistribution introduces new tensions within teams: who owns AI-assisted work, who is accountable when things go wrong, and what happens to junior practitioners who no longer have access to the routine tasks through which expertise is built remain largely unresolved [4]. This paper contributes an initial mapping of how generative AI changes individual roles in NPD teams and how those shifts reshape team collaboration, as a basis for ongoing research into a question the literature has identified but left unresolved: the tension between the process efficiency and cost gains AI makes possible and the creativity, innovation, and product quality that good product development still demands [3].

Keywords. *Human-AI collaboration; Cross-functional teams; Generative AI; New Product Development;*

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Enacting critical media literacy through interaction design and participatory sense-making

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Abstract. Conventional media theory often characterizes digital communication as fundamentally *disembodied* [1], reducing rich interpersonal exchange to the transmission of symbolic information. We argue this inverts the actual relation between body and medium. From a posthumanist and postphenomenological perspective [2, 3], the *living body* is not bypassed by mediation but is its very condition of possibility: every entanglement with media is enacted through a *situated* and *affective* body that co-constitutes what the medium comes to mean. Thus, purely cognitive approaches to digital media literacy are insufficient, and critical media literacy must be grounded in *embodied experience* and the complex, distributed web of relations through which humans, technologies, and the lifeworld are mutually constituted.

The objective of this research is to develop and empirically refine a practice-oriented framework for designing shared immersive environments that cultivate critical media literacy, asking how interaction design can modulate *telepresence* to provoke critical reflection on, and restore agency within, the technological mediation of reality.

The study adopts constructivist Grounded Theory Methodology, treating these theoretical commitments as sensitizing concepts while inductively deriving design categories from iterative cycles of data collection, design experiments, and user studies. The resulting multidimensional framework comprises actionable design guidelines, spatial and audiovisual representation techniques, and embodied interaction models.

Building on our earlier proposal of *telepresence* as a parameter to be purposefully modulated for media literacy [4], we design *shared*, *multi-presence* environments – in which *meaning is co-created* and transformed in the interplay between interacting embodied agents and the interaction process itself – employing "Breaks in Presence" (BIPs) to provoke critical inquiry. Embodied interaction models explore *spatial presence*, *self-presence*, *perceptual realism*, *mutual incorporation,* and the perceived salience of human and non-human actors, making participants reflexively aware of their mediated constitution, facilitating dialogical public engagement and *enactive*, *participatory sense-making* [5]. We anticipate the framework will yield validated design principles, including guidance on calibrating BIPs to elicit critical reflection without provoking disorientation, and empirical evidence of how modulated *telepresence* supports media literacy, thereby advancing both its theory and application.

Keywords. *Interaction Design; Critical Media Literacy; Multi-Presence; Embodied Cognition; Participatory Sense-Making.*

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[ID+] Policy for creative and artistic practices

Relicários de memória: the materialization of entropy in digital interfaces

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Abstract. Inscribed within the Doctoral Programme in Artistic Creation at the University of Aveiro, this research addresses the dialectical tension between the intrinsic volatility of memories and the crystallized form of the memory artefacts used to preserve them. This asymmetry frames the central problem of the *Relicários de memória* project: what if the artefact that evokes memory were itself mutable, and how would this affect remembering? We investigate how artistic artefacts that stage forgetting and fragmentation relate to processes of memory reconfiguration.

We propose responsive artefacts, that stage entropy and mnemonic fragmentation through dynamic, interactive systems. The methodology, practice as research, framed by Batty and Zalipour's creative knowledges enabling framework [1], follows three complementary axes: iterative material experimentation; reflective documentation, capturing processual knowledge; and experiential validation in exhibition contexts.

The theoretical framework likewise converges on three axes: Merleau-Ponty's phenomenology of perception [2], situating memory as an embodied process, Simon Penny's concepts of material thinking and situated machines [3], grounding the epistemological agency of the technological object; an agency that finds historical validation in Cynthia Hahn's analysis [4] of medieval reliquaries as active interfaces.

Over two years, an initial prototype was built, that operated as a responsive system in which sensory inputs of proximity and ambient sound parametrized, in real time, the degree of fragmentation and generative reconfiguration of digital memory artefacts. Its presentation confirmed that the fragmentation, and especially reconfiguration, of video memories, conferred a sense of aliveness that proved captivating. More significantly, the artefact was perceived as a container of valuable things whose mutable contents made them no less valuable. Subsequent iterations should refine narrative presentation and expand the reconfiguration and recollection components.

This research contributes to the discussion on memory objects in the digital age within contemporary artistic production, proposing a framework privileging entropy, corporeality, and empathy over immutable conservation.

Keywords. *Artistic Research; Memory artefacts; Reliquaries; Digital interfaces*

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Research Summit 2026

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The musician as artistic director: devising from within a non-theatrical practice

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This abstract explores the musician's transition from performer to artistic director through the collective creative method known as devising. Traditionally rooted in theatre and dance, this approach is adapted here to the musical context to challenge the historical reliance on scores and predetermined visions such as the one of a "genius" composer. The author analyses how a musician's auditory sensitivity and temporal perception can enrich cross-disciplinary and transdisciplinary collaboration, offering new perspectives on artistic creation and performance. Through two distinct projects, *Masks* and *Music & Friends*, the research highlights the challenges faced by musicians when taking on creative leadership without prior training in this open methodology. It is concluded that the integration of devising into music requires a renegotiation of existing theatrical practices to accommodate the specific identity of the musical performer. This study contributes to the field of artistic research, proposing an evolution in the way musicians participate in the process of creative authorship.

Keywords: Devising, Musical Performance, Cross-Disciplinary Creation, Artistic Research, Performer Identity.

A arte insurgente no contexto de saturação algorítmica: da atenção à ação.

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Abstract. Essa investigação propõe investigar a capacidade política da arte de reorganizar os regimes de visibilidade e sensibilidade [1] em contextos de excesso de informação, repetição contínua de imagens e dispersão da atenção [2]. O problema já não é a invisibilidade, mas o excesso: a saturação digital acaba por produzir um ambiente propício para a dispersão da atenção, originando uma relação apática entre sujeito-imagem-mundo, dificultando a implicação política da experiência estética e promovendo formas de letargia e inércia.

Diante desse cenário, a partir de obras de arte interativas, propõe-se um deslocamento da arte que exibe para a que implica. Como metodologia, recupera-se táticas de guerrilha política e artística [3] para transpô-las aos circuitos algorítmicos contemporâneos, desenvolvendo instalações que articulam videoarte, inteligência artificial e sistemas de interferência mecânica como dispositivos de interrupção dos processos de captura cognitiva e afetiva [4] operados pelos meios digitais. A proposta parte da hipótese de que a arte pode operar dentro destes sistemas de gestão da atenção e dos afetos, apropriar-se das suas estruturas e interromper os fluxos de dispersão para incidir sobre a agência do espectador.

O projeto pretende desenvolver objetos e situações artísticas que funcionem como estrutura de confronto e implicação, investigando – se e – em que condições a arte ainda pode disputar a atenção estética, reorganizar os afetos e produzir incidência política em contextos de saturação algorítmica. Por fim, a investigação contribui para as discussões contemporâneas sobre agência política, atenção estética e responsabilidade social da arte.

Keywords. *arte política, atenção estética, inteligência artificial, interatividade, videoarte.*

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Rural interstices: Ethno-*poiesis* and the audiovisual essay as a 'third place'

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Abstract. This research explores the complexity of the contemporary rural world in southern European countries (Portugal, Spain and Italy), focusing on territories marked by the tension between abandonment and processes of "touristification" that tend to simplify local identities. By embracing the existential condition of being-in-time (Dasein), the researcher immerses themselves in the daily life of these communities to capture the "sense of place" through a perspective of dwelling and a multisensory, empathetic understanding [2, 6]. The research inhabits the dialectical tension between the objectivity of ethnographic records and the freedom of poetic imagination, aiming to reveal some invisible truths that can emerge in the encounter with lived rural life.

At the heart of the methodology lies the audiovisual essay [1] as a "form that thinks", a hybrid model capable of integrating fragments of multiple media — voice, text, video and sound, Through the concept of ethno-*poiesis*, the research utilises border objects (oral archives, maps and material remains) to mediate the dialogue between the researcher and the rural 'other', transforming sensory fieldwork into a process of creative weaving that challenges exclusionary localism [3].

The research plan took shape through the production of nine audiovisual essays grounded in the concept of "dual site-specificity", establishing analogies and dialogues between geographically distant yet culturally related locations. The research culminates in an interactive installation, where the temporality of the essays is transposed into a spatial montage [4].

In this final synthesis, the viewer's body becomes an active agent that triggers fragments of memory and landscape, constructing a poetic "third place". This expanded cinema device [5] returns a dense and multivocal rurality to the public sphere, allowing audiovisual thought to occur "outside" the work through the visitor's physical participation.

Keywords. art in rural context, inter-local dialogue, audiovisual essay, ethno-poiesis, expanded cinema, interactive installation

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[ID+] Research and project in design

Working with the existing: micro-architectural design in industrial heritage interiors

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Research and Project in Design.

Abstract This doctoral thesis is based on a design-led research approach, and aims to examine how micro-architectural interventions, situated between architecture and furniture, can transform the lived experience of repurposed interior spaces in industrial heritage buildings.Rather than addressing heritage reuse through large-scale architectural renovation, the project takes a lighter, more sensitive, and human-centred approach to transforming interior spaces. It explores reversible, playful, and open-ended design interventions that privilege visitors' embodied and sensory experience. These interventions work with the existing conditions of the heritage building: its structural constraints, imperfections, atmospheres, strengths and vulnerabilities, and seek to compose with these qualities, not to erase or obscure them.
The Fábrica Centro Ciência Viva in Aveiro, a former industrial building transformed into a science centre, serves as a case study. Here, design is viewed as a practice, capable of activating underused interiors or spaces that present spatial challenges, and aims to renew the identity and character of existing spaces. The objective is to reconfigure the ways visitors inhabit, perceive and experience these spaces, through environments that evoke, engage and encourage exploration and multiple uses. The project focuses on how visitors, especially children and young people, who constitute the majority of the public, interact with the space and appropriated it through a constant oscillation between body, materiality, perception, imagination, and social encounters. The methodology combines exploratory iterative design, micro-architectural prototyping, long-term situated observation, and participatory engagement with users.
Micro-architecture is seen as an adaptative, sculptural and experiential design method between macro-furniture and small-scale architecture. This type of interventions does not impose fixed uses but creates spaces for appropriation and interpretation, play, rest, observation, and discovery. The research draws on phenomenology, embodiment, theory of affordance, atmosphere, and affective experience to frame micro-architectural intervention as an alternative model of heritage transformation.

Keywords. *Design; Emododied experience; Spatial experience; Industrial heritage; Micro-architecture*

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UX design meets Generative AI: from employer expectations to future designer profiles

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Abstract. Generative Artificial Intelligence (GenAI) is becoming embedded in user experience and digital product design [1], raising questions about which competencies future designers need and how design education should respond. This study examined how GenAI is currently positioned within UX practice and education by combining two methods. First, a thematic analysis [2] of UX-related LinkedIn job postings across Singapore, Brazil, Portugal, and Australia identified the objectives organizations associate with GenAI adoption, the ways GenAI is being incorporated into design practice, and how competency is framed in hiring discourse. These four geographies were selected to examine how GenAI is articulated outside the centres of the AI industry and beyond European design canons. Second, a focused scoping literature review examined pedagogical approaches and curriculum development addressing GenAI in UX and interaction design education [3, 4]. Findings from job postings indicate that hiring discourse focuses on speed, AI-assisted prototyping, and tool proficiency, reflecting organizational pressure for shorter product development iteration cycles. Design education literature engages with technical competency alongside critical and ethical dimensions of working with GenAI, covering areas not yet consistently present in job requirements. By connecting inputs from both strands, this study produced two research outputs: (1) a UX Design–GenAI concept map structured around three modes of integration — AI *in* the design process, designing *for* AI-enabled experiences, and disseminating AI-design practices; and (2) a set of designer competency dimensions, the *Maker*, the *Connector*, the *Activist*, and the *Orchestrator*. Future work will apply complementary methods to challenge and iterate both outputs toward a grounded integration of GenAI in design curricula, equipping future UX designers with resources to navigate, adapt, contribute to, and critically challenge technological advances in creative work.

Keywords. *digital design, interaction design, design education, design pedagogy, 21st century skills*

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[IEETA] IEETA workshop

ChatToCaseStudy: RAG-enhanced platform for AI-supported teaching and learning

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Abstract. As AI tools become increasingly integrated into higher education workflows, a critical misalignment persists: general-purpose large language models respond based on open pre-training data rather than course-specific knowledge and pedagogical intentions, risking hallucination, loss of teacher control, and interactions that undermine rather than support learning. This challenge is particularly pressing in technical disciplines such as Cybersecurity and Data Science, where case-based pedagogy is well established, yet preparing high-quality, course-specific materials remains resource-intensive for educators. ChatToCaseStudy, an EU-funded platform developed at IEETA/University of Aveiro, addresses this by combining Retrieval-Augmented Generation (RAG) [1] with Socratic, Bloom's Taxonomy-aligned [2] case-study tasks, constraining AI responses to teacher-defined course documents while enabling configurable levels of pedagogical support. To evaluate usability and adoption potential, we conducted a structured, unmoderated remote usability study with 13 participants — 2 teachers and 11 students — from the University of Aveiro, spanning varying levels of AI literacy. The evaluation employed the System Usability Scale (SUS), the Technology Acceptance Model (TAM), domain-specific scales for Pedagogical Value and Learning Experience, and a Trust and Reliability scale adapted from Jian et al.. Results indicate excellent usability (SUS = 87.5 for teachers, 88.4 mean for students, both above the Excellent threshold of 85), strong perceived ease of use (PEOU = 5.88 and 6.39 / 7), and strong perceived usefulness (PU = 5.62 and 5.84 / 7). Source attribution with confidence indicators and Socratic scaffolding emerged as the most valued features. Students rated their learning experience positively overall (mean 4.04 / 5), with concept identification and a sense of learning control as the strongest dimensions. A notable trust gap emerged between teachers (3.50 / 5) and students (4.43 / 5), reflecting professional accountability concerns on the teacher side rather than dissatisfaction with the platform. Collectively, these findings provide actionable evidence that RAG-based, pedagogically structured AI assistance can achieve excellent usability without requiring AI-literate users, and that the primary barrier to broader teacher adoption lies in AI-generated content quality rather than interface design — a distinction with direct implications for how institutions evaluate and deploy AI tools in formal education.

Keywords. Retrieval-Augmented Generation; case-based learning; AI in higher education; usability evaluation; Socratic scaffolding; Bloom's Taxonomy

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Developing a Smart Gate Decision-Support System Through a Digital Twin-Based Architecture: A Practical Case in Sines

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Abstract. Modern seaports are data-driven ecosystems where operations increasingly depend on the ability to monitor and coordinate complex processes in real time, because operational demands are high and rapid responses are required [1]. In road access zones, several activities involve the validation of cargo, vehicle identification, traffic management, and the handling of operational exceptions, all of which require timely information and effective decision support. At Container Terminal in the Port of Sines, limited visibility across these activities and the involvement of several stakeholders highlight the need for an integrated solution capable of supporting gate supervision and operational decisions [2].

To address this need, this research presents GateOS.ai, an information system conceived to assist the management of Smart Gate processes. Its design is supported by a Digital Twin-based framework that links data acquisition, information management, analytical functions, and user interaction. The research was conducted according to a Design Science Research approach, incorporating co-creation activities and Human-Centered Design principles. The problem analysis and objective definition process combined the examination of existing terminal processes and infrastructure with a review of scientific studies and technological solutions. Insights and validation were obtained through iterative consultations with domain experts. Unified Modeling Language models were developed to define interactions, workflows, data structures, and system components.

The proposed solution is represented through a set of prototype interfaces and an architectural framework. Prototype functionalities cover performance monitoring, chatbot-assisted decision support, Digital Twin representation, checkpoint supervision, and the analysis of gate processes. These results define how data generated by different equipment and information systems may be organized and presented to operators in a usable form. The work therefore establishes a technical and functional foundation for the implementation of GateOS.ai. Subsequent research will focus on usability assessment, software and hardware integration, system performance, and predictive capabilities, including the forecasting of truck arrivals.

Keywords. *Smart Gate; Smart Port; Digital Twin; Design Science Research; Information System*

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Leveraging AI advancements to support cybersecurity compliance and promote cyber awareness

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Abstract. The growing reliance of organizations on information systems for their various business activities increases the need for robust cybersecurity measures capable of mitigating threats and ensuring operational continuity. In this sense, various security requirements that contemplate the people, process, and technology aspects of organizations are enforced by directives, regulations, and laws, such as the NIS 2 Directive [1].
Accepted cybersecurity frameworks and standards are developed by trusted and well-established entities, used to support the implementation of security compliance obligations or to simply foster secure practices in organizations not embraced by the directives [2]. An important aspect relates to personnel cyber awareness initiatives. These measures are applied to gauge critical members and subsequently upskill them, aiming to bridge potential inconsistencies in human training and alert for unknown risks.
Motivated by ongoing threats reported by the European Union Agency for Cybersecurity and some of the security requirements established by the new NIS 2 Directive, the present work aims to explore and perform research endeavors toward bridging/reinforcing cybersecurity practices with the help of AI, essentially assisting security teams in the analysis and implementation process of their specific requirements. The AI field has seen big advancements in various domains, with a substantial growth of technologies across various industrial sectors that depend on LLM modules. These are powerful in, for instance, general or specialized purpose text generation, with the latter being accomplished by learning the specifics of the intended context. Research initiatives in this direction should be performed while accounting for possible privacy and ethical considerations, which constitute pivotal rights encompassed by data regulations [3].

Keywords: *AI; NIS 2 Directive; GDPR; Cyber awareness; Data privacy*

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AI-driven DevSecOps to enhance software quality and security

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Abstract. The increasing complexity of modern software development, driven by agile methodologies, Continuous Integration/Continuous Delivery (CI/CD), and DevSecOps practices, has heightened the demand for innovative approaches to ensure software quality and security. Traditional testing and validation techniques often prove insufficient to cope with rapid release cycles, evolving requirements, and emerging security threats. This research explores how Artificial Intelligence (AI) can be effectively integrated into the Software Development Life Cycle (SDLC) to address these challenges. The main objective is to design AI-driven mechanisms for enhancing quality assurance and security through automation, intelligent testing, and behavioural monitoring. Specifically, the research will investigate methods for automated functional verification, adversarial vulnerability detection embedded in CI/CD pipelines, and continuous anomaly detection in post-deployment environments to identify and mitigate insider threats. By bridging the gap between AI techniques and DevSecOps practices, this thesis aims to contribute a framework capable of improving reliability, strengthening security, and supporting regulatory compliance in software systems. The research is guided by three core questions, addressing how AI can be used for continuous quality assurance, for vulnerability detection in development pipelines, and for anomaly detection to mitigate insider threats.

Keywords: *Artificial Intelligence; DevSecOps; Software Quality Assurance; Software Security; Continuous Integration*

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Selective Vision-Language Model Labeling for Dataset Expansion

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Abstract. Large image datasets remain expensive to build because raw visual data is often much easier to collect than to annotate reliably. This work explores a selective automated labeling pipeline in which vision-language models are adapted to a target image domain and then used only when their predictions satisfy a consistency-based reliability criterion. Rather than attempting to replace human annotation entirely, the approach aims to identify the subset of images that can be labeled automatically with high confidence, while leaving ambiguous or difficult samples for human review. The method is being evaluated with two vision-language models, Qwen-3.5-9B and Gemma-4-E4B, in image classification settings involving domain-specific label spaces. The pipeline combines constrained label-generation prompts, model adaptation on an initially labeled subset, repeated stochastic inference, and a conservative acceptance rule based on prediction stability. In this framing, the model is not treated as an unrestricted annotator, but as a selective filter for expanding labeled datasets while managing the risk of introducing label noise.

Keywords. *Vision-language models; image classification; selective prediction; dataset expansion; domain adaptation*

Note for Reviewer: This is a preliminary abstract. We are still completing the experimental results and finalizing several methodological details. These will be included in the final version of the abstract to be submitted by June 15th.

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Automation of cybersecurity requirements for guided implementation and assessment

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Abstract. The growing dependence of organisations on digital infrastructures has significantly increased their exposure to cyber threats, driving the reinforcement of regulatory frameworks in cybersecurity. The European Union has responded with instruments such as the NIS2 Directive [1] and its recent transposition into Portuguese law, establishing stricter obligations for organisations operating in critical sectors. Despite the existence of standards such as ISO/IEC 27001 [2] and the General Data Protection Regulation, the practical interpretation and operationalisation of regulatory requirements remains a complex and resource-intensive process. Compliance teams must translate abstract legal provisions into concrete technical and organisational measures while continuously monitoring adherence in a dynamic regulatory environment. These processes traditionally rely on manual document analysis, becoming increasingly inefficient in the face of growing regulatory volume and complexity [3].
This research proposes to explore how recent advances in Artificial Intelligence can support cybersecurity compliance processes. Specifically, it investigates the application of Natural Language Processing (NLP) techniques and Large Language Models (LLMs) to automate the analysis of regulatory documents, extract security requirements, and transform them into structured knowledge. Three main research directions are pursued: (1) automated extraction and structuring of cybersecurity requirements from natural-language regulatory texts using NLP pipelines; (2) a conversational assistant grounded in a regulatory knowledge base, leveraging Retrieval-Augmented Generation (RAG) [4] to guide compliance teams in interpreting and implementing regulatory obligations within their specific organisational context; and (3) a continuous compliance verification framework inspired by Continuous Integration principles, enabling organisations to maintain ongoing audit readiness. By supporting the transformation of complex regulatory texts into actionable guidance, this research contributes to more efficient, scalable, and consistent approaches to cybersecurity compliance management.

Keywords: *Cybersecurity compliance; Natural language processing; Large language models; Retrieval-augmented generation; Regulatory automation*

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Orchestrating intelligent agents for agile software development

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Abstract. Commercial Large Language Models (LLMs) require transmitting proprietary source code to external services, impose substantial recurring costs, and prevent organisational customisation, creating barriers for small and medium enterprises seeking AI-assisted software development. This research proposes multi-agent systems [1] built from role-specialised Small Language Models (SLMs) that coordinate like human development teams across frontend, backend, quality assurance, and infrastructure roles [2]. The methodology encompasses fine-tuning specialised models on role-specific datasets, fine-tunning them for local deployment on consumer-grade hardware and designing inter-agent coordination protocols that implement Agile ceremonies [3]. The approach is evaluated comparatively against single-agent systems driven by frontier LLMs and validated through real organisational deployments. The work hypothesises that specialised SLMs achieve competitive performance within their respective domains at drastically reduced computational cost, that multi-agent systems complete end-to-end Agile workflows with comparable quality while offering superior decision traceability, and that local deployments attain meaningful production adoption. Expected contributions include role-specialised model architectures, multi-agent coordination frameworks, end-to-end workflow evaluation methodologies, and customisation tooling, collectively democratising AI-assisted software development for organisations whose privacy and data-sovereignty requirements cloud-based systems cannot satisfy.

Keywords. *Agentic AI; Software Development; Small Language Models; Agile; Scrum*

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Learning action representations for anthropomorphic robotic hands

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Abstract. The increasing development of humanoid robots has intensified the need for control methodologies capable of enabling complex manipulation behaviors. Although significant progress has been achieved in areas such as locomotion and perception, dexterous object interaction with anthropomorphic robotic hands remains a major challenge due to the high dimensionality and redundancy of robotic hand actuation [1]. Existing grasping methods often rely on large datasets of human demonstrations to predict static grasp poses, overlooking the dynamic nature of grasping, which involves sequential approach, closure, and lifting phases governed by contact and inertial interactions. Reinforcement learning has shown promise for learning reactive grasping behaviors, yet policy optimization in high-dimensional action spaces remains unstable and sample inefficient [2].

This work proposed SACAAR, a reinforcement learning framework that jointly learned a grasping policy and an adaptive low-dimensional action representation for anthropomorphic robotic hands. Instead of relying on predefined synergies extracted from demonstrations or linear dimensionality reduction methods [3][4], the framework employed an inverse world model to encode actions according to their influence on state transitions. This enabled the latent action representation to evolve continuously during training, allowing the policy to explore task-relevant action manifolds while maintaining efficient learning. The method was evaluated in simulation using a subset of YCB benchmark objects and compared against synergy-based baseline approaches. Experimental results demonstrated higher grasp success rates, improved robustness to object variations, and stronger zero-shot generalization to previously unseen objects.

The findings suggested that jointly learning adaptive action synergies and control policies can significantly improve dynamic grasping performance in high-dimensional robotic systems, while also providing representations that may support future applications in transfer learning, generalization, and robotic teleoperation.

Keywords. *Reinforcement learning; representation learning; multi-fingered grasping; action reduction; inverse world models*

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Trust evaluation models for AI-driven software development

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Abstract. Integrating AI-powered code generation tools into software development workflows is transforming the way organisations build and maintain information systems. Recent studies suggest that over 80% of programmers now use AI assistants to develop new applications. This widespread adoption appears to boost productivity and the number of features delivered during software development cycles. However, empirical studies have revealed significant concerns regarding the reliability of code generated by AI agents. Around 40% of code suggestions produced by AI assistants have serious issues, according to recent research [1]. The discrepancy between perceived and actual code quality poses a critical challenge to the security and reliability of information systems [2]. Emerging evidence suggests that developers using AI tools often have greater confidence in the security of their code, even though they produce less secure outputs, indicating a miscalibration of trust. The transition from tool-based assistance to agentic AI systems further exacerbates these issues, as autonomous, goal-directed agents introduce new complexities surrounding accountability, verification and the boundaries of delegated autonomy. Existing trust evaluation approaches in software engineering lack unified frameworks capable of addressing the new characteristics of artefacts generated throughout the software development lifecycle [3]. Although current frameworks address specific aspects of software trustworthiness, they do not provide comprehensive guidance covering all stages of the development process. In light of these challenges, the aim of this PhD proposal is to investigate solutions that can establish trustworthy AI-assisted software engineering practices. One objective is to define the abstract dimensions of trust and examine how these can be converted into measurable metrics suitable for AI-generated software. The research will study how the trust of developers can be calibrated to align with the actual quality of the code produced during each development cycle. Finally, the ethical and privacy implications of integrating AI agents into software development workflows involving sensitive data will be analysed.

Keywords: *Artificial intelligence; Software engineering; Code generation; Trust evaluation; Software security; Software quality*

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Visual-language-action models in multiagent humanoid robotics

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Abstract. Recent advances in vision-language-action (VLA) models have demonstrated that pretrained visual-linguistic representations can be effectively grounded in robot perception and actuation, enabling flexible task execution from natural language instructions [1, 2]. Frameworks such as Pi-0 and Gemini Robotics have shown strong performance in single-agent manipulation tasks; however, these models do not address the coordination challenges that arise when multiple humanoid robots must act collaboratively toward shared objectives. This work investigates the extension of VLA architectures to multi-agent humanoid systems, with a focus on enabling emergent coordination through reinforcement learning (RL). The central hypothesis is that RL can serve as an optimization layer over pretrained VLA policies, allowing agents to develop collaborative behaviors without explicit hand-coded communication protocols. Three main contributions are proposed. First, VLA architectures will be adapted for multi-agent contexts using token-based fusion and graph-based representations to encode inter-agent relationships alongside visual and linguistic inputs. Second, multi-agent reinforcement learning (MARL) algorithms will be integrated to support real-time role allocation and collaborative decision-making [3]. Third, real-time observational learning mechanisms will be developed, enabling agents to adapt by observing teammates' actions and reducing dependence on offline pre-training. Experiments will be conducted in the RoboCup 3D Simulation League and Isaac Gym, providing scalable and controllable environments for evaluating complex team behaviors. Performance will be benchmarked against established single-agent and multi-agent baselines across robotic soccer and collaborative task scenarios. This project, hosted jointly at IEETA (University of Aveiro) and LIACC (University of Porto), is expected to produce novel architectures, open-source implementations, and theoretical contributions to cooperative embodied AI.

Keywords: *Vision-language-action models; Multi-agent reinforcement learning; Humanoid robotics; Emergent coordination; Observational learning*

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History-based observation of pattern evolution (HOPE): A framework for event detection in time series

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Abstract. Time series are widely used in decision support systems, where continuous monitoring is essential for maintaining system reliability and enabling timely intervention. In this work, we address event detection in univariate time series by identifying subsequences, hereafter referred to as events, that deviate from either recent temporal dynamics or the global behavior of the time series. Such events can support monitoring by triggering alerts for expert intervention or by serving as an intermediate preprocessing step, and may correspond to neutral, beneficial, adverse, or simply informative patterns. We propose History-based Observation of Pattern Evolution (HOPE), an unsupervised framework for the detection of unusual subsequences in time series. HOPE combines preprocessing, sliding-window segmentation, symbolic representation using Symbolic Aggregate approXimation (SAX) [1], similarity analysis with Normalized Compression Distance (NCD) [2], and adaptive thresholding to detect events without requiring labeled training data. The framework is modular, domain-independent, and causal, operating on fixed-length windows. It also supports human-in-the-loop validation, allowing expert validation to refine and contextualize automatically detected events, and can be configured with different analysis window lengths to capture both short-term variations and longer-term temporal changes. We evaluate HOPE on physiological time series, including electrocardiogram (ECG), electrodermal activity (EDA), and surface electromyogram (sEMG) signals recorded during a Cold Pressor Task (CPT) for pain stimulation. HOPE identifies multiple event types, including motion artifacts, sensor disturbances, and physiologically meaningful changes associated with pain-induced arousal. Consistent event detection across signals during CPT strengthens confidence that the detected events correspond to relevant transitions in physiological response to pain. Overall, the results demonstrate that HOPE is flexible and robust across heterogeneous physiological signals despite substantial differences in their temporal and statistical characteristics. This highlights its ability to handle complex, noisy data commonly encountered in physiological monitoring, demonstrating its applicability to healthcare monitoring scenarios.

Keywords: *Event detection; Time series; Symbolic representation; Compression; Data mining*

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Movement-based metrics for assessing workload in functional training

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Abstract. Quantifying workload and effort during functional training sessions has traditionally relied on physiological markers such as heart rate and perceived fatigue scales [1], while the kinematic structure of the movement is rarely characterized in a systematic and objective way.

This study proposes and applies a framework for automatically extracting kinematic and spatiotemporal metrics from monocular video recordings of functional training sessions, using markerless video analysis without requiring inertial sensors, wearable devices, or reflective markers [2]. Twenty-five healthy adult participants were recorded while taking part in functional training classes over the course of a week, with one participant per class being monitored. Each participant followed a structured functional training protocol consisting of various exercises organized into several sets, consistent with high-intensity functional training methodologies [3]. Body landmarks were estimated frame-by-frame using the MediaPipe Pose framework [4], and exercise phases were encoded through a Movement Description Language (MDL) previously developed by our research team [5]. Joint kinematics were represented using exercise-specific angle proxies derived from landmark triplets [2, 6]. For each repetition and set, multiple movement-derived metrics were extracted and investigated as potential descriptors of workload, including work time, inter-repetition rest intervals, mean and peak angular velocity, and proxy-based range of motion (ROM) for the knee, hip, elbow, shoulder, and torso segments, among others. Exercise repetitions and movement phases were identified deterministically through exercise-specific finite-state machine models within the MDL framework [5]. Across all participants and exercises, the framework demonstrated consistent metric extraction, revealing exercise-specific kinematic characteristics in proxy joint velocity and ROM that systematically differed between lower-body, upper-body, and full-body movements. Work-to-rest ratios varied substantially across exercise types, reflecting the distinct temporal demands of each movement category. These movement-derived metrics provide an observer-independent characterization of functional training sessions, complementing physiological monitoring and enabling new approaches for movement-based analysis of training load and exercise execution.

Keywords: *Functional Training; Pose Estimation; Movement Description Language; Exercise Monitoring; Movement Analysis*

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A method for de novo reconstruction of viral sequences

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Abstract. The increasing availability of viral sequencing data from diverse human samples has created a growing demand for accurate viral genome reconstruction. However, accurate reconstruction remains challenging, particularly in clinical and forensic contexts, where data may have low coverage, high mutation rates, and be highly fragmented. These limitations highlight the need for specialized computational approaches to improve genome reconstruction. To address these challenges, we developed Virumble, a novel reference-free tool for de novo reconstruction of human viral genomes. Virumble calculates the frequencies of each k-mer in the sequencing reads and uses this information to iteratively extend all reads contained in the input files. To minimize redundancy in the resulting contigs, they are recursively merged using a tolerant overlap strategy. To evaluate the performance of Virumble, we compared it against 16 existing reconstruction tools using several metrics including the Normalized Compression Semi-Distance, Normalized Relative Compression, identity, and the number of reconstructed bases. We evaluated these tools by reconstructing several synthetic datasets containing the viruses B19V, HPV68, MCPyV, and VZV, along with contamination (simulated sequences of random DNA) and mitochondrial DNA. To mimic real-life conditions, we introduced between 0% and 15% of SNPs to the viral genomes, and the sequencing process was simulated with depth coverages between 2x and 20x. Virumble demonstrated strong performance across datasets with diverse characteristics, emphasizing its potential for reconstructing unknown viral genomes. The enhancements made to the reconstruction have the potential to find new viruses and positively impact the accuracy of diagnoses and the search for personalized clinical treatments. Implemented in C, Virumble is fully reproducible and publicly available at `https://github.com/viromelab/Virumble/`.

Keywords: *Computational Biology; Genomics; Genome Assembly; Virology; Computational Virology*

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Reparameterized neural networks for the estimation of stationary autoregressive models

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Abstract. The class of Autoregressive (AR) models and their extensions plays a central role in time series analysis, offering a framework to model the linear serial dependence while maintaining interpretability [1]. Nevertheless, their simplicity also has its drawbacks, such as the inability to capture non-linear patterns. Particularly, Conditional Maximum Likelihood (CML), often the preferred approach due to its asymptotically normal properties, becomes computationally expensive as model order increases and can suffer from convergence issues. This study developed a Neural Network (NN) formulation of AR estimation by embedding the AR structure directly into a feedforward NN [2], enabling coefficient estimation through backpropagation while preserving interpretability. To ensure all estimated processes remained stationary, the NN weights were reparameterized using the Durbin–Levinson recursion [3], allowing optimization in an unconstrained parameter space. Simulation experiments were conducted on 125,000 synthetic AR(p) time series with short-term dependence ($1 \leq p \leq 5$), generated under varying parameter configurations uniformly distributed on the stationarity region [3] and gaussian noise realizations $\varepsilon_t \sim \mathcal{N}(\mu = 0, \sigma^2 = 1)$. These experiments showed that the proposed NN-based method consistently recovered model coefficients for all series, while CML failed to converge in approximately 55% of cases, with failure rates increasing to nearly 80% for higher-order models. When both methods converged, estimation accuracy was comparable with negligible differences in relative error, R^2, and perplexity/likelihood. However, when CML failed, the NN-based approach still provided reliable estimates. In all cases, the NN estimator achieved substantial computational gains, reaching a median speedup of $12.6\times$ and up to $34.2\times$ for higher model orders. Overall, results demonstrated that gradient-descent NN optimization can provide a robust, fast, and efficient alternative to classical AR estimation methods without sacrificing interpretability.

Keywords: *Backpropagation; Conditional Maximum Likelihood; AR Models; Neural Networks; Time Series Analysis*

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Spatial patterns of environmental effects on respiratory hospital admissions at the district-level in Portugal

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Abstract.
Environmental factors affect health outcomes in ways that are neither temporally independent nor spatially uniform. The unequal distribution of these effects across population groups raises concerns about environmental justice (EJ). Thus, statistical modeling of health data must account for temporal dependence before comparisons of environmental impacts across regions can be made. The Integer-Valued Generalized Autoregressive Conditional Heteroscedasticity (INGARCH) models are a common approach to model time series of counts by expressing its conditional mean as a function of past values and exogenous covariates [1]. These models have been applied in environmental health studies to assess the effects of time-varying environmental covariates (temperature and air pollutants) on hospital admissions. Studies assessing impacts within 20 km influence areas [2] and at the district-level [3] have shown significant effects of environmental covariates, although air pollutant effects at the district-level showed larger spatial heterogeneity. To investigate whether the observed spatial heterogeneity is associated with socioeconomic characteristics, correlation analysis was performed. Although strong correlations were found among socioeconomic variables, only weak and limited associations were identified between these indicators and environmental effects. As result of the correlation structure among socioeconomic variables, hierarchical clustering was applied to group districts based on these characteristics. Despite four cluster being identified, no statistically significant differences in environmental effects were detected between clusters. Thus, indicating that district-level socioeconomic structure does not explain the observed spatial heterogeneity. Since air pollutants are known to have a local effect, it is possible that there is a masking effect at this spatial scale, which calls for a finer-scale analysis at the municipality-level. However, the municipality-level scale poses additional methodological challenges due to lower counts and excess zeros, requiring zero-inflated INGARCH models [4]. Therefore, future work will focus on the development and implementation of zero-inflated models for municipality-level analysis of EJ.

Keywords: *Cluster analysis; Environmental justice; INGARCH; Spatial patterns; Time series of counts*

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From rest to rush: Can your heartbeat still identify you?

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Abstract. Biometric recognition systems have become fundamental in safeguarding individuals, as traditional methods like passwords no longer suffice. While fingerprint recognition has emerged as a common solution, it remains vulnerable to spoofing through synthetic replicas [1]. In response, Electrocardiogram (ECG) biometrics offers an inherently robust, continuous, and counterfeit-resistant alternative. However, its practical deployment is severely hindered by real-world physiological and temporal variability, such as template aging, emotional shifts, and physical exertion, alongside a critical lack of understanding regarding the minimum data required for reliable performance. This research presents an adaptive, non-invasive identification framework evaluated under rigorous operational stress tests to map the boundaries of ECG template stability and determine the optimal acquisition windows. Off-the-person cardiac signals from 80 volunteers were captured using custom biocompatible solid-state fingertip electrodes [2], transformed into 2D Gramian Angular Fields (GAF), and processed through an MLP-Mixer architecture [3]. To systematically assess scalability, the system was subjected to four stress scenarios: intra-session baseline, inter-session aging (up to three weeks), emotional elicitation, and post-physical exercise. Crucially, a dual-lens scalability framework was applied to mathematically isolate the minimum enrollment (training) and identification (testing) windows required for high-fidelity mapping. The system achieved a peak intra-session accuracy of 99.51%. Under temporal decay, inter-session accuracy dropped to 45.25% after three weeks but was successfully mitigated to 74.82% via sliding-window updates. Cross-state analysis revealed strong resilience to emotional changes (94.50%) and physical exercise recovery paths, where multi-state training yielded 81.95% accuracy. Notably, scalability analysis proved that enrollment efficiency saturates at 30 GAF images (heartbeats), whereas the ideal trade-off between performance and fast acquisition is achieved with just 10 GAFs for testing. These results highlight the potential of adaptive ECG biometrics for secure, non-invasive identification in dynamic environments.

Keywords: *Biometrics; Electrocardiogram; Gramian Angular Field; Multilayer Perceptron; Machine Learning*

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Deep learning in multivariate time series anomaly detection: a taxonomy and baseline comparison

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Abstract.
Multivariate Time Series Anomaly Detection (MTSAD) has attracted growing interest in recent years, with numerous benchmarks, methodologies, and evaluation protocols being proposed [1]. While Deep Learning (DL)-based models have become the predominant approach, their emergence has fragmented the field, making it difficult to organize the literature systematically and to assess whether these complex models actually outperform simpler statistical or conventional machine-learning alternatives.
To clarify this research landscape, a systematic literature review proposes a novel taxonomy for DL-based MTSAD methodologies [1], categorizing them across eleven dimensions organized into three parts (Input, Output, and Model). These dimensions were derived from an extensive analysis of methodological papers (2019–2024) complemented by insights from prior review papers. The taxonomy was further validated on an additional set of publications from 2025. Designed with sufficient detail to distinguish among approaches, it provides a clear overview of methodological trends in MTSAD, while remaining flexible enough to accommodate future developments. As such, it offers researchers and practitioners a practical tool to understand and navigate the field.
Beyond organization, empirical evidence for the superiority of DL-based methods remains limited. To address this gap, the benchmark model OmniAnomaly [2] was compared against a simpler baseline based on Principal Component Analysis (PCA) [3] across the 28 machines of the Server Machine Dataset (SMD). To account for OmniAnomaly's stochasticity, the model was evaluated 100 times per machine. Performance was assessed at the point level, with and without point-adjustment, under different aggregation strategies across machines and runs, with standard deviations reported throughout. The results reveal large variability across machines and demonstrate that PCA can achieve performance comparable to OmniAnomaly, and even outperform it when point-adjustment is not applied [4]. These findings call for a more critical assessment of evaluation procedures and to reevaluate the actual contribution of DL-based methods in MTSAD.

Keywords: *Anomaly Detection; Deep Learning; Multivariate Time Series; Principal Components Analysis*

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[INET-Md] Contexts and circulation of sound media, instruments and musical practices

THE GUITAR IN PORTUGAL IN THE XIX AND XX CENTURIES: AN ARCHIVAL STUDY

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Abstract.
The guitar in Portugal has increasingly attracted scholarly interest; however, the repertoire produced between the mid-nineteenth century and the early twentieth century remains largely insufficiently studied. The activity of composer-guitarists during this period, as well as the contexts of production and circulation of music for the instrument, continue to be underrepresented both in academic discourse and in contemporary performance practice [1] [2] . This paper presents the results of an archival research project focused on the identification, collection, and description of previously unknown musical sources.
Research conducted in archives and libraries throughout Portugal led to the identification of a substantial body of manuscript and printed scores, revealing the existence of a broad and diverse repertoire. This corpus comprises works of different styles and formal genres, reflecting musical practices associated with both performance and instrumental instruction, in amateur as well as professional contexts. Representative examples of works by Reynaldo Varella, Evaristo Pacheco de Sousa, Manuel Elyseu, Simões de Carvalho Barbas, César das Neves, and Luíz José Maria de Oliveira, among others, will be discussed. In parallel, brief biographical accounts of these composer-performers will be presented in order to situate their activity within the sociocultural contexts of the period.
The preliminary results reveal a marked contrast between the extent of musical activity documented in the recovered sources and its limited presence in the current guitar landscape in Portugal, particularly when compared to later periods. This paper aims to contribute to the dissemination and reassessment of this previously unknown musical heritage, opening new perspectives for research that integrate musicological inquiry with artistic practice.

Keywords. *Composer-performer; Guitar; Repertoire; Archive.*

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Amália brasileira: the trajectories of amália rodrigues in brazil through an ethnography of archives (1944–1972)

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Abstract. Since 1944, Amália Rodrigues has played a significant role on Brazilian stages and radio programs. In 1945, she recorded her first commercial albums for the Continental label in the city of Rio de Janeiro, inaugurating a period frequently referred to in her biographies as the "Continental phase."
From that moment onward, Amália's voice achieved greater prominence through the record industry, particularly due to the possibilities of domestic listening and the expansion of radio broadcasting. At the same time, the singer participated in television programs, served on festival juries, and incorporated Brazilian songs into her repertoire.
The permanence of a mutual legacy can be observed in the continued presence of Amália's songs in the repertoires of Brazilian musicians, as well as in exhibitions and performances held in her honor in recent decades in Brazil.
Drawing on an ethnographic approach to archives, this research analyzes the social and musical contexts in Brazil and Portugal that converged in the beginning of Amália Rodrigues's recording career, seeking to understand the repercussions of this process both for the singer's trajectory and for the musical repertoires and heritage of both countries.

Keywords. *Amália Rodrigues; Brazil; Archive; Etnography.*

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The record before listening: material traces, sound practices and phonographic circulation

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Abstract. This presentation starts from the moment before listening. A gramophone record is usually approached for the sound it contains, but before it is played it already offers a set of clues that connect the physical object to sound practices that were selected, recorded, named, circulated and preserved.
Focusing on Portuguese gramophone records from the mechanical recording era (1900-1925), this presentation draws on the inventory of the Shellac Record Collection at the University of Aveiro, placing it in dialogue with national and international databases. The aim is to follow what can be learned from the record before auditory listening takes place: how a title, a label, a name or a matrix number may point to performers, repertoires, commercial routes, modes of classification and practices of listening.
The record is therefore approached as a meeting point between material and intangible dimensions. A voice, a repertoire or a performance becomes inscribed in a physical medium, but this inscription is never neutral: it is partial, selective and shaped by technological limits, commercial decisions and the ways in which the record was later described, catalogued and preserved. In this context, divergent titles, unstable spellings, multiple issuing or conflicting attributions can reveal the complex documentary life of these objects. By attending to what the record says before it is heard, this presentation explores how material traces can help us understand the circulation of sound practices in Portugal in the early twentieth century.

Keywords. *Music industry; Gramophone records; Sound archives; Databases; Portuguese phonographic labels*

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[INET-Md] Creativity and artistic practice in music: experiences, dialogues and perspectives

Reconfiguring the classical concert through improvisation and instrument augmentation

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Abstract. The traditional concert model that dominates Western classical music practice was established in the nineteenth century [1] and contributes to a risk-averse approach to concert design, in which the reproduction of well-known musical works is privileged and the canonisation of virtuoso performers and composers is reinforced.
The predictability and formal rigidity of this concert model are among the characteristics that contribute to a growing distance between Western classical music and contemporary society [2].
In search of a modern reconfiguration of the concert format, I propose the intersection of instrument augmentation and improvisation to create concerts in which the various musical works are connected through improvised interludes. The process begins with the analysis of the preceding and subsequent musical works and the definition of rule sets for improvisation [3]. Those rule sets are the starting point for a cyclic process of experimentation and reflection that follows the frame of Art-Based Action Research [4]
The use of the electric vibraphone [5] aims to expand the sonic possibilities of the instrument and to create a sound world that resonates with contemporary society. At the same time, improvisation embraces the risk of real-time creation and promotes the uniqueness of each performance.
This presentation will include video recordings of these connecting moments, as well as an explanation of the processes developed to create them, reflecting on the potential of this approach to generate several different musical outcomes from the same exact rule set.

Keywords. *Musical performance; Improvisation; Augmentation; Concert Design;*

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From the archive to the stage: an experimental recreation of Euripides's *Medea*

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Abstract. This paper examines the experimental recreation of Euripides's *Medea*, a collaborative project developed in partnership with the University of Coimbra Students Theater (TEUC) in 2024. This theater collective was responsible for the 1955 premiere of Maria Helena da Rocha Pereira's Portuguese translation of the Greek tragedy, under the artistic direction of Paulo Quintela and with music by Victor Macedo Pinto (1917-1964). At the intersection of the historical dimension of the play and the experimental approach underpinning its recreation, the project addressed the following research questions: 1) what ethical and methodological challenges arise from the combination of archival materials and newly-created contents in a collaborative recreation? 2) how can music operate as a catalyst for deterritorialization within the scope of an artistic research project? The methodology encompassed archival research in public institutions and private collections throughout Portugal, interviews with individuals connected to the context of the 1950s presentations, and performance laboratory sessions with the stage director, actors, and musicians. Centered on scenic and musical experimentation, these sessions fostered a critical engagement with the ontology of the musical work [1], emphasizing processes of deconstruction and subsequent recombination of materials, as well as the application of principles drawn from postdramatic theater [2] and composed theater [3]. The creative process foregrounded the implementation of a collaborative and transdisciplinary working model, offering an alternative approach to this historical repertoire within the field of artistic research. The presentation will explore this approach through video documentation of the final performance, highlighting the intersections among embodied knowledge, experimentation, and forms of shared artistic agency.

Keywords. *Theater; 20th-century Portuguese music; Experimental recreation; Medea; Victor Macedo Pinto*

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Gestures and figures: integrating composition, performance, and fixed audiovisual media

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Abstract. This proposal presents the creative process and artistic outcomes of an ongoing project that explores the integration between composition, performance, and fixed audiovisual media. Assuming the role of composer-performer (guitarist), I sought to expand the creative dynamics traditionally centred on the interaction between instrument and score towards a multidimensional approach based on interaction with electronics and video. Consequently, the project seeks to address the following questions: how are the interrelations between composition and performance manifested through the integration of fixed audiovisual elements? What artistic, aesthetic, and expressive commitments emerge from this process? How do these experiences inform and reconfigure my artistic practice grounded in the Classical music tradition?

Framed as artistic research, the project was conceived as a space for experimentation and critical reflection on modes of integration, drawing primarily on the concepts of gesture and figure as common points between compositional, performative, and visual practices. Through artistic practice itself, the research sought both to respond to these questions and to raise new questions, methods, and forms of knowledge.

The methodology adopted is based on an autoethnographic approach, enabling situated reflection on my activity as a composer-performer. The methods include the study of the concepts of gesture and figure, experimentation in laboratory contexts with possible transpositions and transformations of these elements between compositional, performative, and visual practices, observation and description of the documentation produced during the experimental process, and analysis of the interactions between the areas involved.

Preliminary outcomes reveal possible artistic and conceptual connections between compositional gesture, performative gesture, and visual gesture, while also exposing the tensions inherent in the multiplicity of roles assumed within the creative process. The study contributes to discussions on transdisciplinarity and highlights performance as a central discipline within both the artistic process and outcome, thus questioning the traditional dynamics between composition, score, and performance.

Keywords. *Composer-performer; Composition; Performance; Guitar; Multimedia*

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Performance and Ethics – On Preserving and Re-inventing Bulgarian Cultural Heritage

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Abstract. Based on a wide range of strategies for supporting intangible cultural heritage in a globalized world, this thesis explored innovative approaches to preserving and reimagining Bulgarian cultural heritage through musical performance. The research focused on the transformation of the traditional classical recital into an immersive multisensory experience, seeking new ways of connecting audiences to Bulgarian music, folklore, and cultural memory.

The central artistic product of the thesis was a "concert-museum" experience built around Bulgarian classical piano repertoire. In this format, the audience was invited to move through a specially designed space engaging all five senses – hearing, sight, smell, taste, and touch.

Through artistic experimentation, analytical performance practice, and the study of Bulgarian folk traditions, the research investigated how elements such as irregular rhythms, ornamentation, folk instrumental timbres, non-metric structures and narrative thinking can be reinterpreted within the context of classical piano performance. Attention was given to the relationship between Bulgarian folklore and works by Bulgarian composers, as well as to the performer's role as an active mediator between tradition and contemporary audiences.

The methodological framework combined artistic research, ethnographic observation, performance analysis, and reflective practice, grounded primarily in hermeneutic approaches and knowledge-constitutive interests. Rather than preserving tradition as a fixed artifact, the thesis explored how intangible cultural heritage can remain alive through reinvention, interdisciplinary concert formats, and audience participation.

The final artistic product, the multisensory concert experience, introduced a new concert model that aimed to foster deeper understanding of Bulgarian traditions and the need to preserve the cultural heritage of mankind, based on empathy, on subjective personal meaning constructions. The project suggested that contemporary performance can serve not only as artistic interpretation, but also as an ethical act of cultural preservation, transmission, and reimagination.

Keywords. *Artistic Research; Bulgarian Folklore; Intangible Cultural Heritage; Classical Piano Performance; Multisensory Concert Experience; Cultural Preservation*

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Creativity and artistic practice in music: experiences, dialogues and perspectives through hypercuica

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Abstract. This research explores artistic creation processes involving Hypercuíca, an augmented version of the cuíca, an Afro-Brazilian friction drum traditionally associated with samba. Developed within the Doctoral Program in Artistic Creation at the University of Aveiro and supervised by Nuno Aroso and Filipe Lopes, the project investigates how gesture, bodily movement, digital technologies, and experimental performance practices can expand the expressive possibilities of the instrument. The research combines practice-based artistic experimentation with live electroacoustic performance, free improvisation, and the development of interactive systems for real-time sound modulation. Through the integration of sensors, digital signal processing, and gestural control, Hypercuíca proposes new relationships between performer, instrument, and technology while maintaining connections to the cuíca's cultural and sonic identity. The project also reflects on the dialogue between traditional musical practices and contemporary experimental approaches, positioning the cuíca as both a historical instrument and a medium for artistic reinvention. The artistic process unfolds through performances, workshops, improvisation sessions, and interactions with audiences and communities of musicians, generating reflections on embodiment, listening, creativity, and experimentation. In this context, artistic practice functions simultaneously as a mode of inquiry, critical reflection, and knowledge production. By situating an Afro-Brazilian percussion instrument within experimental and technological contexts, the research seeks to contribute to broader discussions surrounding artistic research, hybrid musical instruments, intercultural dialogue, and creative practices in contemporary music.

Keywords: *Augmented percussion instrument; Friction drum; Experimental music; Gestural control; NIME*

[INET-Md] Music and community engagement: practices, artistic dialogue, and contemporary challenges

Other rituals: musical performance and relational knowledge.

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Abstract. This doctoral artistic research investigates the ritual dimension of musical performance as a set of protocols that shapes the aesthetic experience of the concert. It responds to a decisive concern: the growing distance between audiences and contemporary artistic practices, especially when rigid, hierarchical, and specialised formats weaken the possibility of encounter. Grounded in artistic research and informed by understandings of musicking and ritual as relational practices [1,2] the project proposes other rituals for performance: situated acts that reconfigure the relationship between performer, audience, space, body, listening, scenography, and multimodality. Methodologically, the research is developed through compositions, laboratories, rehearsals, public performances, audiovisual documentation, reflective writing, and critical analysis. The expected outcome is a corpus of performative works that expands the musical concert beyond its conventional concert frame and tests different modes of co-presence, proximity, active/passive participation, and sensitive interaction. Rather than using technology or staging as spectacle, the project looking forward an artistic situation as a relational environment where embodied knowledge may emerge through shared attention and action [3]. Its relevance lies in contributing to the epistemological consolidation of artistic creation as research, while offering concrete strategies to rethink the musical event as a common space for relational and sensitive knowledge.

Keywords. *Artistic research; musical performance; relational knowledge; audience participation; multimodality; participatory performance scores.*

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Acknowledgements. The author acknowledge the support of the Doctoral Programme in Artistic Creation at Universidade de Aveiro and INET-md.

Silence as a Phenomenon of Confinement:

An Artistic Exploration within the Portuguese Prison System

Pedro Emanuel Pereira

Plain Text
Word limit: 300

This doctoral research explores silence in contexts of confinement, focusing on the Portuguese prison system through an innovative approach that combines artistic practice and academic reflection. The study investigates the emotional, social, and spiritual impact of silence on incarcerated individuals, highlighting it as a space of resistance, self-knowledge, and transformation. The artistic intervention is centred on performative concerts held inside prisons, where silence, integrated into musical creation and sensory experience, encourages deep reflection and emotional revitalisation among inmates.

In addition to the concerts, the project develops a final composition by Pedro Emanuel Pereira, inspired by the texts and experiences collected throughout the research. The work incorporates recordings made inside prisons and sounds from the environment of confinement, creating an immersive artistic experience. The use of advanced technologies, such as Dolby Atmos sound, and multisensory installations enhances both the artistic experience and its accessibility to audiences. Through photography, audiovisual media, and exhibitions, the research aims to communicate the potential of silence and art as instruments of social change.

Collaborating with distinguished artists and scholars, the project demonstrates how culture can become a powerful vehicle for social transformation and rehabilitation. By giving voice to the silenced, the research reaffirms the power of artistic creation as a tool for resistance, self-awareness, and the humanisation of the prison system, encouraging a more empathetic, inclusive, and transformative understanding of spaces of confinement.

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Cavaquinhos and Braguinhas: Territories and Dynamics Between Brazil and Portugal

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Abstract. In Brazil and Portugal, chordophones of common origin share morphological similarities while having developed distinct practices across three musical territories: the Brazilian and mainland Portuguese cavaquinhos, both known by the same designation, and the braguinha, whose practice is predominantly associated with the Autonomous Region of Madeira. This paper presents findings from a research residency undertaken at the University of Aveiro (INET-md/DeCA) as part of a doctoral project in Musical Performance at the Federal University of Minas Gerais (UFMG). The study examines the development of these chordophones, focusing on the structural characteristics and sociomusical dynamics through which their respective territories are constituted. The qualitative methodology combines a literature review, semi-structured interviews with musicians and instrument makers, and an autoethnographic approach grounded in the researcher's experience as a professional cavaquinho player. The findings reveal significant organological and technical contrasts. In Brazil, the cavaquinho is larger in size, fitted with high-tension metal strings (8 kgf), and generally played with a plectrum. Its performance practices have expanded beyond choro and samba to encompass solo performance and mixed electroacoustic experimentation. Revitalized following the release of Júlio Pereira's album Cavaquinho (1981) [1], the Portuguese cavaquinho retains lower-tension metal strings (4 kgf), employs distinct tuning systems, and preserves the traditional "rasgado" strumming technique. It circulates among folk ensembles, academic tunas, and solo performance contexts. The braguinha, by contrast, is distinguished by its nylon strings, a tuning identical to that commonly used in Brazil, and fingerstyle techniques resembling those of the classical guitar. Its praxis encompasses concert music and contemporary composition - as exemplified by Pedro Gonçalves and collaborators in the album Miniaturas Contemporâneas para Braguinhas (2026) [2] -, while continuing to coexist with traditional practices. The study concludes that these instruments constitute a dynamic transatlantic ecosystem in which the different variants have moved beyond their conventional associations with popular and traditional music, becoming highly specialized instruments and vehicles for artistic innovation.

Keywords. *Cavaquinho; Braguinha; Musical Performance; Comparative Organology; Artistic Research.*

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Forró as Intangible Cultural Heritage: bottom-up strategies in a mobility context

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Abstract. Forró is a performative practice involving music, dance and poetry, officially recognized as intangible cultural heritage in Brazil since 2021. Throughout the twentieth century, forró consolidated itself as a national musical genre marked by different forms of mobility, especially related to the migration of northestern workers to the southeastern big cities. In the last two decades, this performative practice was also consolidated as a transnational movement, with great expression in countries of Western Europe. In this context, the practice brings together brazilian migrants and practitioners from the host countries. In 2026, a request for the recognition of forró as Intangible Cultural Heritage of Humanity was sent to UNESCO, giving rise to questions related to authenticity, belonging, authority and heritage governance. In this communication, I aim to discuss tensions between the public policies and the forró community and present bottom-up strategies that are being proposed by the forró practitioners - both in Brazil and in european countries - for managing it as a patrimonialized practice. In the brazilian experience, forró practitioners, led by cultural associations, have organized themselves into local and national permanent forums and have engaged in dialogue with Departments of Culture and legislative bodies. In the european context, the attempt to reproduce the organizational models from Brazil provoked conflicts associated with State propaganda, dispossession, power inequalities and the constitution of regimes of truth, in the foucaultian perspective. Finally, the mobility aspect in forró's trajectory creates a diversity of discourses and practices which establish fundamental challenges to its management as an ICH.

Keywords. *Forró; Music and Migration; Intangible Cultural Heritage; Regimes of truth.*

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Some Forms of Recognition in a Samba Context

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Abstract. This presentation stems from an ethnographic research project begun in 2021 with musicians connected to samba practices in a community on the outskirts of Belo Horizonte. The research followed samba gatherings, performances, and rehearsals, observing how samba organizes experiences, repertoires, memories, and modes of recognition. The discussion develops from a question posed to interlocutors during fieldwork: "Do you consider yourself a sambista?" The answer, which might have seemed evident given trajectories marked by singing, composition, musical work, and participation in samba groups, revealed significant hesitations. Many of the interviewees distanced themselves from this identification, even as they recognized other subjects as examples of sambistas, especially older figures who are publicly legitimized within the field. The presentation will examine this difference between participating intensely in samba and assuming the category "sambista" as an identity. In the statements analyzed, the term appears linked to accumulated experience, knowledge of samba history, dedication to musical work, relationships with older generations, Black and diasporic memory, community life, and recognition by peers. The aim here is to understand how the idea of "being a sambista" is elaborated by the interlocutors themselves, within the tensions between lived experience, collective recognition, and the desire to approach an ideal that remains permanently under construction.

Keywords. *Keyword one; Keyword two; Keyword three; Keyword four; Keyword five*

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Media multitasking during music practice and its effect on performance

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Abstract. Music students are increasingly surrounded by digital media in their daily lives, yet the implications of how that reaches into practice remain poorly understood. "Media multitasking" (MMT), associated with digital distractions, is the act of using media during other, unrelated tasks. This study investigates the prevalence of MMT during music practice and examines its relationship with both academic performance and self-regulated learning (SRL). Drawing on a mixed-methods design, data were collected through real-time practice diaries, video-recorded performance observations, in-depth interviews, and a validated SRL scale measuring self-regulation across dimensions of self-efficacy, method, behavior, time management, and social influences. The study began as a triangulation of instruments and participant groups and evolved into an inquiry into the mechanisms underlying MMT's effects. Emerging findings point toward SRL as a potentially central mechanism through which MMT may exert its influence, suggesting that the relationship between media multitasking and academic performance could be less direct than commonly assumed. Data analysis is ongoing, and this work aims to contribute to a reframing of how digital distraction is understood in music education contexts, with implications for SRL-informed pedagogical practice.

Keywords. *Self-Regulated Learning; Self-Regulation; Music Education; Digital Distraction; Academic Performance*

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[IT] Communication networks

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Dynamic network federation and edge slicing

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Abstract. Future 6G networks will be required to seamlessly integrate highly heterogeneous environments, merging centralized cloud infrastructures with extreme edge computing. This thesis proposal addresses the challenges of multi-domain network federation, focusing on the dynamic orchestration of network slices and Multi-Access Edge Computing (MEC) across public and private domains. By exploring highly demanding scenarios - specifically high-density smart stadiums and cross-border Public Protection and Disaster Relief (PPDR) operations - this PhD thesis aims to develop secure, scalable, and stateless federation mechanisms. The work will propose a novel architecture for cross-domain orchestration, leveraging East-West Bound Interfaces (EWBI) and programmable interconnection to ensure continuous service delivery during unpredictable network loads and critical emergency responses.

Keywords: *6G; Network Federation; Multi-Access Edge Computing (MEC); Network Slicing; Private/Public Networks*

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Acknowledgements. The author acknowledge the support given by the Telecommunications Institute (IT) through the 6G-VERSUS projects, which has received funding from the Smart Networks and Services Joint Undertaking (SNS JU) under the European Union's Horizon Europe research and innovation programme under Grant Agreement No 101192633.

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Orchestration of connected and autonomous vehicles in mixed traffic scenarios

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Abstract. Connected and Autonomous Vehicles (CAVs), supported by Vehicle-to-Everything (V2X) communications, are expected to improve the safety, efficiency, and sustainability of urban mobility by enabling cooperative traffic management and coordinated driving maneuvers. Existing traffic orchestration and maneuver coordination approaches, however, are predominantly designed for homogeneous environments in which all participants are connected, cooperative, and capable of explicitly sharing their intentions [1]. Such assumptions are not representative of real-world deployment scenarios, where CAVs must coexist with human-driven vehicles, non-connected participants, and Vulnerable Road Users (VRUs) [2].

This PhD thesis will investigate a unified traffic orchestration framework for mixed-autonomy urban environments, combining explicit V2X-based cooperation with implicit interaction modeling for non-connected road users. The research focuses on three major challenges: intention awareness in the absence of explicit communication, shared situational understanding under partial observability caused by sensing limitations, and robust coordination in the presence of non-cooperative or unpredictable behavior. Building upon these components, the thesis will investigate decision-making and orchestration strategies capable of supporting complex multi-agent interactions, including chained and cascading cooperative maneuvers involving vehicles, infrastructure, and VRUs. The framework to be devised aims to integrate locally observed behavior, inferred intentions, and communication-supported awareness into an unified interaction management system for urban traffic environments. The research will be evaluated through simulation and realistic experimental environments using ITS-G5 and V2X-enabled autonomous driving platforms [3], assessing the framework in representative mixed-traffic scenarios.

Keywords: *Autonomous driving; Road safety; Mixed-autonomy traffic; Vehicular Networks*

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Acknowledgements. This work was supported by the European Union / Next Generation EU, through Programa de Recuperação e Resiliência (PRR) Project Nr. 29: Route 25 (02/C05-i01.01/2022.PC645463824-00000063).

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Human and network architectures and communication frameworks for VRU safety in smart environments

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Abstract. Vulnerable Road Users (VRUs) remain disproportionately harmed in road accidents [1]. This problem is compounded by mixed road traffic composed of conventional, connected, semi-autonomous, and Autonomous Vehicles (AVs). While these intelligent vehicles are supposed to increase VRU safety, current systems lack a reliable way for humans to exchange intent, receive acknowledgments, and understand machine decisions. Advanced driver-assistance systems and external human–machine interfaces, on their own, neither capture human intentions nor deliver personalized, context-aware guidance [2].
This work proposes a human-centered, networked architecture that treats Extended Reality (XR) devices, such as smart glasses or other wearables, as both an interface and a mobile sensor [3]. These devices enable multimodal interactions, including voice, gestures, head motion, and audio, haptic, or visual feedback, which make engagements more interactive and immersive. On the perception side, VRU-generated awareness contributes to collective cooperative perception in smart environments by sharing sensor data across road users and infrastructure. For dense urban areas, a connectivity and data plane is designed to reduce channel load by clustering and fusing redundant detections. This work also reviews foundational concepts regarding vehicle-to-everything (V2X) communications, XR, cooperative perception, and multi-access edge computing. Additionally, to meet the requirements of safety-critical services, mobility-aware orchestration offloads services across VRU devices, roadside edge nodes, and cloud, to place computation where it is most effective [4]. This research combines simulation and real-life experiments to evaluate the system's key performance indicators and key value indicators for the user's experienced usability and workload.
The expected contributions include: (i) an XR-mediated VRU-AV interaction loop with clear semantics for intent and acknowledgment; (ii) a cooperative perception pipeline that leverages XR-enabled VRUs as active intelligent transport system participants; (iii) congestion-aware VRU-generated V2X messages while preserving safety; and (iv) mobility-aware orchestration mechanisms that keep critical services within their latency requirements validated in real-world scenarios.

Keywords: *Vulnerable Road User; Connected and Automated Vehicles; Multi-Access Edge Computing; Extended Reality; Intelligent Transport Systems*

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Towards transferable misbehavior detection for V2X messages in cooperative ITS

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Abstract. Recent advances in wireless communications and onboard sensing are driving the deployment of vehicular networks in Cooperative Intelligent Transportation Systems (C-ITS), where vehicles and other ITS stations exchange safety-critical information [1]. By combining onboard sensing with Vehicle-to-Everything (V2X) communications, C-ITS applications can make more informed decisions. However, the open and distributed nature of these networks makes the exchanged data vulnerable to malicious activities that threaten system security and human safety. To mitigate cybersecurity threats in V2X communications, a Public Key Infrastructure (PKI) authenticates V2X stations and protects message integrity. However, it cannot prevent authenticated insiders from injecting semantically false yet syntactically valid data. This limitation raises a data-integrity problem, where messages may pass all cryptographic checks while still conveying incorrect information about the traffic situation. Addressing this problem requires Misbehavior Detection Systems (MDSs) that monitor V2X data streams to detect any misbehavior. In general, an MDS analyzes messages such as Cooperative Awareness Messages (CAMs) and Collective Perception Messages (CPMs), checks them against physical models, cross-consistency rules, or learned patterns, and flags suspicious behaviors that are inconsistent with reality or with other trusted information sources. However, existing MDSs often depend on specific scenarios or datasets, which limits their transferability to new environments, attack types, and traffic conditions [2]. This research aims to explore how to design and evaluate transferable MDSs for V2X messages in Vehicular Ad-Hoc Networks (VANETs). The current work focuses on simulation and data generation: a new misbehavior-injection architecture is being designed by extending the Artery V2X simulation framework [3]. This architecture is intended to generate reproducible, richly annotated misbehavior datasets that will be used to study how well different detection strategies transfer across message types, attack models, and C-ITS scenarios. The main goal is to derive design guidelines for robust, transferable misbehavior detection in V2X systems.

Keywords: *Misbehavior Detection; Cooperative-Intelligent Transport systems; Vehicle-to-Everything; Machine Learning; Deep Learning*

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Digital twins for roadside infrastructure-enabled cooperative automated driving

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Abstract. The compute capabilities in modern vehicles are on the rise, resulting in increasingly advanced driving automation features. The execution of such advanced functions requires accurate modeling of the physical vehicle and its environment as well as advanced algorithms capable of understanding these models and make decisions about future maneuvers. Such digital models are referred to as digital twins. These highly accurate models rely on real-time data from vehicle sensors to stay updated on vehicle's state. Coupled with communication interfaces, and advanced perception and control algorithms, the digital twin is capable of analyzing its own data as well as that from external sources to better control its physical counterpart. The flexibility of these digital models allows fast development and deployment of more demanding autonomous driving functions that require costly upgrades to on-board hardware. In this context, roadside infrastructure can be used as an edge computing platform, hosting the more demanding driving control components of the digital twin. Offloading advanced driving functions this way, while keeping basic safety systems on the vehicle, allows their hardware requirements to be reduced. Additionally, this can be extended beyond just driving related tasks to include vehicle-to-vehicle or vehicle-to-infrastructure communications reducing radio channel usage. This requires a flexible way to re-deploy these tasks in a way they remain near relevant vehicles as they travel without interrupting driving functions. Such a system raises challenges in workload migration between edge nodes in the form of service continuity and state synchronicity. It also enables for more dynamic control of driving functions, for example switching between urban and highway driving, or adapting to specific scenarios such as road works and toll plazas. Some preliminary work [1] was conducted to evaluate the impact of maintaining the deployment close to the physical vehicle and the workflows of existing tooling.

Keywords: *Intelligent Transportation Systems ; Cooperative connected and automated mobility; Autonomous vehicles; Cooperative driving*

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Digital twin-enabled framework for task offloading in healthcare edge systems

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Abstract. My PhD research focuses on developing intelligent and reliable resource management methods for next-generation healthcare edge computing systems. This work is motivated by the growth of wearable sensors, medical imaging devices, and Internet of Things (IoT)-based healthcare systems, which continuously generate large amounts of data that need to be processed quickly and reliably. Many healthcare applications, such as ECG monitoring, patient tracking, and real-time diagnosis, are highly time-sensitive, where delays or task failures can directly affect clinical decisions and patient safety [1]. Traditional cloud-based solutions are often not suitable for these scenarios because of high communication delays, network congestion, and limited scalability. Edge computing helps address some of these issues by processing data closer to where it is generated [2]. However, efficiently deciding how to offload tasks and allocating resources in such dynamic and constrained environments is still a major challenge due to fluctuating workloads, limited computing capacity, and heterogeneous system conditions.

In my research, I explore how digital twin (DT) technology can improve decision-making in healthcare edge systems. A digital twin serves as a real-time virtual representation of the physical system [1], enabling us to monitor and predict key states such as queue length, resource usage, and energy levels. This predictive capability enables a shift from reactive scheduling to more proactive, informed decision-making [3]. At the same time, digital twins introduce new challenges, such as synchronization overhead and outdated system information, which can negatively affect performance if not properly handled.

A key gap in existing research is that most existing methods focus on optimizing only one or two objectives, such as latency or energy consumption, while ignoring other important factors like fairness, reliability, and the cost of maintaining the digital twin itself. In addition, many approaches assume simplified or ideal system conditions, which do not fully reflect the complexity of real healthcare environments. To address these limitations, my work develops a digital twin–informed mixed-integer linear programming (MILP) framework for task offloading and resource allocation in healthcare edge systems. This approach uses digital twin predictions to support better scheduling decisions while jointly considering multiple conflicting goals, including latency, energy efficiency, fairness, and reliability, under realistic system constraints. Overall, this PhD aims to build more intelligent edge computing systems that can support reliable, fair, and efficient healthcare services in real-world environments.

Keywords. *Edge intelligence; Multi-objective optimization; Task scheduling; System reliability; Healthcare IoT*

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Resilience of future cellular networks: metrics and evaluation framework

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Abstract. Network resilience has been increasingly critical in telecommunications, where uninterrupted network operation is fundamental to the success of the modern digital services. Network breakdown occurs owing to natural disasters or man-made activities like cyberattacks or hardware failures or software bugs, etc. [1]. As sixth-generation (6G) mobile communications approaches its anticipated 2030 roll-out, future cellular networks must autonomously detect failures, respond to disruptions, and restore normal operations with minimal service degradation [2]. This demands that resilience be treated as a concrete, measurable property. However, no universally accepted definition, unified metric, or standardized evaluation framework for cellular network resilience currently exists [3]; practitioners instead rely on fragmented, inconsistently interpreted indicators.

This research aims to identify the Key Performance Indicators (KPIs) of resilient cellular networks, propose a unified resilience metric that consolidates these KPIs, and develop a standardized evaluation framework tailored to future 6G architectures. A design science research approach will be employed for the creation and validation of both the metric and the evaluation framework. KPI identification will include a mixed-method research structure followed by the formulation of a comprehensive definition for cellular network resilience. The metric will be identified through the mathematical conversion of the definition, and then a framework will be developed for future measurements. The anticipated outputs will enable systematic measurement of cellular network resilience, providing a foundation for the standardization of resilience metrics, and assist in identifying network strengths and vulnerabilities.

Keywords: *cellular network resilience, 6G, KPI, resilience metrics, evaluation framework*

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Evaluating temporal deep learning architectures for anomaly detection in 5G network slicing

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The increasing use of network slicing in open and distributed 5G networks has made anomaly detection an important but complex problem [1], [2], as the latency, traffic, reliability performance, and resource requirements of eMBB, mMTC, and URLLC slices differ from each other. A major problem with existing models is that most methods treat all slices in the same way, use the same model or the same threshold [3], and do not effectively handle slice-specific traffic behaviors, data imbalance, low latency, and precision-recall tradeoffs. This study presents a comparative evaluation of the performance of different temporal deep learning models using KPI-based time series data for 5G network slicing. Separate modeling and post-training threshold calibration were used for each slice to achieve better decisions in unbalanced data. Experimental results show that most models performed well in eMBB and mMTC slices, where the best models achieved F1-scores ranging from about 0.80 to 0.85. In contrast, the URLLC slice proved to be more challenging, where advanced models such as BiLSTM, Informer, and Autoformer outperformed the baseline models, and the PR-AUC reached 0.945. The results clearly demonstrate that slice-specific temporal modeling and threshold calibration are essential in practical 5G/Open RAN environments.

Keywords:
5G Network Slicing; Anomaly Detection; Temporal Deep Learning; Open RAN; Key Performance Indicators.

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Investigating low-complexity digital signal processing algorithm for very-high-speed coherent passive optical networks

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Abstract. The escalating demand for bandwidth in next-generation access networks has pushed passive optical networks (PONs) beyond the practical limits of conventional intensity-modulation/direct-detection solutions at very high symbol rates. At 100 and 200 Gb/s capacities, chromatic dispersion, polarization mode dispersion and bandwidth limitations severely restrict traditional transmission. To address this challenge, this research investigated low-complexity digital signal processing (DSP) algorithms specifically tailored for very-high-speed coherent PON (VHSP-PON) architectures to balance performance, cost, and power consumption. The methodology involved designing a simplified coherent receiver structure using single-polarization heterodyne configuration, modelled using offline MATLAB DSP. Alamouti coding, a concept adapted from the antenna scenario in wireless communication, was implemented as a core enabling technique to relax polarization tracking, thereby supporting low-cost coherent reception [1]. The DSP chain was optimized to minimize Optical Network Unit (ONU) complexity by utilizing a singly polarised coherent receiver, evaluating tap-length reduction, and simplified equalizer update method for polarization recovery and impairment mitigation. The proposed setup has the potential to support coexistence conditions and wavelength slot allocations to ensure seamless backward compatibility with legacy PON standards [2]. Results from offline simulation report quantitative figures at improved bit error rates along with the achieved tap-length reduction, revealing that the proposed low-complexity coherent-lite DSP framework successfully meets N1-class power budgets of >29 dB over target short reach distance within the C-band. More so, the optimised equaliser performs faster convergence, aiding signal recovery. Ultimately, this work established a realistic comparative framework proving that simplified coherent architectures, enhanced by streamlined DSP, offer a highly scalable, economically viable pathway for future high-speed optical access systems.

Keywords. *Digital signal processing; Coherent detection; Optical fiber communication; Very-High-Speed Passive Optical Networks*

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Enabling Tbit/s Class WDM-FSO Downlinks from LEO though Adaptive Modulation and Channel Count Allocation

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Abstract. Satellite constellations are being sought as a crucial element in creating a global, high-throughput, communications network, that solves the problem of ubiquitous connectivity. This potential, however, is severely limited by the constraints of the currently implemented radiofrequency techonlogies, particularly the stringent spectrum licensing and the limited bandwidth. Free-space optical (FSO) communications, leveraging license-free operation and higher security, provide a suitable alternative, enabling data throughputs in the Tbit/s range through the use of wavelength-division multiplexing (WDM) and coherent transceivers.

Downlinks from Low-Earth Orbit (LEO) satellites to optical ground stations play a pivotal role in the establishment of a global communications network. However, there is still a set of critical challenges that bottleneck the performance of these links. High geometric losses, paired with the limited electrical power that is available on the satellite, lead to a very strict link budget while atmospheric turbulence creates random fluctuations in the link loss. Moreover, the optical path intrinsically faces varying conditions across the satellite orbit, which imposes a strong time-dependence on losses and performance. All of these factors must be compounded when designing optical downlinks from LEO.

In this work, a system model for WDM-FSO downlinks was developed and used to assess how the throughput and the per-pass transmitted volume can be maximized. Gamma-distributed turbulence and clear-sky conditions were assumed. We found that dynamically adapting the transmitted modulation format and the number of allocated WDM channels, the transmitted data volume can be boosted upwards of 50%, when compared to the case where the system is statically scaled to respond to worst-case scenario conditions [1]. Through this approach, the receiver sensitivity can be relaxed while simultaneously keeping the transmitted optical power at an optimal level without exhausting energy consumption at the satellite, thus threading the path for future, high-throughput optical satellite networks.

Keywords: *Free-space optics; Satellite communications; Optical feeder links; Wavelength-division multiplexing; Coherent detection*

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3D Optical Wireless Communications Enabled by Unmanned Aerial Vehicles.

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Abstract. Free Space Optical (FSO) communications provide high-capacity, terahertz point-to-point links for metropolitan, industrial, satellite, and space-based networks [1]. However, their deployment is constrained by the requirement for an unobstructed line of sight, with geophysical obstacles frequently interrupting communication. A promising solution is a three-dimensional FSO architecture employing an Unmanned Aerial Vehicle (UAV) as an optical relay between terrestrial terminals without direct visibility. Such systems can provide flexible connectivity for disaster recovery, high-altitude fronthaul/backhaul, UAV swarms, and satellite communications [3].

Current UAV-assisted FSO relay systems predominantly employ passive payloads, such as Modulating Retro-Reflectors (MRRs) [4], which require co-located ground terminals and limit communication between separated ground terminals. Furthermore, UAV motion complicates Pointing, Acquisition, and Tracking (PAT) required to maintain alignment of narrow optical beams with receiver apertures used for high-capacity transmissions, while atmospheric turbulence introduces signal distortions that are intensified by platform dynamics. Conventional statistical channel models are often inadequate to quantify and mitigate losses under these conditions, and many machine learning (ML) approaches require large datasets and substantial computational resources.

This PhD research proposes a vibration-aware Fast Steering Mirror (FSM) payload for agile beam steering, stabilization, and PAT, maintaining accurate optical alignment between the UAV and ground terminals. Integrated with coherent optical communication systems, the proposed architecture aims to improve link availability to enable multi-terabit transmission. ML-based channel estimation is employed to predict and compensate turbulence-induced impairments [5].

Preliminary studies using experimentally acquired FSO data under weak, moderate, and strong channel turbulence conditions compared baseline adaptive filters with ML channel estimators. The ML estimators reduced Rytov variance by up to 91% and improved signal-to-noise ratio by approximately 2 dB at 90% link reliability. Initial laboratory results also indicate that increased beam divergence accelerates initial beam acquisition, supporting future outdoor validation of the FSM-assisted PAT system.

Keywords: *Free Space Optics; Atmospheric Turbulence; PAT; Optical Wireless Communications; UAV; Machine Learning*

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Simplifying Multi-Aperture FSO Communications Through Phase-Insensitive Optical Beam Combining

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Abstract.
Free-space optical (FSO) communication has emerged as a promising solution for high-capacity wireless communications, offering fiber-like data rates, immunity to electromagnetic interference, and rapid deployment capabilities. However, FSO systems remain highly sensitive to atmospheric turbulence, which induces scintillation, beam spreading, and beam wandering, causing power fading and reliability degradation [1].
To mitigate turbulence-induced impairments, several complementary strategies have been proposed. Digital approaches include adaptive data-rate [2], forward error correction (FEC) interleavers [3]. Optical-domain solutions, on the other hand, involve adaptive optics [4], aperture averaging, pre-amplification [1]], and spatial diversity (SD) schemes. SD can be implemented through multi-aperture architectures [5], where independent optical paths mitigate fading, or through mode-division multiplexing (MDM), where multiple modes share the same propagation path. In SD receivers, the collimated fiber-coupled signals are commonly combined using digital or optical coherent techniques. However, digital combining requires one coherent receiver per aperture or mode, increasing cost and power consumption, while optical coherent combining demands accurate carrier-phase control to avoid phase-dependent power fluctuations caused by random interference. These requirements often lead to complex and costly implementations based on photonic integrated circuits with non-negligible insertion losses.
Partially coherent beams (PCBs) have recently emerged as an alternative solution to reduce turbulence-induced scintillation, since their lower temporal coherence mitigates interference effects. Wider spectral bandwidths further reduce coherence and improve fading resilience. Nevertheless, although PCBs have been studied for turbulence mitigation, their use in combination with spatial diversity schemes remains unexplored, representing the main novelty addressed in this work.
In this work, we demonstrate a cost-effective technique for turbulence mitigation, that exploits a PCB-enabled SD scheme to overcome interference in optical recombination. Compared with a conventional single-aperture PCB-FSO system, our approach improves reliability by more than 35% in a 10 Gbps transmission experiment under moderate atmospheric turbulence.

Keywords: *FSO; Atmospheric Turbulence; Wireless Communications*

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Overcoming the characterization challenge in cascaded photonic integrated devices

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Abstract. The exponential growth in data traffic, driven by the intensification of cloud computing and search for high-speed communications, has placed increasing demands on optical communication systems. One of the emerging technologies is Photonic Integrated Circuits (PICs), offering high bandwidth, low power consumption, and compactness.
Since their first idealization, significant advances have been achieved in their design and fabrication; however, the development of robust testing and characterization methodologies has considerably lagged behind. This challenge becomes substantially more complex when considering cascaded photonic architectures, where multiple optical components are interconnected in series. In such configurations, only the total system response is availble, while the individual transfer functions of the constituent elements remain hidden [2]. Since the performance of each component directly and cumulatively impacts the overall system behaviour, the inability to isolate individual responses makes it extremely difficult to diagnose fabrication imperfections or guide the tuning of specific elements toward a desired spectral response.
This limitation is especially critical in thermally tunable platforms, such as silicon nitride PICs equipped with integrated resistive heaters, where precise and independent control of each stage is essential for reconfigurable filtering applications [1]. In these systems, conventional characterization approaches are of little use, since they were designed with direct access to individual components in mind.
Therefore, what is clearly missing is a way to characterize individual components within a cascade. As integrated photonic systems grow more complex, solving this problem becomes not just useful, but necessary.

Keywords: *Photonic integrated circuits; Cascaded filters; Thermal-tunning; Optical characterization; Silicon Nitride*

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Fiber-Wireless Convergence for Next-Generation Optical Access

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Abstract. Optical Wireless Communication (OWC) technologies particularly Light Fidelity (Li-Fi) for indoor scenarios and Free Space Optics (FSO) for outdoor links offer a promising complement to RF systems by delivering high bandwidth, immunity to electromagnetic interference, and enhanced security [1][2]. On the wired side, Passive Optical Networks (PON) currently represent the backbone of the installed fiber infrastructure providing high-capacity, cost-effectiveness, and great scalability [3]. However, the development of efficient interfaces between the fiber-to-the-home network and wireless access communications is still a challenge to be solved, especially in the last mile [4]. This thesis investigates and experimentally explores a hybrid fiber-wireless optical system that combines PON and OWC technologies within a collaborative complementary framework of the Instituto de Telecomunicações and Altice Labs to improve the performance of future indoor and outdoor applications. The emphasis is on efficient system integration, aiming to support data rates up to 50 Gbit/s and overcoming challenges at the interface between the fiber and wireless domains through the integration of optical and electrical multiplexing techniques. Preliminary experiments demonstrated the feasibility of the proposed hybrid architecture, achieving maximum data rates of 14.8 Gbit/s using optical multiplexing and 13.1 Gbit/s using electrical multiplexing. These results highlight the higher transmission capacity of optical multiplexing and the resource efficiency and signal-processing flexibility offered by electrical multiplexing. The research methodology adopts a layered, sequential approach starting with a comprehensive literature review to establish a theoretical foundation, encompassing OWC and PON performance, characteristics, limitations, and emerging trends. Indoor LiFi systems are initially studied to optimize mobility and bit rates, while FSO is evaluated as an outdoor optical wireless link complementing PON in last-mile scenarios. Special focus is given to LiFi coexistence by analyzing potential interference and assessing signal integrity, interoperability between legacy and next-generation PON technologies, and experimental integration of PON with OWC systems.

Keywords: *Optical Wireless Communication; Free Space Optics; Light Fidelity; Passive Optical Network; Fiber-Wireless Convergence*

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Compact beam alignment in free-space optical links using multi-core fiber coupling

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Abstract.
Free-space optical communications offer a promising route toward high-capacity wireless links, but their practical deployment is strongly limited by the need for accurate, dynamic, and compact beam alignment solutions [1]. This work presents an integrated fiber-coupling and position-sensing approach based on multi-core fibers, enabling beam position estimation without the need for an additional opto-electronic sensing device. The proposed system exploits the spatial diversity of the cores to monitor the optical power distribution at the receiver and uses a computationally efficient lookup-table-based algorithm to estimate the incident beam position and guide the pointing, acquisition, and tracking mechanism. The methodology was experimentally validated using a 4 m free-space optical link with a seven-core fiber, considering different transmission and reception configurations. The results showed that increasing the number of active transmitting cores improved the spatial information available to the algorithm, reducing the number of iterations required for successful alignment. For a field of view above 4.5 mrad and an alignment resolution of 23 μrad, all tested configurations achieved success rates above 90% within three iterations, while the fully connected 7×7 configuration reached complete alignment after only three iterations. Although experimentally demonstrated over a short indoor link, the proposed methodology is scalable to different K×N core configurations and can be extended to longer FSO links through appropriate lookup-table calibration and power-averaging strategies. In dynamic or turbulence-impaired scenarios, the approach may benefit from fast power readout architectures, particularly wavelength-diverse implementations, to reduce latency and mitigate power fluctuations. These results demonstrate that multi-core fibers can simultaneously support optical coupling and beam position sensing, offering a compact, low-complexity, and scalable solution for robust free-space optical systems, particularly in applications constrained by size, weight, and power [2].

Keywords. *Free-space optical communications; Multi-core fiber; Beam alignment; Position sensing; Pointing acquisition and tracking*

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Optimization of CV-QKD systems for field deployment

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Abstract. The rise of powerful quantum computers threatens to break the encryption methods currently securing our global data, jeopardizing everything from online banking to highly sensitive military, governmental, and healthcare information [1]. In fact, cybercriminals are already harvesting and storing encrypted confidential data, waiting for future quantum computers to decrypt it. To combat this imminent threat, Quantum Key Distribution (QKD) offers a solution capable of providing everlasting security. By leveraging the fundamental laws of physics, QKD ensures the secrecy of encryption keys indefinitely, regardless of any future technological advancements an attacker might possess [2].

One of the most promising approaches is Continuous-Variable (CV) QKD, which uses the phase and amplitude of coherent states to seamlessly be integrated into our existing fiber-optic telecommunication infrastructure. However, quantum information traveling through real-world optical fibers suffers from unpredictable polarization drift [3]. This causes the light carrying the secret data to drift out of alignment, scrambling the quantum signal and disrupting the security link [4].

Conventional passive strategies to fix this alignment rely on transmitting additional helper signals, referred to as pilots [5,6]. Unfortunately, these helpers consume valuable bandwidth and leak noise into the secret data due to cross-talk. To solve this, we propose, and numerically validate, new passive compensation strategies that rely entirely on the quantum data itself, eliminating the need for any auxiliary helper signals [7]. This pilot-free approach significantly simplifies the system architecture, maximizes bandwidth efficiency and blends seamlessly into our dual-polarization CV-QKD experimental setup. This setup encodes information in both polarizations to double the secret key extracted. We successfully validated these strategies in our real-world CV-QKD setup, proving that polarization drift can be mitigated using purely quantum-based, pilot-free methods. Ultimately, this research removes a critical barrier, paving the way for the widespread deployment of secure key distribution.

Keywords: *Quantum key distribution; Continuous variables; Polarization drift; Polarization-diversity receiver; Polarization division multiplexing; Kalman filter; Pilot-free*

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Satellite-to-earth quantum communication links assisted by superconducting nanowire single-photon detectors

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Abstract. Quantum Key Distribution is a communication method that employs quantum cryptographic protocols. These are designed to protect against the ever-looming threat of the quantum computer, which can theoretically break part of modern cryptography, through its immense computational power and specialized algorithms [1]. QKD uses the laws of quantum mechanics to create theoretically unbreakable protocols, e.g., the most popular one: BB84. In this protocol, bit values are transferred by transmitting, through a quantum channel, single-photons that are randomly polarized in one of two bases [2]. The receiver measures each photon on a random basis and registers the bit values. After the transfer, they use a classical channel for post-processing, and the secret key is created [3]. In this work, we address a major problem of these protocols, i.e., the usage of single-photons, a security requirement, severely limits the maximum distance the signal can cover, as the photons can be lost in the quantum channel. To overcome this, and for QKD to have global coverage, a satellite-earth link approach is mandatory. This approach reduces the attenuating quantum channel to just a few kilometers of atmosphere, with the rest of the optical path being vacuum, which has practically zero attenuation. Even so, this type of link still suffers from high losses, which is why the single-photon detector (SPD), a key component of the QKD receiver, needs to have high efficiency values [3]. We have analysed different SPDs (ID210, Aurea, ID230) to establish a method for characterizing their efficiency and dark count rate, expanding on the work in [4] through the study of the results. We also give particular attention to superconducting nanowire SPDs, top-of-the-line detectors with efficiencies of up to 95%. The remaining QKD receiver's components have also been thoroughly characterized, envisioning secret key rate (SKR) estimations. Assuming a downlink between satellite and Earth with good weather conditions, and the satellite near the receiver's zenith (>80º from the horizon), while also assuming detector efficiency and dark count rate above 90%, and below 100 counts per second, respectively, we can expect an SKR for 35 dB of channel and receiver loss of around 10^{-6} bits per pulse. Our analysis shows that SNSPDs are fundamental to achieving viable SKRs to support secure global communications.

Keywords. *QKD; BB84; SKR; Efficiency; SNSPD*

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Quantum random number generation for cryptographic applications

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Abstract. Quantum random number generators are an emerging class of high-quality physical randomness sources well suited for security-critical applications. Despite their claim to ontological randomness, their security is necessarily tied to assumptions about the measuring devices [1]. In a trusted-device scenario, security relies entirely on the apparatus behaving as characterized, an assumption that implementations can routinely violate through device imperfections, miscalibrations, or adversarial manipulation, thereby degrading the privacy or statistical quality of the output [2]. This is particularly troublesome for devices with non-standard output domains, such as random prime number generators, whose non-uniform distributions render them incompatible with traditional statistical testing suites. This creates a critical blind spot in the security validation of an essential resource for asymmetric encryption and digital signature protocols. In [3], we address this with a length-agnostic statistical framework based on an equiprobable binning of the prime distribution, and experimentally implement a vacuum-fluctuation-based probabilistic prime generation scheme with an error probability of 3.5×10^{-15} . Quantum noise further outperforms classical electronic noise in output diversity for small primes. This approach was subsequently expanded in [4], using a predictive machine learning model based on a Long Short-Term Memory architecture that independently learns correlations in the prime output. Our framework successfully exposes flaws in improperly implemented physical prime sources with output lengths up to 128 bits, with predictive power exceeding six standard deviations above the best-guessing strategy. This demonstrates that trusted-device guarantees are unreliable without rigorous output validation. These findings motivate relaxing the trusted-device scenario toward generation schemes certifiable by observable physical witnesses, approaching device independence. As ongoing work, we are developing a measurement-device-independent protocol exploiting the Hong-Ou-Mandel effect, where two-photon interference statistics provide an experimentally accessible security bound, yielding a scheme independent of the measurement apparatus.

Keywords: *Quantum random number generation; Randomness certification; Measurement-device independence; Machine learning; Quantum cryptography*

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Numerical Investigation of Bell Nonlocality Under Constrained Multi-Plane Measurement Geometry

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Abstract. Bell inequality tests demonstrate the incompatibility of quantum mechanics with local realism and underpin quantum communication and information technologies [1,2]. In polarization-based implementations, Bell nonlocality is commonly probed through the Clauser-Horne-Shimony-Holt (CHSH) formulation using coplanar analyzer settings [1,3]. Although these settings maximize the Bell parameter under ideal conditions, practical systems frequently operate under constrained configurations due to hardware limitations, drift compensation, and protocol-specific requirements. Recent studies have shown that Bell nonlocality remains observable beyond planar configurations, even without aligned reference frames [4]. We numerically investigate Bell inequality violation under a structured multi-plane geometry on the Poincaré sphere, with settings spanning the ZX, ZY, and XY planes. Polarization correlations for entangled Bell states are evaluated using a quarter-wave plate, half-wave plate, and polarizing beam splitter analyzer model, which can project onto any point on the Poincaré sphere and therefore realize every multi-plane setting in hardware; these correlations reconstruct the CHSH Bell parameter. The analysis predicts a clear violation of the local realistic bound, with the Bell parameter peaking at $S \approx 2.24$ under the constrained geometry, above the classical limit of $S = 2$ but below the unconstrained Tsirelson bound $2\sqrt{2} \approx 2.83$, and identifies optimal angular regions, correlation evolution across planes, and the minimum visibility (≈ 0.89) required for experimental implementation. These results show that strong Bell violations persist under constrained settings and reveal how measurement geometry shapes nonlocal correlations. As the study is numerical, experimental validation remains an important next step. The framework offers a geometry-aware approach to entanglement characterization, supporting future quantum communication protocols and other nonclassicality tests based on structured polarization measurements.

Keywords: *Bell nonlocality; Poincaré sphere; CHSH inequality; Entangled photons; Quantum communication*

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Fully-passive high-dimensional quantum key distribution with time-energy entanglement from spontaneous parametric down conversion

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Abstract. Entangled-photon pairs generated with spontaneous parametric down-conversion (SPDC) are essential for quantum information technologies including quantum key distribution (QKD) [1]. Existing theoretical and numerical descriptions of waveguided SPDC either neglect spatially-ordered internal losses or become computationally infeasible for narrow-band pumping [2]. In this work, we develop a numerical framework for type-II SPDC in waveguides with internal losses, optimized for narrow-band pumping and accounting for multipair emissions, pump laser linewidth and dispersion. Using this framework, we study how internal losses increase the achievable time-of-arrival dimensionality of photon pairs. We experimentally characterize a quasi-monochromatic SPDC source and propose a fully-passive scheme for high-dimensional QKD using time-energy entanglement. Unlike most QKD implementations, our scheme avoids side-channel vulnerabilities introduced by active modulation and basis selection. Moreover, it does not require precise real-time synchronization, high-speed custom electronics and quantum random number generators [3]. Together, these contributions provide an efficient route to characterize SPDC-based entangled-photon sources and to design more robust QKD implementations.

Keywords: *Spontaneous parametric down-conversion; Quantum key distribution; Time-energy entanglement; Waveguide loss; High-dimensional encoding; Reference-frame-independent QKD*

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Polarization-division multiplexing continuous-variable quantum key distribution over optical fibers

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Abstract. Quantum computers threaten classical cryptography, motivating Quantum Key Distribution (QKD) as a secure alternative for symmetric key exchange. Continuous-Variable (CV) QKD stands out for its compatibility with current telecommunication infrastructures [1]. Dual-Polarization (DP) CV-QKD encodes information in the quadratures of orthogonal polarization modes of coherent states, improving the secret key rate [2]. However, stochastic polarization fluctuations due to optical fiber's birefringence misalign the quantum signal with the local oscillator, compromising performance [3].
We study digital passive polarization drift compensation based on classical optical communication algorithms, considering Gaussian-modulated quantum signals and quadrature phase shift keying pilots. We evaluate the constant modulus algorithm [4] and Kalman filtering techniques [5], and propose an improved pilot-assisted Kalman filter for DP CV-QKD. At pilot-to-quantum power ratios of 20 dB, this method increases robustness to polarization drift variances by 3 orders of magnitude over CMA and enables compensation where radius-directed Kalman filtering fails entirely. We validate the proposed method experimentally.

Keywords: *Quantum key distribution; Continuous variables; Polarization drift; Constant modulus algorithm; Kalman filter*

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Timely and reliable localization based on optical camera communication

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Abstract. In indoor positioning scenarios, satellite-based positioning technologies do not provide sufficient accuracy, and available solutions have low accuracy or high installation and maintenance costs [1]. Alternatively, Visible Light Positioning (VLP) has been increasingly explored, where modulated visible light sources are employed as positioning beacons and cameras as the receiver, providing high accuracy at a low cost [2]. In order to estimate the position, we need to identify each beacon, which can be achieved through rolling shutter based optical camera communication (OCC), allowing the capture of a modulated light signal across the rows of an image [3]. With this, we can transmit packets of data, such as identifiers, and implement optical wireless links with applications in Internet of Things and 6G wireless networks.

This work plans to improve the state-of-the-art on camera-based VLP, by proposing techniques to increase accuracy and robustness. The objective is to explore OCC techniques that increase the maximum communication distance, by exploring new modulation schemes and information recovery techniques, and localization algorithms for improved accuracy and timely position estimation, extending the existing techniques to larger scenarios. We will achieve this through sensor fusion, image correlation and machine learning, using inertial measurements and statistical prediction. This will be combined with a reduced processing time, guaranteeing refresh rates of tens of hertz.

Until now, we have obtained an average positioning error of 7.4 cm for a setup with a height of 2.7 m, and proposed an algorithm to increase the maximum communication distance by 2.5 fold [4]. We also proposed an algorithm to increase the accuracy when using circular transmitters and studied the impact of measurement uncertainties on the positioning error. We also experimentally demonstrated 32-PAM OCC with a low cost camera [5]. Finally, we proposed a beacon identification scheme based on pseudo-random noise transmission, instead of symbol sequences.

Keywords: *Indoor positioning; Optical communications; Camera; Rolling shutter; Robotics*

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Implementation of visible light communication carrier synchronization for the internet of things

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Abstract. Visible Light Communication (VLC) has emerged as a compelling alternative to traditional radio-frequency (RF) systems for indoor and short-range Internet of Things (IoT) applications VLC offers unique advantages such as high directivity, immunity to RF interference, and efficient spectrum reuse within dense environments [1,2]. However, implementing low-complexity, cost-effective IoT nodes using advanced modulation schemes like multi-band carrierless amplitude and phase (m-CAP) and quadrature amplitude modulation (QAM) requires precise carrier synchronization [3]. Because these complex modulations suppress the carrier component, standard Phase-Locked Loops (PLLs) are insufficient for direct phase recovery in the analog domain. This paper proposes the design and implementation of an analog Costas-loop circuit specifically tailored for carrier recovery in hybrid m-CAP/QAM VLC-IoT systems. The proposed architecture facilitates a multi-user downlink where each receiver tunes to its assigned sub-band using a low-complexity analog front-end. The development workflow involved theoretical modeling of a third-order type-II loop, stability analysis using MatLab, and verification through SPICE simulations in TINA-TI. The circuit was implemented on a printed circuit board (PCB) and experimentally validated through an optical channel. Experimental results demonstrate a successful lock time of 686 µs, starting from an initial phase error of approximately 51°. Once synchronized, the loop maintains a phase error below 2%, ensuring accurate symbol demodulation. Unlike digital carrier recovery, which typically requires high-speed ADCs and DSP-based synchronization, the proposed approach performs carrier recovery entirely in the analog domain, eliminating these requirements and thereby reducing implementation complexity and expected power consumption. Furthermore, scalability is achieved by assigning each user a dedicated sub-band, with identical analog receiver front-ends replicated per user, while receiver complexity remains essentially unchanged.

Keywords. *Visible light communications; IoT; Carrier synchronization; Costas-Loop*

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From clean labs to noisy skies: towards real-time UAV radio frequency classification in real-world scenarios

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Abstract. The proliferation of Unmanned Aerial Vehicles (UAVs) demands robust Counter-UAV systems. While Radio Frequency (RF) passive sensing is promising, current research relies heavily on simulated data that lacks real-world urban spectral complexity. This work addresses this gap through a measurement campaign across remote, semi-urban, and city-center locations. We captured signals from seven UAV models under dynamic conditions, including Line-of-Sight (LoS) and Non-LoS scenarios, characterized by uncontrolled interference and SINR values ranging from 7 to 40 dB. We analyze the challenges of annotating spectrograms in these environments and evaluate state-of-the-art real-time object detection YOLO models. Results show that performance is robust for single targets, but accuracy degrades significantly in multi-UAV scenarios with time and frequency overlapping. These findings highlight the limitations of current approaches and show the need for real-world data to validate the effectiveness of data augmentation techniques.

Keywords. *RF Sensing; UAV Classification; Multi-UAV; Interference; Real-World Measurements.*

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Multistatic Sensing for 3D Imaging in Distributed MIMO OFDM Radar

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Abstract. Multistatic 3D radar imaging using Orthogonal Frequency Division Multiplexing (OFDM) serves as a cornerstone for high-resolution target localization in next-generation sensing networks [1,2]. As a first solution for this objective, a Global Maximum Search (a method that scans the entire 3D space at once to pick the brightest reflections) is implemented. While straightforward, this initial approach fails to localize multiple simultaneous targets because a single highly reflective object completely shadows and hides nearby dimmer targets. To overcome this critical drawback, we moved toward two advanced localized alternatives: the Target-by-Target Precision Approach and the Cluster Center Method. The target-by-target approach breaks the overall search down into smaller, guided sub-searches by using depth slicing along the Y-axis to isolate specific windows, forcing the radar to find exactly one peak for every expected target zone. Alternatively, the cluster center method ignores isolated peak coordinates entirely, instead creating a localized Region of Interest (ROI) box that applies a 50% power threshold to extract the entire target cluster, filters out oversized reflections, and calculates the true center using geometric averaging. Simulations show that both localized methods easily outperform the first global search solution in multi-target localization accuracy. The target-by-target approach guarantees reliable detection at different depths, while the cluster center method successfully exploits the target's spatial extent to estimate the true center of extended objects, yielding more robust position estimates than simple pinpoint detection.

Keywords: *3D Radar Imaging, Multistatic OFDM, Target Localization, Global Maximum Search, Adaptive Clustering.*

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Communication-centric partially connected hybrid beamforming design for ISAC systems

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Abstract. Future wireless networks are expected to simultaneously support high-data-rate communications and environmental sensing within a shared hardware and spectral platform. In this context, integrated sensing and communication (ISAC) has emerged as a key enabling technology for 6G systems. However, fully digital and fully connected hybrid analog–digital beamforming solutions introduce severe bottlenecks, not only due to excessive hardware complexity and energy consumption in large-scale antenna arrays but also due to the prohibitive computational complexity required to design optimal dual communication and sensing precoders. Consequently, developing scalable signal processing algorithms that reduce computational complexity while leveraging simplified hardware architectures is important for the future implementation of practical massive MIMO ISAC deployments.

This work investigates a communication-centric ISAC framework based on partially connected hybrid analog–digital beamforming architectures. The proposed approach aims to maximize the downlink communication sum-rate while guaranteeing sensing and transmit power requirements in multi-user and multi-beam scenarios. By exploiting the structural properties of partial connectivity, a low-complexity optimization algorithm is developed using a weighted minimum mean-square error (WMMSE) formulation. Practically, the analog precoder phase updates are computed via an efficient, residual-based coordinate descent strategy that avoids large matrix operations. Meanwhile, the digital precoder is updated via a closed-form Karush-Kuhn-Tucker (KKT) formulation combined with a low-cost one-dimensional bisection search to satisfy the transmit power budget.

The evaluation methodology utilizes extensive Monte Carlo simulations under a clustered millimeter-wave geometric channel model to validate performance. The obtained results show that the proposed design significantly reduces computational complexity and hardware requirements while maintaining competitive communication and sensing performance. In particular, the algorithm achieves linear complexity scaling with the number of transmit antennas, making it especially attractive for scalable and energy-efficient massive MIMO ISAC deployments.

Keywords: *ISAC; Hybrid beamforming; Partially connected architecture; MIMO; Computational complexity*

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On the input capacitance of AlGaN/GaN HEMTs: Physical mechanisms and TCAD analysis

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Abstract.
Gallium nitride (GaN) high-electron-mobility transistors (HEMTs) have emerged as leading candidates for high-frequency and high-power applications owing to their wide bandgap, high breakdown voltage, and the formation of a high-density two-dimensional electron gas (2DEG) at the AlGaN/GaN heterojunction. Accurate characterization of the nonlinear capacitance–voltage (C–V) behavior is critical for reliable compact modeling and circuit-level design, particularly for switching and RF power amplifier applications [1].
This work investigates the bias-dependent behavior of the gate input capacitance in a GaN HEMT through physics-based synopsys sentaurus Technology Computer-Aided Design (TCAD) simulations. A two-port Y-parameter framework is employed to extract the intrinsic capacitances as a function of gate-source voltage.
At $V_{DS} = 0$ V, the C_{11} characteristic is a sigmoid shape. In the above-threshold regime, the gate capacitance is primarily governed by the modulation of the 2DEG sheet charge density beneath the gate. As the device approaches and enters the sub-threshold regime, progressive depletion of the 2DEG channel significantly reduces the charge-modulation contribution. Nevertheless, even in the fully depleted state, a non-negligible residual capacitance persists due to fringing electric fields originating from the gate edges, including gate-to-source and gate-to-drain access regions, as well as lateral depletion effect. These effects are discriminated by TCAD results and explained by an equaivalent distributed circuit model for the channel. The obtained results provide physical insight into the distinct capacitance plateaus and transition regions observed in the C_{11}–V_{GS} characteristics, establishing a direct relationship between device geometry such as gate length and barrier height and small-signal capacitance response. The findings contribute to a deeper understanding of GaN HEMT capacitance behavior and support the development of more accurate physics-based compact models for RF and power electronic applications.

Keywords: *Bias Dependent ; Gallium Nitride ; HEMT ; Input Capacitance ; Small Signal*

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Modeling the effects of field plates on AlGaN/GaN HEMT devices

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Abstract. Aluminum Gallium Nitride / Gallium Nitride (AlGaN/GaN) High Electron Mobility Transistors (HEMTs) have become key devices for high-power and high-frequency applications, with Field Plates (FPs) widely employed to improve breakdown voltage and reliability. Despite their broad deployment, existing models of their intrinsic capacitances rely on empirical or semi-analytical formulations that use adjustable parameters rather than physically meaningful quantities, offering limited insight into charge-storage and redistribution mechanisms and restricting device optimization. To address this gap, and building on the distributed equivalent-circuit model previously developed by the group [1,2], a comprehensive physical and analytical formulation was derived for the capacitances of AlGaN/GaN HEMTs with and without field plates. The analysis focused on charge transport and accumulation, as well as the electrostatic potential in the channel, to clarify the connection between intrinsic physical capacitances and the small-signal electrical model under different bias conditions. The proposed model captured the effects of charges, potentials, electron density, current flow, surface states, and polarization across the device, describing interactions among the channel, depletion regions, and FP structures. The formulations were validated through Technology Computer-Aided Design (TCAD) simulations in Synopsys Sentaurus, performed on a device with a gate length of 0.25 μm, source–gate and gate–drain spacings of 1 μm, and a field-plate length of 0.25 μm, as default values. Direct-current (DC) and alternating-current (AC) analyses provided the current–voltage characteristics, admittance parameters, and capacitances. The trap occupancies were frozen at the initial bias of $(V_{\mathrm{GS}}, V_{\mathrm{DS}}) = (0, 0)$ V before the bias sweeps, which removed their response to simplify the analysis and avoided the convergence failures that otherwise prevent returning to zero drain bias once the buffer traps are charged at higher voltages. The frozen traps are used to simulate high frequencies, during which the traps do not have time to discharge. The analytical equations were implemented in MATLAB to enable direct comparison between theory and numerical results. The resulting framework provided accurate, physically interpretable expressions and introduced a new degree of freedom for optimizing HEMT devices incorporating field plates.

Keywords: *AlGaN/GaN HEMT; Field plate; Physical modeling; Model extraction; Intrinsic capacitances; Electric field*

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Two-tone harmonic-balance modeling for fast linearizability assessment of wideband RF power amplifiers

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Abstract. Wideband radio-frequency power amplifiers require accurate and computationally efficient behavioral models to predict distortion, output power and achievable linearization under modulated excitation. In practical transmitter design, this evaluation is often performed with envelope-transient harmonic-balance simulations using realistic communication signals. Although accurate, these simulations are computationally intensive, sensitive to convergence conditions and difficult to repeat during iterative design or predistortion optimization. Single-tone simulations are faster and routinely available [1], but they do not sufficiently excite intermodulation, cross-frequency coupling and memory mechanisms that dominate wideband behavior. A straightforward solution would be to increase the number of excitation tones, but this rapidly increases the number of spectral interactions to be simulated, reintroducing the time-consumption and convergence difficulties. Therefore, this work developed a two-tone harmonic-balance based modeling strategy to extract richer nonlinear information from a reduced set of circuit simulations. The approach was inspired by Volterra-series analysis, where two-tone excitation reveals two-dimensional regions of the nonlinear response associated with intermodulation memory effects [2]. These responses were represented with lookup-table basis functions and converted into a time-domain behavioral model able to process arbitrary complex-envelope signals. The methodology was validated with a high-efficiency Doherty power amplifier designed in Keysight ADS and tested with wideband OFDMA signals. Compared with a single-tone-based model, the two-tone model improved the prediction of spectral regrowth and output waveform behavior while maintaining practical extraction and evaluation times. These results showed that limited harmonic-balance evidence can provide actionable information for wideband performance assessment. In the ongoing PhD work, this framework is being extended from behavioral prediction to design-oriented linearizability assessment. The frequency-decomposed information provided by the model could also be used to infer suitable transfer characteristics for analog predistortion circuits. The final objective is to support faster specification of predistorters and reduce the need for exhaustive modulated-signal circuit simulations during transmitter design.

Keywords: *Behavioral Modeling; Volterra Series; Power Amplifier; Two-tone Modeling; Predistortion*

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Waveform-engineered concurrent power amplifiers for multi-band transmitters

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Abstract. Future wireless communication systems must support higher data rates, flexible spectrum use, and simultaneous operation over several frequency bands, while still reducing energy consumption and hardware complexity. This requirement created a major challenge for radio-frequency transmitters, especially for the power amplifier, which is one of the main blocks affecting efficiency, signal quality, and system cost. This study developed new design methods for concurrent power amplifiers, where more than one carrier is amplified at the same time. The purpose of the work was to overcome the limitations of traditional high-efficiency power amplifier theories, which were mainly developed for single-band operation and therefore did not fully explain the additional waveform interactions created by concurrent multi-band signals. The method was based on waveform engineering and nonlinear circuit analysis. Instead of designing the amplifier by looking at each frequency independently, the amplifier was treated as one connected nonlinear system, where the fundamental, harmonic, intermodulation, and baseband components jointly shaped the voltage and current waveforms inside the device. The main result was the identification of intermodulation and baseband impedances as important design variables for concurrent operation. These impedances were shown to be more than unwanted distortion paths or secondary constraints; when properly controlled, they supported the desired waveform behavior and helped reduce the efficiency and linearity degradation normally observed under simultaneous multi-band excitation. The novelty of this research was therefore the use of these additional impedance conditions as active degrees of freedom in the design process. Beyond single-ended power amplifiers, the same design philosophy was also intended to support more advanced load-modulated architectures, such as Doherty power amplifiers. The main implication was a clearer and more systematic route for developing compact, energy-efficient, and spectrum-flexible transmitter front ends for future wireless communication systems.

Keywords: *Concurrent operation; Waveform shaping; Intermodulation impedance; Baseband termination; Load-modulated power amplifiers*

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Origami antennas for adaptive communication, sensing and wireless power transfer systems

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Abstract. Origami-based antennas offer a promising solution for developing compact and reconfigurable radio-frequency systems with adaptable electromagnetic performance. By combining folding mechanics with antenna design, these structures may enable compact storage, controlled deployment and mechanical reconfiguration of key parameters such as operating frequency, radiation pattern, polarization and effective aperture. This capability is particularly relevant for communication systems, wireless sensing and wireless power transfer applications where conventional rigid antennas may be limited by size, weight, volume or adaptability constraints [1]. This work aims to investigate the development of origami antenna architectures by exploring the relationship between folding geometry, material behaviour and electromagnetic response. Two complementary antenna concepts are intended to be addressed. The first involves transforming a conventional rigid broadband antenna into a foldable origami-inspired configuration suitable for compact sensing platforms, with the objective of reducing storage volume while preserving broadband operation. The second focuses on the development of a fully reconfigurable origami antenna based on selected folding patterns, such as Miura-ori, Kresling or accordion-type geometries, and flexible material platforms, where different folding states are expected to support frequency tuning, beam steering and radiation-pattern reconfiguration. The study will address substrate flexibility, conductive-layer continuity, printed or laminated metallization, mechanical resilience and the stability of radio-frequency performance under repeated folding cycles. Additionally, a mathematical framework will be developed to connect folding parameters and geometrical transformations with the corresponding electromagnetic response. This framework will then be used to support physics-informed neural networks, allowing physical constraints and electromagnetic relationships to be embedded into the learning process for more reliable performance prediction and design optimization across different folding states. The expected outcome is a systematic methodology for designing compact, adaptable and multifunctional origami-based antenna systems.

Keywords. *Deployable antennas; Reconfigurable structures; Electromagnetic modelling; Physics-informed machine learning; Flexible Materials*

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From technical literature to verified electromagnetic simulation: a verification-gated agentic artificial intelligence workflow for antenna engineering

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Abstract. Manual antenna development still requires literature analysis, Computer-Aided Design reconstruction, electromagnetic simulation, evaluation, and repeated tuning. Solver automation can execute parts of this process, but it usually starts from a model defined by an engineer [1]. Retrieval-augmented generation can support literature analysis, but it does not enforce unit-normalized and build-ready antenna specifications [2]. Machine-learning methods can reduce optimization cost, although they often assume that a valid baseline geometry is already available [3]. Agentic Artificial Intelligence can coordinate multi-step tool use [4], and the Model Context Protocol can expose external tools to language-model agents through controlled capabilities [5].
This communication presents a research-in-progress methodology for a verification-gated agentic workflow for antenna engineering. The proposed workflow converts antenna literature and design requirements into verified electromagnetic simulation artefacts. Its contribution is not unrestricted language-model design. Instead, language-model agents populate schema-constrained artefacts, including an antenna specification, build plan, simulation report, and evaluation report. Each field stores provenance, normalized units, and uncertainty. Before simulator execution, a verification gate checks field-level evidence, unit consistency, material coherence, geometric plausibility, parameter bounds, feed and port definitions, frequency sweep validity, and completeness. Unsupported values remain unresolved. Ambiguous cases are routed to human approval rather than being passed to the simulator.
Controlled simulator execution is performed only after this gate is satisfied. Simulation outputs are then evaluated with deterministic metrics, including reflection coefficient, bandwidth, gain, efficiency, and application-specific constraints. When required, an optimization agent proposes bounded parameter updates under solver-call budgets. The expected contribution is a reproducible workflow from paper evidence to simulation artefacts and evaluation. The work will be assessed through case studies that compare reconstructed simulation results with reported antenna performance, while measuring failure modes, intervention points, and computational cost.

Keywords: *Agentic AI, antenna engineering, electromagnetic simulation, Paper-to-CAD, verification gates*

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Multi-reconfigurable antenna for low-earth orbit satellite constellations

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Abstract. The rapid expansion of Low-Earth Orbit (LEO) satellite constellations, such as Starlink and Amazon Leo, has introduced demanding requirements for ground terminal antennas, namely simultaneous frequency agility, polarization reconfigurability, and beam steering. Conventional fixed-parameter antennas cannot satisfy these requirements, making reconfigurable antennas a key technology for next-generation satellite communications [1,2,3]. Advances in this area have the potential to expand internet access to the millions of people in remote regions who currently lack reliable connectivity. This work addresses the limited availability of antenna designs capable of independently reconfiguring frequency, polarization, and beam direction within a single structure. The proposed solution is a multiparameter reconfigurable antenna operating in the Ku- and Ka-bands used by LEO satellite constellations, integrating electronically tunable components that allow the parameters to be reconfigured without physical modifications to the antenna. A simulation model for a frequency reconfigurable patch antenna has been developed, based on the integration of varactor diodes as a switching mechanism, optimizing the design to achieve the best compromise between a broad continuous tuning range and good radiation performance. As an initial proof of concept to validate the proposed reconfiguration technique before its implementation in Ku- and Ka-band designs, an antenna was fabricated with this method and demonstrated a tunability of 22%, varying between 5.28 GHz and 6.58 GHz while maintaining an S11 below −10 dB across the tuning range. A complementary topology, in which the switching mechanism is relocated to the ground plane, is also under investigation. Future work will focus on implementing polarization reconfigurability, integrating both capabilities into a single antenna structure, and subsequently extending the design to an array architecture with beam steering. This research aims to produce a fully reconfigurable antenna structure capable of meeting the simultaneous frequency, polarization, and beam-steering requirements of modern LEO satellite ground terminals.

Keywords. *Patch antenna; Polarization; Frequency; Beam; Reconfigurable; satellite constellations*

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RIS-aided through wall radar sensing

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Abstract.
Radar based remote sensing of human subjects is a field with potential applications in security, healthcare and smart-home environments that has garnered a lot of attention due to its potential for non-intrusive sensing and robustness to environmental interference (e.g. light, noise, temperature), [1], as well as being capable of sensing targets through walls [2]. However as it currently stands, high-resolution radar sensing, more specifically in through-wall scenarios, often gravitates towards using Multiple Input Multiple Output (MIMO) systems which tend to be expensive and difficult to develop. Another approach to radar sensing that has gained traction in recent years is radar sensing assisted by Reconfigurable Intelligent Surfaces (RIS) which are devices capable of redirecting incoming signals towards programmable directions and therefore, making three dimensional possible using one dimensional radars [3]. Although widely used in outdoor scenarios, these devices remain relatively unexplored in through-wall applications. To that end, the aim of this work is to study the feasibility of using a RIS to enhance the sensing performance of one dimensional radars in through wall scenarios. The methodology followed in this work consists of initially studying through wall wave propagation and then analyzing the effect of RIS design parameters using simulations in order to optimize the design of the system [4] (e.g. hardware designs and device placement). Subsequently, RIS beamforming optimization strategies, as well as the required signal processing chains, will be developed for two different applications: the detection/location of a subject and subject pose/gait analysis. The end goal is to demonstrate a RIS-aided through wall radar system capable of high resolution sensing in scenarios with an obstructed line of sight which, if proven effective, can then be integrated into wider and more complex smart city or remote sensing environments.

Keywords: *Through Wall Radar; Reconfigurable Intelligent Surfaces; Remote Monitoring; Through Wall Propagation*

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Sensing-assisted beam robustness and re-acquisition for 6G mobile communications

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Abstract. The deployment of millimetre-wave (mmWave) and sub-terahertz bands in 6G wireless networks is essential to meet the data rate, latency, and spectral efficiency requirements of emerging mobile services. At these frequencies, however, the narrow beams needed to compensate for severe path loss render the communication link highly sensitive to user mobility, beam misalignment, and intermittent blockage, particularly when sensing observations become temporarily unavailable [1,2,4].
This work proposes a Sensing-Assisted Communication (SAC) framework that jointly addresses beam robustness and link re-acquisition in mobile 6G scenarios. Within an Integrated Sensing and Communication (ISAC) architecture, the base station exploits echo measurements of the downlink dual-functional waveform to track the user's kinematic state. An Extended Kalman Filter (EKF) combines sensing observations with a motion model to estimate the user's angle, distance, and velocity and predict the beam direction. The prediction enables proactive beam alignment without dedicated pilots, while a complementary aperture-control mechanism adaptively reduces the number of active antennas during outages to widen the beam, mitigate misalignment, and accelerate link re-acquisition once sensing is restored [2,3].
The framework is evaluated through a vehicle-to-infrastructure simulation that models user dynamics, narrow-beam mmWave transmission, blockage events, and EKF-based predictive beamforming with adaptive aperture control. Performance is assessed in terms of received signal-to-noise ratio, achievable rate, and angle and distance estimation accuracy, and benchmarked against a conventional fixed-aperture scheme and an ideal no-outage reference. The results indicate that conventional sensing-assisted beamforming maintains accurate alignment under nominal conditions but degrades sharply during sensing loss, since the narrow beam becomes intolerant to the prediction error accumulated by the EKF. By coupling state prediction with adaptive aperture control, the proposed framework preserves beam awareness across sensing interruptions, limits rate loss during outage, and enables faster link recovery, enhancing the robustness of high-frequency 6G links in challenging mobile environments.

Keywords: *SAC; Beam Alignment; Link Re-acquisition; EKF; Millimetre-Wave Communications; 6G*

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[LAQV-REQUIMTE] Clinical biochemistry

Revisiting exercise-related proteomics data to identify a molecular signature for exercise mimetics in cancer

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Abstract. Physical exercise is recognized as a nonpharmacological therapy that can be integrated into multimodal care approaches, especially for cancer patients, by improving prognosis and quality of life. However, many patients are unable to participate in exercise programs. For these patients, the development of exercise mimetics may be a promising pharmacological alternative. To support this goal, is essential to identify the molecular mediators underlying exercise anticancer benefits. In this context, extracellular vesicles are thought to mediate, at least in part, many of these effects. Hence, this project aims to identify exercise-induced molecular mediators by integrating human proteomic datasets. Proteomics datasets were obtained from PRIDE using the keyword "exercise". From 207 datasets, a manual selection was performed resulting in six datasets (PXD058255; PXD020122; PXD058573; PXD050113; PXD026483; PXD051559), comprising 464 raw files from different exercise modalities (aerobic, resistance and combined), multiple timepoints (e.g. before exercise, immediately after exercise, 1 hour after) and different plasma fractions (total plasma, extracellular vesicles). Raw files were reprocessed in MaxQuant (v2.5.0) against a human proteome database (UniProt, April 2026) for label-free quantification. Results were uploaded into MetaboAnalyst 6.0 for univariate statistical data analysis of proteins expression between groups (sampling timepoints) and multivariate analysis using PCA and PLS-DA. The identified proteins were used to construct a network in STRING (v12.0). Resistance exercise primarily affected proteins related to metabolism and coagulation, consistent with hemostatic activation and muscle repair. In contrast, aerobic exercise predominantly modulated inflammatory and immune-related proteins, consistent with systemic immune modulation. These findings provide insights into conserved protein signatures of different exercise types, which may give insights into molecular mechanisms of exercise, and provide candidate targets for the development of exercise mimetics as a pharmacological strategy for cancer patients unable to engage in physical activity.

Keywords. *Physical activity; exerkines; mimetics; molecular signature; proteomics*

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Biofabricated 3D breast cancer models for assessing the impact of microbial metabolites on neoadjuvant therapy response

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Abstract. Triple-negative breast cancer (TNBC) accounts for 15-20% of invasive breast cancers and is characterized by high aggressiveness and poor prognosis. Standard treatment involves neoadjuvant therapy (NAT), which aims to shrink tumors, facilitate breast-conserving surgery, eradicate micrometastasis, and guide decisions on adjuvant therapy. However, many patients fail to achieve a pathological complete response (pCR) to NAT. Emerging evidence suggests that both gut and intratumoral microbiomes significantly modulate cancer treatment outcomes, including responses to NAT [1,2]. Microbial metabolites (MMs) serve as a direct functional interface between microbiota activity and host biology. MMs have been shown to influence systemic inflammation, hormone regulation, and immune responses, all critical in shaping the tumor microenvironment (TME) and therapeutic efficacy [3]. Despite their relevance, the bioactivity of MMs within the breast TME remains poorly understood. To investigate the impact of MMs on TNBC therapeutic responses, we are developing 3D cellular models of increasing complexity, ranging from breast cancer spheroids to organoids comprising tumour and stromal cells embedded in a breast tissue-specific decellularized extracellular matrix (dECM). These models will serve as testing platforms to assess the bioactivity of MMs and identify positive and negative metabolite effectors of treatment response. Furthermore, in-depth omics analyses of biomolecular alterations induced by top-performing metabolites will provide mechanistic insights into how these metabolites influence therapeutic response. Looking forward, this project may contribute to the future development of microbiome-targeted interventions that support more personalised and effective TNBC therapies.

Keywords. *Triple-negative breast cancer; Microbiota; Neoadjuvant therapy; Spheroids; Organoids; Tumor microenvironment*

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Metabolomics and lipidomics characterisation of iPSC-derived brain organoids during unguided and morphogen-guided differentiation

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Abstract. Brain development requires tightly coordinated metabolic and lipid remodelling, yet how these molecular changes emerge during human neural tissue maturation remains incompletely understood. Brain organoids derived from induced pluripotent stem cells offer a human-relevant system to investigate whether developmental cues alter metabolic trajectories and lipid composition over time. Here, we investigated how morphogen-guided differentiation influenced metabolomic and lipidomic profiles during brain organoid maturation. Specifically, we profiled forebrain and hippocampal-like organoids collected at day 35 and day 70, using a SIMPLEX-based workflow for integrated extraction of proteins, metabolites and lipids, followed by liquid chromatography-mass spectrometry-based metabolomics and lipidomics. Metabolomic analysis revealed distinct maturation-associated trajectories between organoid types. Forebrain organoids showed increased acylcarnitines and purine degradation products, suggesting enhanced fatty acid mitochondrial transport and possible metabolic stress. In contrast, hippocampal-like organoids displayed increased N-acetylaspartate, D-serine, polyamines and glycosylation-related metabolites, consistent with neuronal maturation, synaptic modulation and glycan remodelling. Lipidomic profiling showed extensive changes in membrane-associated lipid species. Both organoid types showed increases in phospholipids linked to membrane expansion, while hippocampal-like organoids exhibited triacylglycerol depletion, increased phosphatidylcholines and marked ceramide accumulation, suggesting active lipid mobilisation, sphingolipid remodelling and neuronal membrane specialisation. Overall, these results indicate that metabolomic and lipidomic profiles capture both developmental maturation and morphogen-guided regional specification in brain organoids, supporting their use as models to study human neurodevelopmental metabolism.

Keywords. *Neurodevelopment; Forebrain organoids; Hippocampal-like organoids; LC-MS; Metabolites and Lipids*

Acknowledgements. This project has received funding from the European Union's Horizon Europe EIC 2023 Pathfinder Open programme under grant agreement No 101130747.

Proteomic characterisation of iPSC-derived brain organoids during unguided and morphogen-guided differentiation

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Abstract. Organoid models are innovative three-dimensional constructs that develop and maintain key features and structures of the tissues they are designed to mimic. Particularly, human induced pluripotent stem cell (iPSC)-derived brain organoids offer a human-relevant platform for modelling early neurodevelopment *in vitro*, overcoming some of the limitations of animal models, which cannot fully reproduce the cellular and molecular complexity of the developing human brain. They are valuable tools for studying neurodevelopment and supporting the development of more precise and personalized therapeutic approaches. In this study, we investigated the proteomic changes of iPSC-derived brain organoids generated under unguided and guided differentiation conditions. Unguided organoids were cultured for 70 days to generate forebrain organoids, whereas guided organoids were exposed to WNT3A and BMP4 morphogens to promote hippocampal-like specification. Proteomic profiling was performed by liquid chromatography–mass spectrometry (LC-MS) at day 35 and day 70. The development time was the dominant source of variation, separating day 35 from day 70 organoids, while morphogen-guided differentiation produced a distinct treatment-associated proteomic signature. The direct effect of morphogens was strongest at day 35 and markedly attenuated by day 70 at the individual-protein level, suggesting an early role in reshaping organoid differentiation. Nevertheless, pathway-level analysis showed that guided organoids retained a coordinated late molecular imprint, with relative enrichment of RNA/chromatin-associated programmes and reduced representation of transport, adhesion, ion-handling and neuronal maturation-associated pathways compared with unguided controls. These findings suggest that morphogen-guided differentiation redirects aspects of the default forebrain organoid maturation trajectory, supporting the generation of a distinct developmental state. Together, these results demonstrate that LC-MS proteomics captures both time-dependent and morphogen-dependent molecular changes in iPSC-derived brain organoids. This work contributes to the optimisation and molecular validation of forebrain and hippocampal-like organoid models, supporting their future application in studies of human brain development, neurological disease modelling and therapeutic discovery.

Keywords. *Neurodevelopment; WNT3a and BMP4; Forebrain and Hippocampal-like Organoids; LC-MS Proteomics*

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[LAQV-REQUIMTE] Food biochemistry

2Sweet2Go: Valorisation of sugarcane molasses as a functional sweetener for food applications

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Abstract. Sugarcane molasses is an agro-industrial by-product, with an estimated global production exceeding 50 million tons annually [1]. Due to its high carbohydrate content, molasses represents a promising raw material for the development of functional ingredients supporting innovative strategies that align public health objectives with industrial innovation and sustainability. In this work, controlled maturation of molasses is explored through non-enzymatic transglycosylation reactions, promoted by the manipulation of pH, temperature, and time, with the aim of promoting oligosaccharide content.

The resulting systems are expected to yield a sweet-tasting ingredient with reduced glycaemic impact, together with prebiotic, and antioxidant properties, partially attributed to melanoidins. To demonstrate practical applicability, the feasibility of incorporating matured molasses as a natural sugar substitute is evaluated, with a particular focus on fruit-based systems, including strawberry jams and fruit preparations for dairy applications.

This study addresses how controlled molasses maturation can modify its chemical composition to enhance sweetness, improve functionality, and generate novel value-added ingredients. Overall, this work contributes to the valorisation of agro-industrial by-products and supports the development of next-generation sweeteners that combine functionality, low glycaemic impact, and clean-label attributes.

Keywords. *Sugarcane molasses; Carbohydrates; Transglycosylation reactions; Oligosaccharides; Maillard reactions; Melanoidins*

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Unlocking aroma potential: a green analytical strategy for varietal aromatyping of portuguese grapes

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Abstract. Grape aroma arises from a complex mixture of volatile organic compounds (VOCs), which play a key role in grape and wine quality. VOCs occur in grapes in both free and glycosylated forms, and the integrated evaluation of both fractions is essential for assessing oenological aroma potential. VOC characterization has also emerged as a valuable tool for varietal fingerprinting and traceability studies. However, current grape aroma evaluation frequently relies on solvent-intensive methodologies not aligned with green analytical chemistry principles. Therefore, the aim of this study was to perform an aromatyping of 23 red and white grape varieties collected over two consecutive vintages (2023–2024) and from two Appellations (Bairrada and Távora-Varosa, Portugal) by integrating free VOCs and aroma potential using HS-SPME-GC × GC-TOFMS (headspace solid-phase microextraction coupled with comprehensive two-dimensional gas chromatography). Also, parameters to access technological maturity were evaluated. Thus, a solvent-free direct enzymatic hydrolysis methodology was optimized and evaluated using the AGREEprep metric [1], achieving the highest greenness score (0.67) compared with previously reported analytical strategies [2–4]. Multivariate analysis, including Common Dimensions (ComDim), Partial Least Squares Discriminant Analysis (PLS-DA) and Variable Importance in Projection (VIP) scoring were applied. ComDim analysis revealed a clear grouping of grape varieties according to vintage, highlighting the strong influence of harvest year on grape aroma potential. In addition, distinct varietal aroma signatures were observed among grape varieties. VIP analysis identified linalool oxide, linalool and β-ocimene as the main discriminant compounds of Loureiro, associated with floral and sweet aroma descriptors, whereas Sercialinho was mainly characterized by sesquiterpenic compounds, including calamene, γ-cadinene, α-copaene and aromadendrene, associated with herbal, woody and spicy aroma notes. Overall, this approach provides a sustainable way for evaluating oenological aroma potential, offering relevant information to support varietal characterization and winemaking decision-making.

Keywords. *Grapes; volatile organic compounds; aroma potential; green analytical chemistry; HS-SPME/GC×GC-TOFMS*

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Polysaccharide characterization from *Agaricus bisporus* by-products for development of functional ingredients

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Abstract. Global mushroom consumption has increased 10% annually due to their unique organoleptic properties and the growing demand for healthy, vegan and high-protein foods[1]. The global mushroom market size was 19.65 Ktons[2] generating approximately 60 Ktons of by-products currently used as fertilizer or feed[3]. These by-products are a rich source of proteins and polysaccharides, like β-glucans which have been associated with the hypocholesterolemic potential[4] and represent a significant opportunity for high-value applications. However, a detailed characterization is still needed to fully exploit these bioactive components.

In this work, extraction and characterization of different polysaccharide rich fractions from *Agaricus bisporus* by-products were addressed. Ethanolic, aqueous and alkaline extracts resulted in low yield of soluble (29%) and high yield of insoluble (54%) polysaccharides. The fractions are rich in sugars (37-83%) with glucose as the major monosaccharide residue (44-96mol%). After hot water extraction, the residue (WIR) (39% of initial mushroom (IM)), was composed by 28% protein and 53% carbohydrates (69mol% glucose; 19mol% glucosamine). The characteristic glycosidic linkage profile was (1→4)-Glc (30mol%), (1→6)-Glc (23mol%) and (1→4)-GlcNAc (11mol%) linked. After alkali extraction (NaOH 1M), the supernatant (Sn_1M.NaOH) (16% of IM), was rich in carbohydrates (83%) mainly glucose (96mol%). The soluble glucan was composed by (1→4)-Glc (43mol%) and (1→6)-Glc (26mol%). The precipitate obtained after supernatant dialysis (ppt_Sn1M.NaOH) (3% of IM) amounting 57% carbohydrates (94mol% glucose) with (1→3)-Glc (39mol%) and (1→4)-Glc (24mol%). The residue (R_1M.NaOH) (12% of IM) was composed by 60% carbohydrates (53mol% glucose; 42mol% glucosamine). The main glycosidic linkages are (1→3)-Glc (5mol%), (1→4)-Glc (6mol%) and (1→6)-Glc (12mol%), characteristic of β-glucans, and an enrichment of (1→4)-GlcNAc (25mol%), characteristic of chitin.

The identified amounts of β-glucans, chitin and protein show promise for the development of functional food ingredients. This detailed structural characterization provides essential insights contributing to the valorization of mushroom by-products and explore bioactive and nutritional claims.

Keywords. *Mushrooms; By-products; β-glucans; Chitin; Bioactivities*

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Recovery of rare earth elements using untreated shrimp shells: a sustainable approach for NdFeB magnet recycling

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Abstract. The increasing deployment of renewable energy technologies, driven by international climate policies such as the Paris Agreement and the European Green Deal, has significantly intensified the demand for critical raw materials (CRMs), particularly rare earth elements (REEs) including Nd, Pr, Dy, and Gd used in NdFeB permanent magnets [1]. These magnets are essential components in wind turbines and electric vehicles; however, their supply chain remains vulnerable due to geopolitical and resource constraints. In addition, approximately 15–30 % of the raw materials used during NdFeB magnet manufacturing are lost as process scrap, while end-of-life (EoL) magnets constitute an additional secondary resource stream [2,3]. Consequently, the development of sustainable recovery strategies for REEs is essential to support circular economy objectives.

Among available recovery technologies, sorption using biosorbents has emerged as an environmentally friendly and cost-effective alternative. In this study, untreated shrimp shells, an abundant biowaste material, were investigated as a low-cost biosorbent for the selective recovery of REEs from multi-element aqueous solutions simulating the dissolution of wind turbine NdFeB magnets.

The synthetic solution contained B, Ni, Co, Nd, Dy, Pr, Y, and Gd at concentrations of 100 µM each. The sorption performance of untreated shrimp shells and pyrolyzed shrimp shell, produced at 400, 500, and 600 °C, was evaluated. Untreated shrimp shells exhibited the highest selectivity toward REEs, achieving approximately 99 % removal of REEs while maintaining comparatively low removal efficiencies for Co (28 %) and Ni (27 %). Response surface methodology identified sorbent dosage and initial concentration as the most influential operational parameters, whereas salinity and pH showed no statistically significant effects within the tested range. Kinetic studies demonstrated rapid REE uptake, reaching equilibrium within 6 h of contact time, with a maximum adsorption capacity of 80.4 mg g^{-1}.

Overall, the findings demonstrate the potential of untreated shrimp shells as an efficient, low-cost, and sustainable biosorbent for the selective recovery of REEs from complex aqueous mixtures, contributing to the development of circular strategies for CRMs recovery from NdFeB magnet waste.

Keywords. *Wind turbine waste, Critical Raw Materials, Removal, Secondary resource, Shrimp shell*

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Making volatile profiling data comparable across grape-based beverage matrices

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Abstract. The increasing demand for no- and low-alcohol grape-based beverages (<5% v/v) is accelerating product innovation and increasing the need for analytical tools that support product development and process monitoring. A key obstacle for the analysis of grape-based beverages resides on matrix variability, as grape-based beverages can differ in ethanol (from 0 to more than 10% v/v) and sugar content, which alters beverages physicochemical properties and strongly affects headspace partitioning of compounds and analytical response [1]. As a result, volatile profiles obtained with conventional approaches are not directly comparable across grape-based products, limiting the use of aroma data to guide product development innovations as well as (bio)technological monitoring. This work aimed to develop a workflow that enables consistent and comparative volatile profiling across grape-based beverages with distinct physicochemical properties. A solvent-free, high-throughput HS-SPME coupled to GC×GC method was implemented to provide a broad volatile coverage and high chromatographic resolution across matrices. To turn complex chromatographic data into data suitable for cross-matrix comparison, a matrix normalization strategy was developed. A correction model based on sample density, ethanol content, sugar content and total ion current (TIC) area was used to adjust internal standard response and calculate a sample-specific correction factor. Volatile compounds were reported as corrected internal standard equivalents, allowing a direct comparison of analytes responses across beverages with different compositions, including across different ethanol contents. The proposed workflow supports a faster and more reliable development of no and low-alcohol grape-based beverages by allowing monitoring processes impacts, grape-based beverages comparison and generation of robust datasets for formulation development.

Keywords. *Grape-based beverages; No-Low beverages; HS-SPME-GC×GC.*

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From sea to land: valorization of autochthonous portuguese species for functional beverages

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Abstract. The growing interest in sustainable and functional foods has intensified the exploration of underutilized native plant species with potential health-promoting properties. Among these, *Arbutus unedo* (strawberry tree), *Corema album* (white crowberry), and *Sambucus nigra* (elderberry) stand out as relevant autochthonous berries due to their adaptation to distinct Portuguese ecosystems, ranging from coastal habitats to inland and mountainous regions. These species represent valuable natural resources with increasing relevance for food innovation and biodiversity valorization, particularly in the context of plant-based functional ingredients development. Despite originating from different ecological niches, these berries share a notable richness in bioactive compounds, while presenting complementary phytochemical profiles that may enhance their overall functional potential when considered collectively. *Corema album*, an endemic Atlantic coastal species, is characterized by a fresh and slightly acidic profile. Its fruits are rich in water, dietary fiber, minerals, and a diverse array of phenolic compounds, which contribute to antioxidant capacity and have been associated with protective effects against oxidative stress and chronic degenerative diseases [1]. *Arbutus unedo* is widely recognized as a medicinal species, mainly due to its high polyphenolic content, linked to antioxidant, antimutagenic, anticarcinogenic, and anti-aging properties. Beyond its functional relevance, the fruit has traditionally been used in fermented beverage production, reinforcing its value in food applications [2]. *Sambucus nigra* is extensively studied for its high levels of anthocyanins and other phenolic compounds, which contribute to strong antioxidant, anti-inflammatory, and antimicrobial activities [3]. Collectively, these native berries represent a diversified resource with potential synergistic value in the development of functional plant-based beverages. Their incorporation into innovative formulations may support the design of products aimed at modulating oxidative stress and gut-related dysfunctions. In this context, their application in gastrointestinal health, including conditions such as Irritable Bowel Syndrome (IBS), emerges as a relevant and underexplored avenue within functional food development.

Keywords. *Native berries; Bioactive compounds; Functional beverages; Gut health*

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Healthypassion: from bioprospection of purple passion fruit to the preclinical evaluation of health-promoting food ingredients in a murine asthma model

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Abstract. Asthma is a chronic airway disease with a high socioeconomic impact, often characterized by Th2-driven inflammation and increased reactive oxygen species (ROS). This ROS accumulation leads to severe oxidative stress, promoting exacerbations and disease progression. While conventional pharmacological treatments effectively manage symptoms, they often lack preventive capabilities against oxidative damage. Consequently, dietary intake of exogenous antioxidants has emerged as a promising mitigation strategy, with epidemiological data confirming that polyphenol-rich diets correlate with lower asthma incidence. This work evaluates the potential of purple passion fruit (PPF)-derived ingredients as functional solutions for the health promotion of asthmatic patients. With this intent, the nutritional and bioactive profiles of PPF peel, pulp, and seeds were determined. PPF peel was identified as the most promising matrix, exhibiting a high dietary fiber content (~70%), the highest overall antioxidant capacity, and rich levels of Vitamin C (458 mg/100g DW) and anthocyanins, specifically cyanidin-3-glucoside. Concurrently, an in-depth volatile profiling of PPF juice assessed how different pasteurization technologies impact aroma, physicochemical traits, and consumer sensory perception. Subsequently, PPF peel powder was evaluated in an *in vivo* ovalbumin-induced asthma murine model. A 3% (w/w) dietary supplementation safely enhanced enzymatic antioxidant defenses (SOD, CAT, GSH) without inducing hepatotoxicity. Furthermore, it significantly attenuated systemic Th2-driven inflammation, evidenced by reduced IL-4, IL-5, IgE, and markedly decreased inflammatory cell infiltration in the lung tissue. Although localized IL-13-driven airway remodeling persisted, these findings highlight a synergistic whole-food matrix effect, likely combining polyphenol-mediated enzymatic reinforcement and dietary fiber-driven systemic immunomodulation via the gut-lung axis. Overall, this work demonstrates the potential of valorizing PPF peel, an underutilized agro-industrial by-product. Through minimal processing, it can be transformed into a sustainable, safe, and effective nutritional coadjuvant, simultaneously supporting circular economy principles and complementing conventional asthma management strategies.

Keywords. *Purple passion fruit; Chemical characterization; Bioactivities; in vivo evaluation; Asthma management*

Acknowledgements. This work received financial support from PT national funds (FCT/MCTES, Fundação para a Ciência e Tecnologia and Ministério da Ciência, Tecnologia e Ensino Superior) through the Associate Laboratories LAQV-REQUIMTE (UID/50006/2025) and CICECO-Aveiro Institute of Materials (UID/50011/2025 & LA/P/0006/2020). A.M.A. Fonseca also thanks FCT (Fundação para a Ciência e Tecnologia) and ESF (European Social Fund) through POCH (Programa Operacional Capital Humano) for his PhD grant [SFRH/BD/146391/2019].

[LAQV-REQUIMTE] Organic chemistry and natural products

Photocatalytic Synthesis of Sulfonylguanidines under Blue Light

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Abstract. The development of sustainable and mild methodologies for the construction of nitrogen-rich functionalities remains a central goal in modern organic synthesis. Guanidine motifs are prevalent in pharmaceuticals, agrochemicals, catalysts, superbases, superpotent sweeteners, and bioactive natural products.1 Yet, their installation by traditional methods often relies on reaction conditions with high E-factor, generating stoichiometric amounts of byproducts (such as EDC2 or Mukayama reagent3) or on the use of toxic reagents such as HgCl2.4

Herein, we report a blue-light-mediated guanylation strategy enabled by methylene blue (MB), an inexpensive, commercially available organic photocatalyst. Upon irradiation with blue LEDs, the reaction proceeds under mild conditions, providing access to sulfonyl guanidine from readily available starting materials.

Initial optimization studies using a model sulfonylthiourea and morpholine as starting materials evaluated key parameters, including the photocatalyst, base, and solvent. With the optimized conditions for the model reaction, we present a preliminary scope to demonstrate the reaction's robustness.

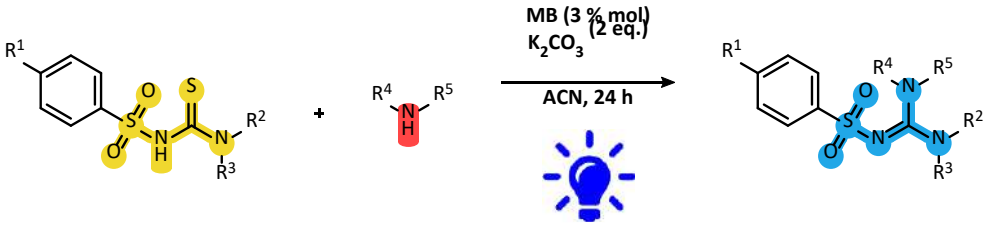

Fig.1. Photocatalytic synthesis of sulfonylguanidines aided by Methylene Blue.

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Keywords. *Sulfonylguanidines; Photocatalysis; Methylene Blue; Blue-light; Guanylation.*

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Photoredox-catalyzed Giese decarboxylation of (–)-Quinic acid: A green route to spiro-scaffolds and potentially bioactive frameworks

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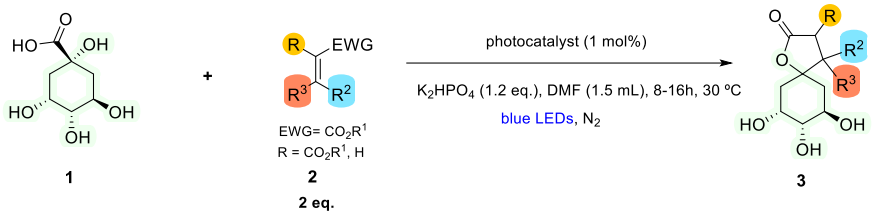
Abstract. Photocatalyzed Giese reactions are a type of photoredox-mediated radical conjugate addition reaction, enabling sustainable routes in organic synthesis. It consists of adding alkyl radicals to electron-deficient olefins through conversion of visible light into chemical energy.[1] The substrate scope of this synthetic tool is broad, as carboxylic acids and derivatives are widely used radical sources via photochemical decarboxylation under greener, milder conditions, a strategy recently extended to tertiary carboxylic acids.[2] (–)-Quinic acid can be isolated from nature in its enantiomerically pure form, being an attractive chiron for the design of new compounds. Therefore, several methods for quinic acid modification have been reported in the literature, indicating the need for harsh reaction conditions and sometimes hazardous reagents.[3] γ-Lactones, and their spiro-derivatives are important for their biological activities, including anti-inflammatory, antiviral, antibiotic and anticancer effects, making them valuable in drug design. Developing greener, more efficient methods is crucial for exploring new derivatives and providing environmentally friendly solutions in drug development.[4]

Combining all these facts, we started a study of a promising and versatile transformation where (–)-quinic acid (**1**), a tertiary carboxylic acid, is used as a radical precursor for a non-stereoselective photocatalyzed decarboxylative Giese-type conjugate addition with a malonate derivative (**2**), followed by lactonization to afford spiro-lactones (**3**) - PGaL methodology (**Scheme 1**).

Optimization of this reaction was done through an extensive screening of photocatalysts, solvents and bases. Preliminary results reveal the impact of hydroxyl group protection on diastereoselectivity, thereby establishing a platform for the development of stereocontrolled radical transformations and the synthesis of biologically relevant spirocyclic scaffolds.



Scheme 1 Standard conditions of PGaL with QA and its derivatives.

Keywords. *Photocatalysis; photodecarboxylation; Giese reaction; diastereoselectivity; (–) quinic acid; spiro-lactone.*

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[PDBQ] Biochemistry: where science meets the future

Lipid Signatures of Atherosclerosis: From molecular mapping to disease insights

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Abstract. Atherosclerosis is a chronic, lipid-driven inflammatory disease of the arterial wall and the leading cause of morbidity and mortality worldwide, accounting for over 40% of global deaths [1,2]. Despite advances in cardiovascular medicine, current diagnostic strategies, largely based on traditional risk-factor assessment and standard lipid panels (LDL-C, HDL-C, triglycerides), fail to capture the disease's molecular complexity, failing to diagnose 40-60% of cases [3]. Additionally, current therapeutic approaches, focused on modifying risk factors and lipid-lowering therapies, still fail to prevent up to 70% of cardiovascular events [4]. Lipid accumulation and alteration (e.g., oxidation) are central hallmarks of atherosclerosis development, progression, and severity. Lipids are bioactive mediators, regulating key biological processes in atherosclerosis, including endothelial function, inflammation and immune processes, platelet activation, coagulation, and smooth muscle cell proliferation and migration [5,6]. Lipidomics is emerging as a new omics discipline, offering unique advantages in deciphering the role of lipids in atherosclerosis and complementing other omics. Herein, we investigate how lipidomics and epilipidomics, the systematic profiling of native and modified lipid species, can provide an accurate molecular depiction of atherosclerosis. Evidence from human studies across plasma and atherosclerotic plaque matrices shows that specific lipid signatures, particularly those involving cholesterol esters and their oxidized form, oxysterols, polar lipids (ceramides, sphingomyelins, glycosphingolipids), oxidized phospholipids, lysophospholipids, and oxylipins, may provide information about plaque formation, progression, vulnerability, and clinical outcomes. We also discuss how these molecular signatures vary with disease stage, plaque location, symptom status, histological characteristics, and disease outcomes.

Keywords: *Atherosclerosis; Lipidomics; Epilipidomics; Plasma; Atherosclerotic plaques; Biomarkers; Mass spectrometry*

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Maternal Biomarker Specimen Collection: Enabling Environments for Non-communicable Disease Risk Reduction in Ethiopia (ENABLE) project – the ENABLE exposome of urban Ethiopian women.

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Abstract. In low-and middle-income countries, Non-Communicable Diseases(NCDs) are increasingly shaping the pregnancy and birth outcomes, where pregnant women face a "double burden" of chronic conditions like diabetes, and hypertension, and related risk factors like anemia and obesity. Under the ENABLE project currently underway in Ethiopia we are conducting an epidemiological biomonitoring study to explore the effect of a prevention intervention on early NCD risk factors among pregnant women and their newborns, as measured by biomarkers. The lifestyle intervention aims to reduce exposure to three NCDs risk factors: unhealth diet, physical inactivity, and air pollution, in urban Ethiopia.

The evaluation of the intervention is conducted in four urban cities of Ethiopia: Addis Ababa, Adama, Harar, and Jimma, using a a cluster randomized control trial (cRCT). The biomarker sub-study includes 432 pregnant women across 24 intervention and control health facilities in Addis Ababa. Whole blood and urine specimens will be collected at baseline (first trimester), at follow-up (third trimester), and also from newborns. Inflammatory, metabolomic, and lipidomic biomarkers will be analyzed, and together with survey-based collected information on lifestyle and behavioral factors we will compile the "ENABLE" exposome.

Recruitment of participants began in May 2026 and is ongoing. As of end of May, 2026, n=48 participants have been recruited from control and interventions health facilities. Biological specimens, fasting venous blood (10mL), urine, and dried blood spot (DBS) were successfully collected. Plasma and serum aliquots have been prepared and appropriately stored at -80°c for subsequent inflammatory, metabolomic, and lipidomic analyses. Several challenges related the recruitment of women to the substudy are being reported and strategies to overcome them are supported by the local teams.

This study will be the first kind to map the maternal exposome among pregnant women in Ethiopia. Furthermore, the operational framework established by this project will offer critical, scalable lessons for executing high-quality, resource-efficient biomonitoring studies in similar low-resource settings like Ethiopia.

Keywords: Non-Communicable Diseases, pregnant women, Ethiopia

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Associations between dietary patterns and plasma fatty acid profiles in Ethiopia using a GC–MS approach

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Abstract. Non-communicable diseases (NCDs) are increasing globally, particularly in low- and middle-income countries such as Ethiopia, where undernutrition coexists with rising obesity and ongoing dietary transitions [1,2]. Within the exposome framework, diet is a major modifiable exposure influencing circulating fatty acid composition and NCD risk [3]. However, sub-Saharan African populations remain underrepresented in fatty acid research.

This exploratory study aims to provide a preliminary overview of the variability in plasma fatty acid profiles among 100 Ethiopian women in urban areas using gas chromatography–mass spectrometry (GC–MS), within the ENABLE project. Plasma samples (n=69) were extracted using the BUME method for lipid extraction and analyzed through GC–MS-based fatty acid profiling, while dietary patterns were assessed using dietary diversity scores reflecting food variety and diet quality. Samples were selected from participants representing both higher and lower dietary diversity patterns, with higher dietary diversity corresponding to consumption of five or more food groups per day and lower dietary diversity corresponding to fewer food groups, reflecting diets considered more and less beneficial for health, respectively [2].

Preliminary results suggest differences in fatty acid composition according to dietary diversity scores. Participants with lower dietary diversity scores showed a tendency toward a higher relative abundance of FA 18:2 *n*-6, whereas participants with higher dietary diversity scores appeared to present higher levels of FA 22:6 *n*-3. These findings may indicate a more favorable omega-6/omega-3 ratio in individuals with more diverse diets. However, these preliminary observations will be further explored in a larger sample size to better understand the relationship between dietary diversity and plasma fatty acid composition. By integrating dietary assessment with plasma fatty acid profiling, this work contributes to a better understanding of diet-related metabolic signatures within the exposome framework and NCDs risks in an underrepresented population.

Keywords. *Expossome; Non-Communicable diseases; Mass spectrometry*

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Multifunctional encapsulation of cannabis oil using polysaccharides to potentiate its efficacy against colorectal cancer

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Abstract. *Cannabis sativa* has been widely used for therapeutic purposes. In particular the cannabinoids tetrahydrocannabinol (THC) and cannabidiol (CBD) have gained renewed interest due to their anti-cancer properties. Although the mechanisms are not fully understood, tumour growth, cell invasion inhibition, anti-inflammatory effects, induction of apoptosis and autophagy have been reported, making them potential adjuncts to conventional therapies. Regarding colorectal cancer (CRC), the second leading cause of cancer related deaths, cannabinoids have shown to positively modulate immunotherapy response and suppress tumor growth. Targeted delivery of cannabis oil to the colon presents a promising approach for enhancing the therapeutic efficacy of cannabinoids in the treatment of colorectal cancer. However, oral administration often results in low bioavailability due to degradation in the gastrointestinal tract. Colon-specific delivery systems can overcome these limitations by protecting cannabinoids during gastrointestinal tract and ensuring localized release at the tumor site. Polysaccharides are increasingly recognized as versatile delivery systems for various health applications. [1-4] Thus, alongside with the pharmaceutical company Portocanna S.A., the aim of our work is to use the polysaccharides levan and chitin/β-glucan complex to encapsulate cannabis oil to aid colorectal cancer treatment. Chitin would be deacetylated and partially protonated by the colonic enzymes, guiding the capsules to the cancer environment whereas levan and β-glucan fermentation would exert a prebiotic effect. Delivery of THC and CBD in colorretal cancer environment would potentiate response to therapy and gut homeostasis. Furthermore, taking advantage of sialylase activity of probiotic bacteria it is expected that cancer cells will be more vulnerable to elimination by the immune system, due to elimination of sialic acid residues. The ultimate outcome of this work would be translating the obtained knowledge into an oral product developed at the Portocanna facilities, closing the bridge between academic and practical knowledge.

Keywords. *Polysachharides; Cannabis Oil; Encapsulation; Colorectal Cancer; Prebotic effect*

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Fruit pulp fiber modulation for gut psychobiotic promotion

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Abstract. The microbiota-gut-brain axis plays a fundamental role in mental health through the production of neuroactive metabolites by specific microorganisms known as psychobiotics [1, 2]. This project aims to investigate the potential of fruit pulps, an undervalued co-product of the juice industry, as sustainable sources of soluble dietary fibers, such as pectic polysaccharides, arabinoxylans and xyloglucans, to selectively promote these beneficial bacterial populations [3]. Aqueous extractions will be applied to recover polysaccharide-rich fractions from fruit matrices such as apple pulp. To overcome the limitations of insoluble fibers, like cellulose, specific enzymatic hydrolysis or partial acid hydrolysis using food-grade acids will be performed to enhance fiber solubility and produce oligosaccharides, which will be fractionated by size-exclusion chromatography and ultrafiltration. These extracts will be characterized through the determination of monosaccharide composition and glycosidic linkages, with oligosaccharides analyzed using high-performance anion-exchange chromatography and electrospray ionization/mass spectrometry. Subsequently, the fibre-rich fractions will be subjected to in vitro digestion and fermentation using human faecal inocula [4]. This approach will enable the analysis of oligosaccharide consumption and the quantification of short-chain fatty acids and essential neurotransmitters, including gamma-aminobutyric acid (GABA) and tryptophan derivatives [5], produced during fermentation, alongside microbiota profiling via 16S rRNA metagenomics. The results will allow for establishing correlations between specific carbohydrate-structures and the selective growth of genera associated with mental health, such as *Bifidobacterium* and *Lactobacillus* [5]. Furthermore, fermentation-derived metabolites will be applied to neuronal cultures to evaluate their impact on synaptic connectivity and neurotrophic benefits. By integrating structure-function analysis, this project aims to illustrate how the valorization of fruit co-products through precise fiber modulation can cultivate psychobiotic populations, offering a sustainable and strategic approach to enhancing brain health via prebiotic-enriched food systems.

Keywords: *Fruit pulp; Gut-brain axis; Prebiotics; Psychobiotics; Soluble dietary fiber*

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Valorization of agar extraction byproducts: a carbohydrate characterization approach

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Abstract. Agar is a commercially relevant polysaccharide extracted from red seaweed whose production generates substantial volumes of byproducts that are typically discarded, despite their potentially valuable composition [1]. This study aimed to valorize these byproducts through the characterization of their carbohydrate fraction. The alkaline wastewater recovered after seaweed alkali pretreatment (NaOH 5%, 2 h) contains approximately 29% (w/w) of carbohydrates, predominantly galactose (Gal) and 3,6-anhydrogalactose (AnGal), accounting for 49 and 27 mol%, respectively. Part of the Gal content is likely associated with (iso)floridoside and its oligosaccharide derivatives, compounds synthesized by red seaweed for osmotic regulation. These molecules have attracted increasing interest due to their promising bioactive properties, including prebiotic activity mediated by gut microbiota modulation and promotion of beneficial bacterial growth [2]. The insoluble residue, separated after agar extraction (hot water, 2 h), accounted for 27% (w/w) of the initial biomass and exhibited a carbohydrate content of 43% (w/w), composed mainly of Gal (50 mol%), AnGal (32 mol%) and sulphates (8 mol%), reflecting the presence of agar, alongside with glucose (Glc, 6 mol%) from floridean starch and cellulose. The predominance of agar in this fraction suggests its potential as a source of galacto-oligosaccharides, which have also been investigated for their prebiotic properties [3]. The freeze-thaw wastewater, obtained after thawing and separating the agar gel, presented a carbohydrate content of 24% (w/w), like the alkaline wastewater, but with a distinct composition dominated by Gal and Glc (47 and 39 mol%, respectively). The extracted agar showed a purity of 77% (w/w) and low sulphate content (2 mol%). Altogether, these findings highlight the valorization potential of agar extraction byproducts, indicating that the recovered carbohydrate fractions hold promise for further exploration of their rheological and bioactive properties, with potential applications in the food industry.

Keywords Biorefinery*; Gelidium corneum; Residue valorization; Floridoside.*

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Mechanical pre-treatments for the extraction of arabinoxylans from brewers' spent grains

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Abstract. Brewer's Spent Grain (BSG), the main by-product of the brewing industry, is a rich source of arabinoxylans (AX). Despite its high valorization potential, BSG is still primarily used as animal feed or disposed of in landfills. The soluble or oligomeric derivatives of arabinoxylans have been associated with prebiotic activity, contributing to improved gastrointestinal health. [1] However, the extraction of these biomolecules from BSG remains challenging, as most soluble arabinoxylans are released into the wort during the brewing process, leaving the majority of AX in an insoluble form within the outer layers of the grain matrix. [2] To replace alkaline extraction methods, which generate hazardous waste, a novel solid–liquid extraction technology, Turbex, will be evaluated. This technology employs turbulence, high-shear forces, and cavitation to enhance extraction efficiency while operating at lower temperatures. To mimic these mechanical forces at laboratory scale, two pre-treatment methods were investigated to improve arabinoxylan extractability by disrupting the lignocellulosic matrix. The treatments were applied individually and in combination to assess possible synergistic effects. A sequential extraction strategy proved to be more effective in obtaining a richer extract. In the first step, the biomass was subjected to Ultra-Turrax treatment for 1 minute at 6500 rpm, followed by ultrasound treatment for 3 minutes at 40% amplitude, aiming to remove glucose associated with residual starch. Subsequently, the insoluble fraction was treated enzymatically with endo-xylanase for 24 hours to generate arabinoxylan-oligosaccharides (AXOS) and xylo-oligosaccharides (XOS), which can be incorporated into bread toast formulations to develop prebiotic, value-added products. This approach contributes to sustainable waste valorization and the development of functional foods with health benefits.

Keywords. *Brewer's spent grain; Arabinoxylans; Mechanical pre-treatments; Ultra-Turrax; Ultrasound; Prebiotics*

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Solid residue from agar extraction as a source of bioactive polysaccharides

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Abstract. Agar is a sulfated polysaccharide derived from *Gelidium* spp. and is widely used for its gelling and thickening properties. However, its extraction generates a carbohydrate-rich solid residue that remains largely undervalued [1]. This work explores the valorization of these residues through the extraction and characterization of high-value polysaccharides. The extraction process involved hot-water treatment (95 °C for 2 h), followed by evaporation, centrifugation, and dialysis. The procedure was repeated until no insoluble material was observed in the soluble fractions. Fractions with the highest yield and sugar content were selected for studying the type of glycosidic linkage and the sulfate positions.

The fraction that remained consistently soluble presented the highest yield and was identified as a highly branched sulfated xylogalactan. The presence of terminal xylose (t-Xyl, 16%) indicated xylose branching on a backbone mainly composed of 3-linked galactose (32%), with smaller amounts of 4-linked galactose (6%) and 4-anhydrogalactose (5%). Sulfation (30%) occurred predominantly at position C3 of 4-linked galactose. This fraction is particularly promising, as sulfated polysaccharides are known to exhibit immunomodulatory and anticoagulant activities. The fractions that became insoluble after evaporation and centrifugation showed an agar-like composition and linkage patterns, mainly consisting of 4-anhydrogalactose (54%) and 3-linked galactose (25%), with a low sulfate content (9%). Sulfation occurred primarily at position C6 of 3-linked galactose. Due to their distinct structural features (namely, a low degree of sulfation and a high 4-anhydrogalactose content), these agar-like fractions were evaluated for hypocholesterolemic activity. The results showed a 45% reduction in cholesterol solubility within a glycodeoxycholic acid micellar intestinal model, indicating a potential hypocholesterolemic effect. Overall, these results highlight *Gelidium* residues as a valuable source of bioactive polysaccharides for use as functional ingredients in the food industry, supporting their valorization within a circular economy framework.

Keywords. *Sulfated xylogalactans; hypocholesterolemic activity; Gelidium; glycosidic linkages;*

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Lipids from green seaweeds are promising ingredients for cosmetics applications

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Abstract. Lipids from the green seaweeds *Ulva* sp. and *Codium tomentosum* are sources of omega-3 polyunsaturated fatty acids (*n*-3 PUFAs), mainly esterified in polar lipids such as glycolipids and phospholipids. These lipids have attracted increasing interest due to bioactive properties, such as antioxidant and anti-inflammatory potential, highlighting their applicability in nutricosmetics and cosmetics. In this work, *in vitro* assays were performed to screening the bioactive properties of lipids extracts from *Ulva* sp., and *C. tomentosum* using RAW 264.7 macrophages and the KeratinoSens™ assay. A reduction in nitrite (•NO) production was observed in LPS-stimulated RAW 264.7 cells co-treated with algae lipids from both seaweeds. At 25 µg/mL, •NO levels decreased from 23.5 ± 1.68 µg/mL to 18.5 ± 1.66 µg/mL, while at 50 µg/mL they decreased to 15.1 ± 1.10 µg/mL and 16.0 ± 2.66 µg/mL for *Ulva* sp. and *C. tomentosum*-co-treated cells, respectively. In the KeratinoSens™ assay, *Ulva* sp. lipids induced a slight increase in luciferase activity (1.23 fold induction) only at the lowest tested concentration, while *C. tomentosum* lipids induced higher fold induction at both 25 and 50 µg/mL (1.55 and 1.52, respectively). These results may suggest the activation of the Nrf2 pathway, particularly by *C. tomentosum* lipids, supporting their role in antioxidant and anti-inflammatory responses. Overall, these findings emphasize the potential of green seaweed lipids as bioactive ingredients for the development of innovative cosmetic and health-related formulations.

Keywords. *macroalgae, macrophages, keratinocytes, inflammation*

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Study of carrageenan structures suitable for meat alternative proteic foods

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Abstract. Carrageenan refers to a group of sulfated galactans derived from red algae. These polysaccharides are commonly used to enhance the textural properties of meat products and their analogues. Meat substitutes typically depend on protein gelation or other hydrocolloids to provide the firmness and textural characteristics required to mimic conventional meat products. Although vegetarian formulations can include animal-derived ingredients, such as egg whites due to their gelling properties, vegan alternatives depend on plant-based proteins supported by carbohydrate-based hydrocolloids capable of forming stable and robust gel networks.

This study examined the characteristics of carrageenans suitable for incorporation into two distinct protein-based food formulations: cooked ham and a meat-free analogue. In the cooked ham formulation, a commercially available carrageenan was used to improve water-holding capacity by forming a gel that binds water, reduces shrinkage, and increases yield. Its carbohydrate composition consisted of 53 mol% galactose and 46 mol% 3,6-anhydrogalactose, with one in every four residues being sulfated, accounting for a total carbohydrate content of 47%. Texture Profile Analysis of the cooked ham model revealed that carrageenan addition significantly increased hardness from 83.1 N to 97.0 N and chewiness from 2474 N to 3239 N compared to the carrageenan-free formulation. This increase in hardness and chewiness is consistent with gel formation, resulting in a more sliceable product. For the cooked ham analogue, gel emulsion formation was achieved using a commercial carrageenan-rich ingredient composed of 64% carbohydrates (43 mol% galactose, 33 mol% 3,6-anhydrogalactose, and 24 mol% glucose), with a sulfation level of 22 mol%. The final formulation exhibited a firm product with desirable textural properties, similar to a vegetarian version formulated with egg white as a gelling agent.

The results of this study reveal that carrageenan represents a promising gelling hydrocolloid for use in cooked ham and their analogues formulations.

Keywords. *Carrageenan; meat analogues; food; ham; anionic polysaccharides.*

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[PDC] Thesis project defense in accounting

Informational value of going-concern uncertainties: a hybrid model for bankruptcy prediction using financial, textual, and audit data

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Abstract. Going-concern uncertainties reported in audit reports are central to assessing bankruptcy risk, as they encapsulate professional judgments regarding liquidity, financing, operational performance, and the future viability of companies [1]. However, traditional bankruptcy prediction models remain heavily anchored in financial ratios and do not always systematically incorporate the qualitative information found in auditor narratives [2]. This limitation highlights the need to understand the conditions under which textual going-concern signals add explanatory and predictive value to quantitative indicators. In this context, this research aims to develop an analytical framework to evaluate the informational value of going-concern uncertainties by integrating financial data, textual information extracted from audit reports, and variables related to the audit context. The study employs a mixed-methods, exploratory, and sequential approach, integrating a systematic literature review following the PRISMA 2020 protocol, document and textual analysis of reports, coding of going-concern risk categories, and the construction of hybrid bankruptcy prediction models, evaluated using metrics such as accuracy, precision, recall, F1-score, and AUC [3]. The study expects to identify which linguistic patterns, uncertainty categories, and financial indicators enhance the models' predictive capacity, as well as to clarify their contribution to the interpretability of risk assessments. This research aims to contribute to more transparent early-warning systems, enhance the informational utility of audit reports, and support decision-making by auditors, investors, and regulators.

Keywords. Going concern; Bankruptcy; Textual analysis; Audit data; Hybrid models

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Anti-dumping duties, competitiveness and the green transition: the European Union's trade defence policy in the steel sector vis-à-vis China

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Abstract. In a context of trade tensions, climate transition and growing geoeconomic rivalry between the European Union and China, steel has once again assumed a central role in the European Union's industrial policy. Building on the debate on China's state interventionism and on the EU's shift from the "non-market economy" framework to the concept of "significant market distortions" [1], this project analyses the evolution of the European Union's trade defence policy in the steel sector between 2001 and 2026, with a focus on anti-dumping duties applied to imports from China and on their articulation with industrial competitiveness, World Trade Organization (WTO) law, judicial review and new economic security instruments, particularly the Carbon Border Adjustment *Mechanism* (CBAM) and its interaction with EU customs law [2].

The research adopts a structure in three essays. The first carries out a systematic review of the literature and of the case law of the European Union and the WTO, identifying the main legal and regulatory milestones of the period, including the consolidation of concurrent anti-dumping and anti-subsidy investigations against China [3]. The second constructs a longitudinal analysis of anti-dumping, anti-subsidy and safeguard measures applied to steel products, relating them to trade patterns, trade diversion and signs of circumvention, in light of empirical evidence on the trade effects of anti-dumping actions [4]. The third collects perceptions of economic operators and stakeholders on the effects of these measures on the protection of the European industry, on downstream users, on the green transition and on security of supply.

By combining legal, economic, regulatory and accounting-fiscal perspectives, the project seeks to understand to what extent the European Union's trade defence policy has been capable of responding to distortions in international trade and of reconciling industrial protection, sustainability, transparency and competitiveness.

Keywords. *Trade defence; Anti-dumping; European Union; China; Steel*

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Determinants of Fintech Adoption in Emerging Countries: An Empirical Study in the Angolan Banking Context

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Abstract. This study examines the determinants of the adoption of financial technologies (fintechs) in the Angolan banking sector, in a post-COVID-19 digital acceleration context. The theoretical framework combines Rogers' Diffusion of Innovation Theory (1995) and Ajzen's Theory of Planned Behavior (1991), incorporating variables such as customer base pressures, competitive intensity, the institutional size of banks, digital infrastructure, and accumulated experience with digital channels, highlighting mobile banking as the main driver of financial inclusion. The methodology combines qualitative document analysis with panel data econometrics, covering 19 Angolan banks from 2019 to 2024 (114 observations). The results reveal that unobservable internal factors organizational culture, strategic leadership, and technological management capacity exert a greater influence than external variables, indicating limitations in applying models developed for mature markets. The study offers practical contributions for managers, regulators, and policymakers committed to modernizing the Angolan banking system.

Keywords. *Fintech, banking sector, emerging markets, innovation diffusion theory, theory of planned behavior.*

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Audit expectation gap and interpretation of the auditor's report: a multimethod experimental approach

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Abstract. The audit expectation gap constitutes a persistent problem in auditing, arising from the mismatch between what users expect from the auditor and what the audit actually assures. Despite reforms to the auditor's report, empirical studies show that these differences persist, suggesting that the problem is simultaneously normative, institutional, cognitive and communicational. However, research has remained largely focused on surveys and self-report measures, providing little process-level evidence on how the report is read, which sections attract attention, and how these patterns relate to users' understanding and perceptions. This project examines how the communicative design of the auditor's report influences visual attention, understanding and users' perceptions, and the extent to which these factors contribute to the persistence of the audit expectation gap. It adopts a three-essay research design that combines bibliometric mapping, a systematic review focused on behavioural and cognitive mechanisms associated with report interpretation, and an experimental study using eye-tracking, comprehension testing and a perceptions questionnaire. The project is expected to generate theoretical, methodological and empirical contributions by deepening understanding of the audit expectation gap through the articulation of agency theory, communicative design and cognitive mechanisms of interpretation, by producing experimental evidence on how different versions of the auditor's report are read and perceived. From a regulatory and professional perspective, the project has the potential to support the development of clearer auditor's reports aligned with users' cognitive architecture, strengthen confidence in financial information and the effectiveness of markets, thereby contributing to professional practice and the regulatory review of the auditor's report.

Keywords. *Cognitive mechanisms; Communicative design; Behavioural auditing; Eye-tracking; Financial communication*

Taxation of artificial intelligence agents: impact of human labour substitution on the financial sustainability of social security

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Abstract. The substitution of human labour by Artificial Intelligence Agents (AIA) generates a systemic negative fiscal externality, designated in this research as Fiscal Displacement Externality (FDE). The FDE is defined by the erosion of the Welfare State's financing base, caused by the migration of taxable labour to algorithmic capital that is exempt from contributory charges [1]. In Portugal, contributions from labour income account for 97.9% of Social Security (SS) funding [2], placing the social protection system under dual demographic and technological pressures [3]. The research has two objectives: to quantify the magnitude of the FDE in the Portuguese business sector and to formulate a European fiscal instrument in response. The methodology is divided into three essays: the first conducts a systematic literature review following the PRISMA 2020 protocol and bibliometric analysis; the second estimates the causal effect of AIA adoption on SS contributions through Autoregressive Distributed Lag (ARDL) and Vector Autoregressive (VAR) models, applied to 21 sectors of the Nomenclature of Economic Activities (NACE) between 2015 and 2026, with a projection of pension system solvency until 2050 using an Overlapping Generations (OLG) model calibrated for Portugal; the third develops a comparative legal analysis of artificial intelligence taxation regimes, culminating in the EU-FDE Tax proposal. The anticipated results include the first empirical quantification of the FDE in Portugal, the role of tax incentives for innovation in contributory erosion, and a fiscal policy proposal transferable to the European space that reconciles social protection with business competitiveness.

Keywords. *Fiscal displacement externality; Robot tax; Overlapping generations model; Contributory erosion; Eu-fde tax*

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Root-cause analysis in accounting using interpretable machine learning: a decision-support architecture

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Abstract. The reliability of financial information is fundamental pillar of capital market functioning, investor confidence, and effective auditing. Nevertheless, recent corporate scandals such as [1] have shown that, even under rigorous external supervision, accounting anomalies, misrecognized revenue, overstated assets, and manipulated provisions can remain hidden for years. The question is not merely to detect that something is incorrect, but understanding the reasons behind irregularities, which internal control processes or systems have failed, and how their recurrence can be prevented through Root Cause (RC) analysis. RC is an approach used to analyse adverse events and identify the RC of a problem to find effective solutions [2]. The main objective of CATIVA is to identify the fundamental causes of errors, rather than focusing solely on the mistakes of a single operator. This study addresses the lack of causal diagnostic capabilities in current auditing tools, and is the central focus of this research. Traditional methods remain reactive, sampling-based, and poorly scalable to the volume and complexity of modern transactional data. The adoption of ERP systems and IFRS standards has increased data availability without providing adequate tools for causal interpretation. Furthermore, IFRS 18 introduces new risks related to financial statement presentation and Management-Defined Performance Measures (MPMs). In response to these limitations, this research advances the design, implementation, and empirical validation of CATIVA, an integrated decision-support architecture for accounting information systems, which leverages Interpretable Artificial Intelligence to provide auditors and financial controllers with traceable, evidence-based explanations of the root causes underlying financial misstatements and control failures. The study follows a Design Science Research (DSR) [3] approach and is validated using real accounting and auditing data.

Keywords: *Explainable artificial intelligence; Root cause analysis; Financial anomaly detection; Accounting information systems; Audit decision support*

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Estrutura conceptual para a peritagem contabilística em Portugal: fundamentos, práticas e validação empírica

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Resumo. A peritagem contabilística assume relevância crescente na produção de prova técnica especializada em litígios económico-financeiros e patrimoniais, arbitragem, procedimentos administrativos e contextos judiciais e extrajudiciais, dada a necessidade de transformar informação contabilística complexa em evidência inteligível, verificável e processualmente útil [1]. Todavia, em Portugal, a atividade permanece marcada por institucionalização limitada, dispersão de práticas, reduzida oferta formativa especializada e inexistência de um referencial técnico-profissional especificamente orientado para a atuação do perito contabilista [2]. Esta realidade não permite concluir pela ausência de conhecimento especializado; antes evidencia a necessidade de o sistematizar, articulando literatura científica, prática profissional, enquadramento processual e experiências internacionais [3]. Neste contexto, a investigação tem como objetivo desenvolver e validar empiricamente uma estrutura conceptual para a peritagem contabilística em Portugal. A proposta não assume natureza legislativa, regulamentar ou prescritiva vinculativa; visa oferecer um referencial conceptual e analítico capaz de organizar princípios, competências, procedimentos, critérios de qualidade e dimensões institucionais relevantes para a produção de prova técnica contabilística. O estudo adota abordagem metodológica mista, exploratória, descritiva e comparativa, integrando revisão crítica da literatura, análise documental e jurisprudencial, entrevistas semiestruturadas, inquérito por questionário e validação por painel de especialistas. A triangulação das evidências permitirá confrontar contributos da contabilidade, auditoria, direito, teoria institucional e regulação profissional. Espera-se contribuir para o aprofundamento científico da área, para o reforço da credibilidade da prova pericial e para futuras iniciativas de formação, supervisão, qualificação e aperfeiçoamento técnico da atividade.

Palavras-chave. *Peritagem contabilística; Prova pericial; Estrutura conceptual; Forensic accounting; Portugal.*

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The use and disclosure of tax benefits by non-profit organizations in Portugal

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Abstract.
The present study investigates the utilisation of tax benefits by non-profit organisations in Portugal, as well as how these benefits are disclosed in their financial reports. The study combines a systematic review of the literature, a quantitative analysis of the tax benefits granted, and an examination of the relationship between benefits, transparency and accountability, using data from the Tax Authority, the SABI database and institutional documents. The objective of this study is to make a contribution to the literature on taxation in the non-profit sector, with the aim of enhancing understanding of the role of tax benefits in the sustainability and accountability of these organisations.

Keywords. Non-profit organisations, Tax benefits, Accountability, Financial reporting, Transparency

The implications of tax adjustments on accounting results and financial reporting quality in Portugal.

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Abstract. This study takes a disaggregated approach to examining the differences between accounting and taxation in Portugal. It focuses on the tax adjustments reported in Table 7 of Form 22 of the Corporate Income Tax (IRC) return. While the literature has predominantly focused on aggregate book-tax differences (BTDs), this project aims to analyse the composition, materiality and temporal evolution of these specific tax adjustments in a disaggregated and detailed manner. The study covers the period from 2005 to 2024, capturing the critical transition from the Official Accounting Plan (POC) to the Accounting Standardisation System (SNC) in 2010 and subsequent convergence with international standards (IAS/IFRS). The central objective is to evaluate the significance and informational value of these adjustments, distinguishing between normal BTDs (NBTDs), which arise from regulatory inflexibility, and abnormal BTDs (ABTDs), which are often linked to earnings management or tax evasion. Using a three-pronged methodology combining a systematic review, a longitudinal econometric study using statistical data from the tax authority and a qualitative survey of chartered accountants, the research aims to determine the impact of these adjustments on earnings quality and accounting conservatism.
The expected results will inform the debate on book-tax compliance and contribute to improvements in tax and accounting policies in Portugal.

Keywords. *Tax adjustments; Book-tax differences; Accounting profit; Financial reporting quality; Portuguese corporate income tax return.*

Analysis of the participation of companies in the mozambique capital market: determinants, barriers, and implication

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Abstract. The capital market plays a fundamental role in financing economic growth by facilitating the mobilisation of savings and channelling them into productive investment (Weiss & Prates, 2017). However, in many developing countries, including Mozambique, the level of corporate participation in the capital market remains low, thereby limiting its potential to stimulate economic development. In Mozambique, the stock exchange has only a small number of listed companies, which constrains its role as a mechanism for mobilising savings and financing productive investment. Although the Mozambique Stock Exchange has been in operation for approximately 28 years, many businesses continue to overlook it as a source of finance. At present, only 11 companies are listed on the exchange, a situation that motivated the present study to investigate the factors that influence this limited level of corporate participation. Against this background, the primary objective of this research project is to analyse the factors explaining the low level of corporate participation in the Mozambican capital market, with a view to contributing to the formulation of policies and strategies aimed at strengthening this segment of the financial system. The study will adopt a mixed-methods approach which, according to Leite et al. (2021), is characterised by the integration of qualitative and quantitative approaches within a single investigation. It is expected that the research will identify factors such as institutional constraints, market access costs, limited financial culture, low levels of financial literacy, firm characteristics, and regulatory weaknesses as critical elements influencing the development of the capital market in Mozambique. Furthermore, the project seeks to examine the consequences of this limited corporate participation, particularly with regard to restricted access to corporate finance, the concentration of financing sources in the banking sector, and the resulting implications for the country's economic development. The findings are expected to contribute to the academic debate by providing evidence-based recommendations for public policies and business strategies that promote a more inclusive, efficient, and dynamic capital market in Mozambique. In addition, the project aims to advance the understanding of capital market dynamics in developing economies and to provide valuable insights for the design of public policies and institutional strategies aimed at expanding the capital market and encouraging greater participation by both firms and investors.

Keywords. Low corporate participation; Capital Market; Economic Development; Mozambique; Low Financial Literacy.

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Carbon accounting in the public sector and its role in carbon neutrality: A study in the railway sector

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Abstract.
Climate change has intensified the need for organisations to reduce greenhouse gas (GHG) emissions and promote the transition to carbon neutrality. In this context, carbon accounting has emerged as an important mechanism for measuring, monitoring, and reporting emissions, supporting organisational accountability and strategic decision-making [1], [2]. Although carbon accounting practices are increasingly consolidated in the private sector, their application in the public sector remains underexplored, particularly regarding their role in governance, transparency, and decarbonisation policies [3].
This research aims to analyse how carbon accounting systems influence organisational decision-making and contribute to carbon neutrality strategies in the public sector, focusing on the railway sector. The study adopts a sequential mixed-methods approach, structured into three interconnected essays. The first essay develops a systematic literature review and analyses international standards and frameworks, including the GHG Protocol, ISO 14064-1, IPSASB SRS 1, and the Rail Carbon Accounting Framework (RCAF). The second essay consists of a case study at CP – Comboios de Portugal, combining documentary analysis with semi-structured interviews to explore carbon accounting practices and their influence on management and accountability processes. The third essay adopts a comparative European perspective, analysing carbon accounting practices in public railway operators in Portugal, Spain, France, and Germany.
The study is expected to contribute to the theoretical development of carbon accounting in the public sector and to identify governance and reporting practices that enhance transparency, comparability, and alignment with decarbonisation and climate neutrality objectives.

Keywords. *Carbon accounting; Carbon neutrality; Accountability; Reporting*

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Contribution of the *regime fiscal de apoio ao investimento* to regional state aid goals: evidence from the manufacturing sector

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Abstract. The project aims to investigate the effectiveness of the *Regime Fiscal de Apoio ao Investimento* as a regional State aid instrument, established under the General Block Exemption Regulation of the European Union. Focusing on the manufacturing sector in Portugal, the research problematises whether the tax expenditure inherent to this incentive promotes true territorial cohesion or whether it induces systemic allocative failures, such as deadweight loss and capital-labour substitution. The primary objective is to assess the causal impact of the incentive on the net creation of sustainable jobs and on the convergence of gross domestic product *per capita* at the regional level. Methodologically, the architecture of the thesis is structured into four complementary essays. Initially, it combines a Systematic Literature Review with a Comparative Qualitative Analysis of the normative frameworks of the Member States, scrutinising the structural correlation between the legislative requirement of each jurisdiction and the material effectiveness of the respective aid measures. It then develops two counterfactual impact assessment studies. The first applies Difference-in-Differences models coupled with Propensity Score Matching to measure the direct impact on employment. The second uses panel data regressions to estimate the elasticity of regional economic growth. The expected contributions will provide the legislator with solid empirical evidence that allows the optimisation of national tax policy, ensuring the maximisation of socio-economic utility and the real mitigation of territorial asymmetries.

Keywords. *Regional state aid; GBER; Cohesion policy; Tax incentives, RFAI*

Earnings Management in Portuguese Municipalities: An Integrated Analysis and Its Implications for Municipal Transparency and the Quality of Public Services

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Abstract. Research on earnings management in the public sector remains largely centred on accrual-based measures. This doctoral project adopts a broader perspective, treating the management of reported performance as a multidimensional phenomenon through which incumbents may strategically adjust budgetary information, operational decisions, and accrual-based accounting estimates. It examines whether this unobservable opportunism, inferred from budgetary, real, and accrual-based dimensions, is associated with municipal transparency and the quality of public services in Portuguese municipalities.

The thesis comprises three interdependent studies. The first is a systematic literature review identifying the field's main concepts, theories, methods, evidence, and gaps. The second develops measures for the three dimensions, tests whether they coexist, complement, or substitute one another, and analyses their political-electoral, financial, and institutional determinants. The third examines their relationships with municipal transparency and public service quality.

The empirical design is quantitative and longitudinal, using municipality-year panel data for Portugal's 308 municipalities. Budgetary and real dimensions will be analysed for 2015–2025, while the accrual-based dimension will cover 2020–2025, following SNC-AP implementation.

Multiple proxies will be constructed from financial, budgetary, accounting, political-electoral, statistical, and documentary data. Transparency will be assessed through the availability, accessibility, completeness, and timeliness of financial and budgetary documents, while public service quality will be measured using objective municipal indicators. Panel econometric models and documentary analysis will be applied.

By integrating the three dimensions without combining them into a single index, the project aims to advance public sector accounting research and provide evidence relevant to accountability, oversight, and local governance.

Keywords. *Earnings management; Portuguese municipalities; Municipal transparency; Quality of public services; Public sector accounting.*

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Large language models in the audit process: evidence in going concern assessment

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Abstract. The going concern assessment is a critical area of auditing that requires the integration of financial and narrative information and a high degree of judgment under conditions of uncertainty. Thus, the aim is to investigate the extent to which Large Language Models (LLM) can support the auditor's professional judgment in the going concern assessment, and what the incremental value of narrative information is relative to financial indicators. We propose an approach that integrates artificial intelligence and the regulatory framework by operationalizing International Standard on Auditing 570 (IAASB, 2025) within an LLM-based model designed to identify signs of going concern risk from information contained in financial statements. The research adopts a quantitative empirical approach with an experimental component, structured in three phases: systematic literature review, development and validation of a computational model, and external evaluation of the model by audit professionals. This design combines theoretical grounding, computational implementation of regulatory provisions, and validation in a professional context, ensuring rigor, practical relevance, and alignment with the European agenda for the responsible use of artificial intelligence in regulated contexts. The study is expected to contribute to the literature at the intersection of auditing and artificial intelligence, demonstrating how LLM can support professional judgment in business continuity assessment processes as transparent, interpretable solutions aligned with regulated contexts.

Keywords. *ISA 570; Going concern; Professional judgment; Large language models; Narrative information*

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Corporate social responsibility and tax compliance: empirical evidence from Euro Stoxx 50 companies

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Abstract. The increasing integration of sustainability in the European context, driven by the Corporate Sustainability Reporting Directive (CSRD) and the European Sustainability Reporting Standards (ESRS), has heightened the visibility of taxation as a dimension of governance and social responsibility. Nevertheless, the relationship between tax transparency and actual tax behavior remains ambiguous, potentially reflecting either a substantive commitment to responsible tax practices or symbolic legitimacy strategies. The present research analyses the relationship between the integration of taxation into the discourse on Environmental, Social and Governance (ESG) aspects, and the tax behavior of companies included in the Euro Stoxx 50 index. To this end, a mixed-methods approach is adopted, combining a systematic literature review, narrative analysis, content analysis of sustainability reports to construct a Tax Disclosure Index (TDI), and empirical analysis of panel data, which relates the TDI and ESG performance to the Effective Tax Rate (ETR). The results are expected to assess the extent to which higher levels of tax disclosure are associated with more responsible tax behavior proxies. This will contribute to the debate on taxation and corporate sustainability, as well as to the development of tax transparency metrics.

Keywords. *ESG disclosure; Tax transparency; Effective Tax Rate; Tax disclosure index; Decoupling*

Power, governmentality and accounting in Braga cathedral (18th and 19th centuries): a Michel Foucault

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Abstract. This doctoral project aims to analyse the role played by accounting in the social dimensions and exercise of power within the Archdiocese of Braga between the second half of the eighteenth century and the first half of the nineteenth century. Drawing on a critical and interpretative perspective of accounting, distanced from conventional accounting theories, the study considers accounting documents not merely as financial records, but as instruments of visibility, control, legitimation, discipline, and governmentality.

The research focuses on the Cathedral of Braga, particularly on the relationships between the Mitre, the Chapter, and central political power, seeking to understand how these bodies and institutions established relations of dependence, influence, resistance, and manipulation. The main research question guiding the thesis is: what role did accounting play in the social dimensions and exercise of power in the Archdiocese of Braga during the eighteenth and nineteenth centuries?

The thesis will be structured as a three-article dissertation. The first article will analyse the power relations between the Mitre and the Chapter. The second will examine the relationships between these ecclesiastical bodies and central political power. The third will investigate how accounting reflected and materialised these influences in accounting books. Methodologically, the study will draw on accounting history, qualitative and interpretative research, content analysis, supported by archival sources and specialised literature. Theoretically, the research will be guided by Michel Foucault's concepts [1, 2, 3], namely power, power-knowledge, and governmentality, aiming to contribute to the history of accounting and religious institutions in Portugal.

Keywords. *Accounting history; accounting and religion; governmentality; power relations; archdiocese of Braga*

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Determinantes e benefícios da adoção de sistemas de custeio: uma análise empírica às grandes empresas portuguesas

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Resumo. No atual cenário de competitividade global e dinamismo tecnológico, os sistemas de custeio assumem um papel fundamental na sustentabilidade estratégica e na precisão da informação financeira das organizações. Esta investigação analisa os determinantes e os benefícios da adoção de sistemas de custeio nas grandes empresas portuguesas, procurando colmatar a escassez de estudos nacionais que abordem simultaneamente estas duas vertentes.

O problema central reside no persistente desfasamento entre as prescrições da literatura académica, que preconiza modelos contemporâneos como o *Activity-Based Costing* (ABC), e a realidade operacional, marcada por uma resistência à mudança e preferência por métodos tradicionais. Fundamentado nas Teorias da Contingência e da Inovação, o estudo utiliza uma metodologia dividida em três ensaios: uma revisão sistemática da literatura e dois ensaios quantitativos. A recolha de dados é efetuada através de questionários dirigidos aos responsáveis financeiros das maiores empresas em Portugal.

Através de técnicas multivariadas, o trabalho avalia como os fatores contingenciais influenciam a escolha e permanência dos sistemas. Adicionalmente, investiga-se a utilidade percebida destes modelos na eficiência operacional e inovação destas empresas. Espera-se que os resultados proporcionem uma compreensão profunda da eficiência da gestão de custos no tecido empresarial português, oferecendo contributos teóricos e implicações práticas relevantes para a contabilidade de gestão.

Palavras-chave. *Sistemas de custeio; Fatores contingenciais; Activity-Based-Costing; Grandes empresas; Portugal*

[PDCEA] Thesis project defense in environmental sciences and engineering

Environmental and socioeconomic sustainability assessment of valorisation pathways of agri-food losses: towards a circular economy.

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Abstract
Although the world's population is growing more slowly than in the past half-century, the increase remains significant and places a growing pressure on global food systems. Ensuring sufficient food availability for a larger population will require more efficient resource use, reduced food losses, and the development of sustainable production practices. Food loss is a significant challenge to achieving sustainability and circularity in agrifood systems. According to the European Commission, in 2023, total food loss in the EU during primary production amounted to 5.6 million tonnes of fresh mass. Moreover, it is estimated to account for 8-10% of global greenhouse gas emissions. The food supply chain is a complex and dynamic system, influenced by a combination of environmental, economic, technological and institutional factors. Climate change, as well as technological innovation or operational inefficiencies, policy and framework and various other factors collectively determine the agricultural productivity and sustainability. Accurate, careful, and detailed quantification of food loss is crucial for determining the type and composition of materials and for data collection across different production stages.
This project aims to identify and characterise food losses and by-products generated across the agri-food sector, and to evaluate their potential use as feedstock for the development of new food products. It will further assess the environmental and socioeconomic sustainability of these valorisation pathways, with the broader goal of improving circular economy performance and promoting industrial symbiosis among closely located agro-industrial facilities.

Keywords. *Food loss, Life Cycle Assessment, Sustainable agrifood systems, valorisation*

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Seaweed futures: a life cycle thinking framework for sustainable food innovation

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Abstract. Seaweed is a marine resource for sustainable food innovation, and seaweed-based food products are promising options for sustainable, nutritious and diversified food systems, aligning with European priorities for a strong and sustainable algae sector [1]. However, assessments of seaweed-based foods remain fragmented, with environmental, nutritional and socioeconomic dimensions addressed separately or only partially integrated, limiting comparisons with conventional alternatives and evidence needed to support responsible innovation. This research aims to develop and apply an integrated life cycle thinking framework for seaweed-based food products. The framework will combine a prospective life cycle assessment component to evaluate future scenarios of technological development, market evolution, energy mixes and policy contexts [2], a seaweed-specific nutritional footprint approach, linked to life cycle assessment and incorporating nutrient profiling, to link life cycle environmental impacts with nutritional performance [3], and a socioeconomic evaluation focused on production costs, value creation and employment potential. It will be applied to seaweed-based food prototypes, including rice balls with varying seaweed incorporation, and compared with conventional alternatives. Both wild-harvested and cultivated species will be considered, namely *Ulva* spp., *Porphyra* spp., *Gracilaria* spp. and *Saccharina* spp. Partner-provided data will be complemented by literature and life cycle databases to support cradle-to-gate comparison, scenario development and sensitivity analysis. In parallel, consumer studies will examine perception, acceptance and willingness to pay for seaweed-based foods, considering psychological, sensory, social and economic drivers and barriers, given the relevance of consumer responses to foods containing seaweed [4]. Expected outcomes include an integrated framework, a seaweed-specific nutritional footprint tested for applicability and robustness, comparative evidence on environmental, nutritional and socioeconomic performance, and recommendations for product development, communication and market positioning. By linking life cycle-based sustainability assessment with consumer and market insights, this research contributes to the responsible development of seaweed-based foods and to healthier, more resilient and sustainable food systems.

Keywords. *Macroalgae; Prospective life cycle assessment; Nutritional footprint; Consumer acceptance; Willingness to pay*

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Firefly environmental education: serious games, game base learning and gamification – developing a board game

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Abstract. This research delves into the potential of board games as transformative tools for environmental education, namely Fireflies. The present study seeks to verify if board games and serious games are a viable educational tool in formal and informal education targeting adults (over 27 years old) and young adults (18-26 years old). Despite growing interest, serious games often face difficulties in clearly communicating complex climate science and achieving intended learning outcomes. This study focusses upon established frameworks in the literature to identify key factors in the usage of board games as educational tools as well as identifying and analysing the corresponding challenges and shortcomings. This study is guided by four complementary objectives (SO1-SO4). SO1 concerns the design and development of a firefly-themed gamification tool for adult education for sustainability, employing an iterative, user-centred design methodology in which prototype mechanics are refined across successive playtesting cycles. SO2 addresses the construction and validation of an accompanying rulebook through expert review and structured comprehension testing with representative players. SO3 employs a quasi-experimental pre-post design to assess the game's educational impact, measuring changes in players' knowledge, attitudes, and awareness regarding firefly ecology, soil health, and environmental sustainability through validated psychometric instruments administered before and after gameplay sessions. SO4 situates these findings within a broader comparative evaluation of environmentally themed board games as instruments for education for environmental sustainability and soil literacy. The project spans three years (2026–2028) and is organized into five interrelated strands of activity. Its work plan comprises a series of discrete tasks, each aligned with one or more of the projects core objectives. Anticipated outcomes include enhanced environmental awareness and more favourable attitudes toward biodiversity conservation among adult audiences, together with empirical evidence regarding the effectiveness of board games as tools for improving knowledge of biodiversity, soil health, and ecosystem conservation.

Keywords. *Serious games; Gamification, Game base learning; Adult education, Environmental education*

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Valorisation of pyrolysis bio-oil aqueous fractions for bio-herbicide development

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Abstract. The widespread use of synthetic herbicides in agriculture as a crop protection practice has raised serious environmental concerns, including ecosystem disruption and the emergence of herbicide-resistant weed species, motivating the need for sustainable alternatives. Aqueous fractions of bio-oil, produced from the pyrolysis of residual biomass, can represent a promising bio-herbicidal option due to their unique chemical composition, which is significantly influenced by pyrolysis temperature and feedstock type. However, limited systematic research has linked the physicochemical characteristics of these fractions to their biological effects on plants and practical applicability. This doctoral research aims to evaluate the bio-herbicidal potential of bio-oil aqueous fractions, while hypothesising that pyrolysis conditions and feedstock type significantly influence the physicochemical profile of bio-oil aqueous fractions, and that these differences determine their herbicidal selectivity and agronomic applicability. To this end, it will combine physicochemical characterisation of bio-oil batches produced under contrasting parameters, progressive biological evaluation, and further techno-economic assessment towards a potential scale-up of the solution. The results are expected to contribute to the development of sustainable crop protection strategies and to provide a science-based approach for the valorisation of residual biomass within a Circular Economy context.

Keywords. *Bio-herbicides; Pyrolysis; Bio-oil aqueous fractions; Residual biomass*

Framework for sustainable ceramic tableware production

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Abstract. The ceramic tableware industry is under tremendous pressure to adopt sustainable manufacturing approaches because of its longstanding use of energy-intensive firing methods and substantial resource usage. Therefore, in order to tackle these problems, a comprehensive framework is introduced within this doctoral study that seeks to support the design of more sustainable production of ceramic tableware products. The proposed system will be structured around three major lines: Life Cycle Assessment (LCA), Additive Manufacturing (AM), and Artificial Intelligence (AI).

Firstly, the framework will employ LCA as a core diagnostic and monitoring approach that helps to identify areas for improvement, monitor the flow of resources and implement necessary eco-design practices to reduce environmental impacts associated with the process. Second, the proposed framework will examine the environmental performance of AM as an alternative manufacturing process. Using life cycle assessment tools, the study will determine the benefits of AM's geometrical flexibility, specifically its ability to reduce the ecological footprint by adopting lightweight structures and minimizing waste of materials. Finally, the application of AI within the framework can be focused on Optimizing the thermal processing of the new material and products. Instead of adopting the conventional trial and error techniques, the process will involve developing machine learning methods aimed at predicting and generating the optimal firing curves for the new ceramic material formulations.

By incorporating environmental measurement, innovation assessment, and information, this doctoral research aims to establish a holistic knowledge base for the ceramic tableware industry. Ultimately, the research is expected to provide the critical data and decision support tools that will aid in the creation of more environmentally friendly production systems in the future.

Keywords. *Ceramic Tableware; Sustainable Production Systems; Life Cycle Assessment; Additive Manufacturing; Artificial Intelligence; Process Optimization*

Estratégias de literacia e comunicação para a gestão de resíduos urbanos

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Abstract. A gestão de resíduos urbanos (RU) atravessa, em Portugal, um momento de tensão estrutural. Em 2024, foram produzidas 5 550 mil toneladas de RU, das quais 54% foram depositadas em aterro, e a taxa de preparação para reutilização e reciclagem (PPRR) situou-se em 37% — um desvio de 18 pontos percentuais face à meta europeia de 55% para 2025 [1]. Num contexto em que o PERSU 2030 [2] e o Plano de Ação TERRA [3] reconhecem a sensibilização da população como alavanca crítica do sistema, a investigação evidencia que o principal fator limitante não é a capacidade técnica das infraestruturas, mas a participação efetiva e qualificada do cidadão na separação na fonte.

O presente projeto de doutoramento tem como objetivo analisar o papel da literacia ambiental e da qualidade da comunicação institucional enquanto fatores determinantes do comportamento de separação seletiva dos cidadãos em Portugal. Para o efeito, a investigação procura caracterizar o nível de literacia ambiental da população, identificar as barreiras cognitivas, mitos e equívocos que condicionam a separação na fonte e examinar o papel da transparência económica enquanto fator motivacional para a mudança comportamental. Neste enquadramento, testam-se hipóteses relativas ao impacto da simplificação pedagógica, da transparência económica e da comunicação multimodal na eficácia comunicacional, partindo do pressuposto de que estas dimensões, articuladas entre si, produzem maior impacto comportamental do que as campanhas informativas convencionais.

Espera-se, assim, desconstruir os principais equívocos que condicionam a separação seletiva e produzir um quadro de recomendações operacionais dirigido às entidades gestoras de resíduos, aos municípios e aos decisores de política pública, com vista à conceção de estratégias de comunicação ambiental mais eficazes, inclusivas e adequadas à diversidade territorial e cultural portuguesa.

Keywords. *literacia ambiental; comunicação ambiental; resíduos urbanos; separação seletiva; mudança comportamental*

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Urban proximity, micromobility, and air quality: a spatial health impact assessment framework for Lisbon

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Abstract. Transport systems, circular mobility principles, and micro-scale spatial planning are increasingly interconnected, creating complex sustainability challenges for contemporary urban environments. Despite this interconnection, current approaches often examine mobility, urban form, environmental impacts, and public health outcomes in isolation, thereby limiting their integrative capacity and obscuring the complete causal chain from spatial intervention to quantified health outcomes, with consequent constraints on transferability and policy applicability [1]. This doctoral research proposes a novel circular mobility framework that conceptualises travel time and urban space currently lost to motorised transport as recoverable urban resources through proximity-oriented planning strategies and modal shifts toward micromobility. The proposed framework combines GIS-based spatial accessibility analysis, micromobility scenario modelling, machine-learning approaches for travel demand prediction, transport-related pollutant emissions estimation, and WHO-aligned health impact assessment methodologies to quantify potential reductions in emissions and avoidable premature mortality attributable to modal shift toward micromobility. Lisbon was selected as the case study due to its pronounced car dependency, limited modal share of active transport, spatial inequalities in access to essential urban services [2], established bike-sharing infrastructure, and the availability of high-resolution mobility, environmental, and air-quality datasets. The framework directly supports SDGs 3, 9, 11, and 13 by evaluating the role of active transport infrastructure in enabling modal shifts and by quantifying the resulting health co-benefits from reduced car dependency [3]. The results will be made available in an open-source toolkit to allow for replication in other data-rich cities and to provide urban planners with evidence-based tools to inform sustainable, health-oriented mobility transitions.

Keywords. *Circular Mobility; 15-Minute City; Micromobility; Health Impact Assessment; Sustainable Transport; Machine Learning.*

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Avaliação da qualidade do ar e identificação de estratégias de mitigação em ambientes urbanos complexos através de modelação de alta resolução

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Abstract. A poluição atmosférica urbana constitui um dos principais desafios ambientais e de saúde pública, exigindo ferramentas avançadas para compreender a sua variabilidade espaço-temporal e apoiar a definição de políticas de mitigação eficazes [1]. Este projeto propõe o desenvolvimento de uma abordagem integrada para a avaliação da qualidade do ar em ambientes urbanos complexos, combinando análise observacional de longo prazo, modelação atmosférica de alta resolução e avaliação quantitativa de cenários de mitigação. Será implementado um sistema de modelação baseado nos modelos WRF, CHIMERE e URBAIR, permitindo simular a dispersão de poluentes à escala urbana. Como elemento distintivo, o projeto integra uma comparação internacional entre áreas urbanas em Portugal e no Brasil, permitindo analisar a influência de diferentes contextos climáticos, urbanos e socioeconómicos na dinâmica da poluição e na eficácia de medidas de mitigação. Os resultados contribuirão para o desenvolvimento de ferramentas de apoio à decisão e para políticas públicas mais eficazes, alinhadas com abordagens centradas na gestão integrada da qualidade do ar [2].

Keywords: *Dispersão de poluentes; Análise espaço-temporal; Cenários de emissões; Áreas urbanas; Estratégias de mitigação.*

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Mapping the circular city: a spatial framework for industrial-urban water symbiosis

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Abstract. The transition towards a water circular economy is essential for long-term resource sustainability, yet current frameworks lack the spatial integration needed for macro-level circularity. While existing research addresses plant-scale optimisation, non-spatial city metabolism indicators [1, 2], and localised industrial symbiosis [3], current tools remain detached from spatial planning, limiting the capacity to identify where cross-sector water exchanges are technically and economically feasible. This research develops a spatially based evaluation framework to bridge this scale gap by identifying urban-industrial water symbiosis and quantifying its contribution to city-scale water circularity. By integrating Material Flow Analysis, multidimensional circularity metrics, and GIS-based network optimisation, the study maps urban water metabolism and identifies unexploited cross-sector reuse pathways. Through scenario modelling of policy levers, the research evaluates how regulatory and economic constraints influence the feasibility of circular interventions. It is expected that the framework will successfully identify optimal infrastructure pathways that maximise wastewater reuse and minimise freshwater source depletion. Furthermore, scenario analysis is expected to reveal the key economic and regulatory thresholds required to make macro-level symbiosis viable. Ultimately, this research delivers a decision support tool providing actionable, spatial guidance to implement a water circular economy at the city scale.

Keywords: *Water Circularity; Industrial Symbiosis; Material Flow Analysis; City-scale planning*

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Carbon dioxide capture and injection in anaerobic digestion to enhance methane production

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Abstract.
Anaerobic digestion is a mature technology for stabilizing organic residues and recovering renewable energy as biogas, but raw biogas still contains a substantial CO_2 fraction that typically requires downstream upgrading before use as high-value biomethane. Conventional upgrading is effective, yet it adds cost, energy demand, and operational complexity, especially for decentralized and medium-scale waste or wastewater treatment systems. This PhD project explores an integrated alternative in which the anaerobic digester itself is used as a platform for CO_2 retention, biological conversion, and methane enrichment. The work focuses on two complementary strategies: CO_2-pressurized methanogenic reactors and biochar-supported reactors designed to strengthen microbial cooperation and process stability. The central research question is whether pressure, dissolved CO_2 availability, biochar properties, and microbial pathways can be controlled together to improve methane purity, methane productivity, carbon retention, and reactor stability. Pressurized operation can increase CO_2 dissolution and shift carbon between the gas and liquid phases, but methane enrichment alone does not prove biological CO_2 conversion [1,2]. Biochar may contribute through buffering, microbial attachment, inhibitor adsorption, mineral release, and electron-transfer-related pathways, although its effect depends strongly on material properties and digester conditions [3]. The project will combine lab-scale reactor experiments, gas and liquid-phase monitoring, biochar characterization, microbial interpretation, and carbon-balance analysis. Particular attention will be given to methane yield, methane productivity, gas composition, dissolved CH_4/CO_2, dissolved inorganic carbon, pH, alkalinity, volatile fatty acids, sulfide, ammonia, microbial response, and biochar ageing. By comparing pressure-based, biochar-mediated, and selected combined conditions, the study aims to distinguish physical CO_2 retention from true CO_2-to-CH_4 conversion and to identify whether pressure and biochar act synergistically, independently, or antagonistically. The expected outcome is an experimental basis for designing anaerobic digestion systems that recover more biomethane from organic residues, reduce greenhouse-gas losses, and support more energy-neutral waste and wastewater treatment.

Keywords: anaerobic digestion; biomethane; CO_2 retention; CO_2 conversion; pressurized anaerobic digestion; biochar; methane enhancement; carbon balance.

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Hydrogen for ceramic decarbonisation: a Life Cycle Sustainability Assessment

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Abstract. The use of hydrogen (H_2) in the ceramic sector is a promising, complementary solution to help achieve the European goals of reducing dependence on fossil fuels and achieving carbon neutrality by 2050 [1,2]. This is highly relevant for the ceramic sector, which is highly energy-intensive, especially when using natural gas for high-temperature thermal processes such as firing [1]. However, H_2 adoption lacks a whole-value-chain assessment that integrates environmental, economic, and social dimensions. This thesis aims to develop and apply a Life Cycle Sustainability Assessment (LCSA) framework, integrating the above-mentioned dimensions to assess H_2/natural gas blends in ceramic kilns [3, 4], and to compare grey, green, and blue H_2 (produced from renewable sources or SMR with/without carbon capture). The assessment will consider different ceramic types, such as floor tiles, earthenware, and stoneware, as they involve distinct kiln technologies, firing profiles, and product quality constraints. A stakeholder-informed roadmap will also be developed, aiming to identify, not only limitations and constraints for a successful H_2 implementation in the ceramic industry but also to help defining strategies to support sector acceptance and adoption of H_2.

Keywords. *Carbon neutrality; hydrogen value chain; clean energy; energy-intensive; ceramic industry; Life Cycle Sustainability Assessment;*

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Multi-objective optimization (energy, greenhouse-gas emissions, cost) of upgrade scenarios for selected Portuguese WWTPs to meet both treatment and energy-neutrality targets

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Abstract. This thesis will examine the transition of Portuguese wastewater treatment plants toward energy neutrality as a strategic requirement shaped by the recast Urban Wastewater Treatment Directive (UWWTD) [1], rather than as a purely technical upgrade problem. WWTPs are increasingly expected to contribute not only to pollution control but also to broader sustainability goals. Current literature often emphasizes short-term operational improvements; however, this study will argue that a more fundamental limitation lies in the limited integration of energy, greenhouse gas emissions, and life-cycle costs into long-term upgrade sequencing between 2030 and 2045 [2]. For this reason, the research will develop an integrated decision framework designed to support more robust and context-sensitive planning. The framework will incorporate site-specific factors that are often insufficiently represented in generic international benchmarks, including local temperature conditions and electricity-grid decarbonization trajectories [2][3]. A hybrid modelling approach will be employed to combine the computational efficiency needed for multi-scenario evaluation with the process transparency of mechanistic models [2][3]. This will allow the identification of Pareto-optimal alternatives across competing objectives, rather than relying on a single solution that may be unrealistic under policy and operational constraints [2]. By evaluating alternative pathways involving advanced aeration control, sludge-to-energy recovery, and renewable integration, the study will highlight the trade-offs inherent in wastewater infrastructure planning and the importance of avoiding stranded investments. The resulting analysis will provide utilities and policymakers with a structured basis for comparing feasible upgrade options that align treatment compliance, economic feasibility, and the 2045 energy-neutrality target. Overall, the thesis will reframe wastewater infrastructure planning as a policy-aware sustainability challenge tailored to the constraints and opportunities of Portuguese wastewater systems.

Keywords. *Sustainable infrastructure; Pareto optimization; Process integration; Emissions accounting; Scenario analysis*

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Air Pollution in the Niger Delta, Nigeria: Sources Apportionment, Exposure Pathways, and Mitigation Strategies

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Abstract

Air pollution in the Niger Delta region of Nigeria represents one of Africa's most pressing environmental health crises, driven by decades of oil exploration, gas flaring, artisanal refining, and urban emissions. In this context, the main objective of this work is to evaluate the contribution of emission sources to air pollution levels, assess their impacts on human health, and recommend strategic mitigation measures to support policymaking. To this end, a comprehensive methodological framework will be developed, comprising four complementary components. First, a literature review will be conducted to examine the main sources of air pollution, exposure pathways, and associated health impacts in the Niger Delta region. Second, air quality and population exposure assessments will be performed through environmental data collection and the application of air quality and exposure modelling approaches, including source apportionment techniques to identify and quantify the contribution of different emission sources to ambient air pollution levels. Finally, mitigation strategies will be evaluated to identify effective measures for reducing pollutant emissions and minimizing population exposure. The first component, consisting of a systematic literature review, has already been completed and identified particulate matter (PM), nitrogen oxides (NOx), and sulfur oxides (SOx) as the most frequently investigated pollutants, with gas flaring and road transport emissions representing the dominant pollution sources. Artisanal refining activities were also associated with recurrent “black soot” episodes reported across the region. Inhalation of ambient particulate matter was identified as the main exposure pathway, while the findings also highlighted significant limitations in current monitoring and regulatory frameworks. The results of the proposed work are expected to improve the understanding of air pollution dynamics in the Niger Delta and provide scientific evidence to support air quality management and environmental policymaking in the region.

Climate-smart Mediterranean pastures: engineering soil productivity and climate adaptation through biochar-plant synergies (SYNSOIL)

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Abstract. Climate change is increasingly compromising soil productivity and other soil-based ecosystem services in Mediterranean rainfed sown biodiverse pastures, particularly through reductions in soil water availability, during plant establishment. SYNSOIL proposes an interdisciplinary soil-engineering strategy to improve the productivity and climate resilience of Portuguese legume-rich biodiverse pastures through the combined application of biochar and a newly developed deep-rooting perennial wheatgrass (Kernza®). Biochar, a carbon-rich product derived from biomass pyrolysis, has been shown to improve soil structure, water retention, nutrient availability and soil organic carbon dynamics, while also enhancing biological activity and crop productivity [1,2]. At the same time, perennial wheatgrass demonstrates substantially deeper root systems than conventional pastoral plant species, thus potentially contributing further to improving soil structure and drought resilience.

The project aims to evaluate whether synergistic interactions between biochar and perennial wheatgrass can enhance soil health, pasture productivity and climate-change adaptation, without compromising biodiversity or livestock nutrition. Particular attention will be given to soil hydrology, nutrient dynamics, biomass yield and forage nutritional quality for livestock, under current and projected climate scenarios. Existing studies indicate that biochar may increase legume competitiveness and biological nitrogen fixation in mixed pastures [3,4], although its long-term ecological impacts in biodiverse Mediterranean systems remain poorly understood.

SYNSOIL builds upon ongoing interdisciplinary collaborations and previous FCT- and EU-funded projects developed by the supervisory team, integrating existing infrastructures and expertise to ensure methodological feasibility and scientific impact. By addressing current knowledge gaps in sustainable pasture management, the project seeks to support decision-making towards more resilient agroecosystems aligned with the European Green Deal and the United Nations Sustainable Development Goals 13 and 15.

Keywords. *Soil health; Biodiverse pastures; Livestock nutrition; Sustainability; Functional biodiversity*

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Occupational exposure to airborne micro(nano)plastics in a textile industry: chemical characterisation, oxidative potential and respiratory dose modelling

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Abstract. Airborne micro(nano)plastics (MNPs) are emerging contaminants of concern in occupational environments, yet their exposure levels, chemical characteristics, and toxicological relevance remain insufficiently understood [1]. Textile-related activities are important potential sources of airborne synthetic fibers and plastic fragments through processes such as cutting, abrasion, mechanical handling, and material transport [2]. Therefore, this project aims to characterise occupational exposure to microplastics suspended in the air in a large textile industrial facility, integrating an intensive monitoring campaign with advanced physicochemical and toxicological analyses. The air monitoring campaign took place between February and March 2026, in an industry located in the city of Viana do Castelo, Portugal. During the campaign, particulate matter with diameter lower than 10 and 1 µm (PM_{10} and PM_1, respectively) samples were collected using high-volume gravimetric samplers (MCV-model-CAV-A/mb) equipped with 150 mm diameter quartz-filters. Simultaneously, continuous monitoring of parameters related to thermal comfort and ventilation (CO_2, temperature, and relative humidity) was carried out using the IAQ-Calc-7545 (TSI®) device. Additionally, continuous monitoring of size-segregated particulate matter was performed using the Mobile Environmental Dust Monitor Model-EDM-164. For the next stages of this work, the following activities will be carried out: (i) Correction of the continuously monitored PM data using the gravimetric method; (ii) Physicochemical characterisation of the PM samples, based on analyses of organic and elemental carbon, water-soluble ions, and elements, as well as polymers and additives (Pyr-GC-Orbitrap-MS); (iii) Evaluation of the oxidative potential of the filters using AA and DTT assays, complemented by simulated lung fluid extractions; (iv) Identification of the determinants of oxidative reactivity and the deposited dose, through multivariate statistical modelling and dosimetry approaches (MPPD/ExDoM2). This project is expected to contribute to discussions on the presence of MNPs in occupational environments in the textile industry, as well as to the development of mitigation actions for this type of emission.

Keywords: *Micro(nano)plastic; Occupational exposure; Textile industry; Oxidative potential; Respiratory dose modelling.*

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[PDEC] Thesis project defense in cultural studies

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Supervisor: Dr. Rita Himmel

Culture As A Tool For Shaping National Identity in Northern Nigeria: Examining the Role Of The Durbar And Argungu Festivals.

ABSTRACT

This research examines the role of culture in shaping national identity in Northern Nigeria, focusing on two major festivals: the Durbar in Kano and the Argungu International Fishing and Cultural Festival in Kebbi State. These festivals serve as critical junctures where identity is performed, negotiated, and transformed. During these events, communities in Northern Nigeria collectively articulate the meaning of their shared identity, determine which traditions hold significance, and decide what should be transmitted to future generations. A defining moment at the Kano Durbar occurs when the kakaki trumpets sound, their resonant notes filling the air as horses adorned in scarlet and gold charge toward the Emir's palace and halt precisely at the designated location. As the dust settles and the crowd's collective anticipation subsides, the event takes on heightened significance. This research is grounded in three principal theoretical perspectives: Stuart Hall's assertion that cultural identity is constructed through representation and shaped by historical and power dynamics; Judith Butler's theory that identity is constituted through repeated performative acts rather than being an inherent attribute; and Anthony Smith's emphasis on the role of deep memories, myths, and symbols in endowing cultural practices with meaning and affective resonance. Additionally, the study draws on insights from Gramsci and Althusser to elucidate how certain interpretations of Northern Nigerian identity achieve dominance, while others are marginalised. This research uses a qualitative approach with three main methods: focus group discussions with young people and key stakeholders at both festival sites, semi-structured interviews with older community members and institutional actors, and a review of selected documents such as colonial records, government cultural policies, print media from the last sixty years, and school curricula. The data will be analysed using reflexive thematic analysis. This study offers three primary contributions. Theoretically, it extends the Cultural Studies framework, particularly Butler's theory of performativity, to the underexplore context of Northern Nigerian cultural politics. Empirically, it provides detailed comparative analyses of how two major festivals shape and negotiate. In practice, it formulates policy recommendations grounded in a nuanced understanding of the processes through which traditional traditions are maintained and transformed within communities. The central argument posits that identity is not merely displayed at these festivals but is actively constructed by participants as they engage with and reinterpret traditions.

Keywords: Cultural Studies Festivals Identity National Identity

Palavras-chave

Estudos Culturais; Oligarquias algorítmicas; Plataformas digitais; Poder algorítmico; Mediação cultural.

II — Sumário

O presente projeto de investigação propõe uma análise crítica das transformações contemporâneas da mediação cultural e das formas de exercício do poder simbólico no contexto das plataformas digitais. Inscrita no campo dos Estudos Culturais e dialogando com contributos da teoria crítica, da sociologia digital, da filosofia da tecnologia e da economia política da comunicação, a investigação procura compreender de que modo as grandes plataformas tecnológicas se afirmam como estruturas oligárquicas capazes de influenciar os processos de circulação cultural, reconhecimento público e produção de relevância social.

Partindo do entendimento de que os algoritmos deixaram de desempenhar funções meramente técnicas de recomendação ou classificação, o projeto analisa a forma como estes sistemas passaram a ocupar uma posição central na organização da experiência social contemporânea. Plataformas como TikTok, Instagram, YouTube, X ou Facebook intervêm diretamente nos modos de circulação dos discursos e da informação, condicionando aquilo que ganha visibilidade pública e o que tende a permanecer marginalizado no espaço digital.

Neste contexto, a noção de "oligarquias algorítmicas" procura designar formas emergentes de concentração de poder associadas ao controlo das infraestruturas digitais, dos sistemas de recomendação e das arquiteturas contemporâneas de circulação informacional. As plataformas digitais concentram hoje capacidades sem precedentes de mediação simbólica, influenciando hierarquias culturais, dinâmicas de reconhecimento e formas de participação pública.

Mais do que simples instrumentos tecnológicos, os sistemas algorítmicos serão compreendidos como dispositivos culturais capazes de reorganizar centralidades discursivas, modular regimes de atenção e influenciar mecanismos contemporâneos de hegemonia simbólica. A investigação procurará, assim, compreender criticamente os modos pelos quais as arquiteturas digitais intervêm na organização da circulação cultural e contribuem para a configuração da experiência social contemporânea.

Entre a formação e a prática: vivências e negociações sobre corpo e género no ensino superior em dança

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Abstract. Esta investigação visa compreender as experiências de estudantes do ensino superior em dança em Portugal, analisando como padrões corporais, estéticos e de género são vivenciados, incorporados e negociados ao longo da formação. Sob a perspetiva dos Estudos Culturais, a experiência estudantil é entendida como espaço de produção de sentidos, valores e hierarquias corporais e estéticas. Será adotada abordagem qualitativa, baseada em entrevistas em profundidade com cerca de dez estudantes finalistas de licenciaturas em dança em Lisboa. Além disso, serão realizados cerca de dois laboratórios pedagógicos com os participantes. A análise buscará examinar como estudantes experienciam exigências corporais, padrões estéticos e expectativas de género ao longo da formação em dança, tanto nas disciplinas e conteúdos formais quanto nas práticas e relações cotidianas do ambiente académico. Pretende-se compreender de que modo os estudantes internalizam, adaptam ou contestam normas institucionais e expectativas sociais, evidenciando estratégias de negociação e resistência. Os resultados poderão contribuir para a identificação de lacunas curriculares e para o desenvolvimento de propostas pedagógicas mais inclusivas, com uma perspetiva crítica sobre os ideais de género e de corpo na dança.

Keywords. *Estudos Culturais; Corpo; Género; Dança.*

Visibilidade negociada: género, autopromoção e poder nas redes sociais

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Abstract. O presente projeto tem como objeto as formas de visibilidade e de negociação do capital simbólico por parte das atrizes portuguesas nas suas redes sociais, em particular a forma como articulam o seu percurso artístico com as exigências da visibilidade mediática, tendo em conta a precariedade algorítmica. Esta tensão cultural manifesta-se no modo como as atrizes estão perante uma tensão entre o polo autónomo e o heterónomo, e como negoceiam as suas expectativas tendo em conta a presença, ou ausência, de campanhas de publicidade nas suas redes sociais. Daqui surge a pergunta de investigação, de como é que as atrizes portuguesas constroem o seu posicionamento, face às campanhas publicitárias nas suas redes sociais, e de que modo é que essas negociações revelam e/ou reproduzem relações de poder no campo cultural português contemporâneo. Para tal, irá articular-se a teoria de campo de Bourdieu, com o trabalho de visibilidade nas redes sociais de Abidin e a precariedade algorítmica de Duffy, através de uma abordagem metodológica qualitativa que combinará netnografia com entrevistas semiestruturadas, articuladas através da análise de conteúdo. Deste modo, o projeto propõe-se a delinear uma dissertação que futuramente contribua para um campo ainda pouco explorado na literatura portuguesa, ao analisar as formas de visibilidade e de negociação de capital simbólico de atrizes nas redes sociais digitais e quais estratégias através das quais as atrizes gerem a tensão entre legitimidade artística e visibilidade comercial.

Keywords. *Estudos Culturais; Estudos de Género; Visibilidade Digital; Atrizes; Capital Simbólico; Poder*

As condições das práticas de cuidado: poder, economia e ética – o caso de estudo Museu Nacional Soares dos Reis

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Abstract. A presente proposta pretende analisar como as práticas de cuidado do Museu Nacional Soares dos Reis (MNSR) operam na articulação entre a ética política do cuidado de Joan Tronto [1] e as analíticas de poder dos Estudos Culturais através de Stuart Hall [2], examinando como o cuidado é disputado, organizado e vivenciado na atual conjuntura neoliberal [3]. Esta investigação confronta a legitimação institucional com as condições de produção dos programas comunitários do MNSR "Arte e Saúde", "Projeto SER" e "Agora Nós!". Através de um desenho metodológico qualitativo com base no método WPR de Bacchi [4], a recolha de dados combinará análise de discurso institucional, entrevistas semiestruturadas e grupos de foco com mediadores, decisores e participantes, e observação participante, pretendendo-se identificar dinâmicas de poder e estruturas de governação, vinculando diretamente os métodos aos eixos dos trabalhadores, da instituição e dos públicos. A desconstrução dos símbolos e das representações de hegemonia, definida por Stuart Hall [2] como a fixação discursiva de sentidos em disputa, mapeará ainda a análise da implementação da prescrição cultural no ecossistema de saúde e bem-estar comunitário destes programas. Confrontando o discurso institucional com as experiências vividas e com o trabalho afetivo possivelmente invisível, aqui operacionalizado como a naturalização hegemónica e a exploração económica das competências relacionais dos mediadores e dos públicos, que possam atuar como amortecedores da precarização, avaliar-se-á empiricamente a fronteira instável entre práticas de cuidado emancipatórias e potenciais lógicas de *carewashing* sem as predefinir, ou seja, uma mobilização performativa do discurso do bem-estar sem correspondência nas condições materiais, laborais e relacionais que o sustentem. Pretende-se, por isso, produzir um diagnóstico crítico que, ao desmontar a hipótese de naturalidade de uma ordem institucional e revelar a contingência histórica das suas assimetrias [3], possa também identificar forças de resistência capazes de propor novas articulações democráticas de corresponsabilidade no espaço museológico.

Keywords. *Cuidado; Hegemonia; Trabalho afetivo; Carewashing; Mediação cultural; Estudos culturais*

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Maternidade, biopolítica e nação: genealogias autoritárias de género na direita radical contemporânea

O presente projeto de tese analisa como discursos contemporâneos da direita radical reconfiguram imaginários autoritários de maternidade e biopolítica no Instagram da AfD e do CHEGA. A maternidade é entendida como dispositivo discursivo e visual através do qual se articulam natalidade, crise demográfica, proteção da infância, família tradicional, género e nação.

A investigação mobiliza o Terceiro Reich e o Estado Novo português como enquadramentos genealógicos, distinguindo a "mãe racial" nazi, ligada à reprodução biológica, racial e nacional, e a "mãe cristã" salazarista, associada à família, à domesticidade, ao catolicismo e à ordem moral. Estes modelos são usados como quadros analíticos, não para estabelecer continuidades diretas, mas para observar a rearticulação de repertórios autoritários em ambientes digitais.

Inserido nos Estudos Culturais, o projeto articula estudos de género, biopolítica, autoritarismo, direita radical e comunicação digital. Metodologicamente, recorre à Análise Crítica do Discurso Multimodal, à netnografia digital e à análise documental genealógica. O corpus será composto por publicações de Instagram da AfD e do CHEGA sobre maternidade, natalidade, família, infância, "ideologia de género", imigração, ameaça demográfica e futuro da nação.

A investigação procura compreender como texto, imagem, corpo, cenário, símbolos, hashtags e formatos visuais constroem sentidos sobre maternidade, biopolítica e ordem social, demonstrando que discursos sobre proteção das crianças, defesa da família e crise demográfica atualizam imaginários autoritários que ligam género, reprodução, autoridade e nação.

Palavras-chave: Maternidade; Biopolítica; Direita Radical; Instagram; Género; Autoritarismo; Família; Infância; Nação.

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Sob o feitiço de uma estrela: ideologia patriarcal e agência feminina na imagem de Olivia de Havilland

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Abstract. No presente projeto de investigação, de um ponto de vista geral, pretende-se analisar de que forma as estrelas femininas da antiga Hollywood negociavam tensões entre modelos patriarcais de representação e formas de agência feminina, tendo como objeto de estudo específico a construção da imagem estelar de Olivia de Havilland. Visa-se, então, problematizar de que forma a sua imagem pode ser interpretada como possuidora de uma dimensão feminista, explorando a possibilidade de essa imagem funcionar como um elemento ideológico ambíguo que simultaneamente reproduz e desestabiliza o patriarcado. Este objetivo parece-me genuinamente aliciante visto aquela ser uma atriz com uma imagem complexa e dúbia, balançando entre modelos tradicionais de feminilidade e comportamentos de autonomia e resistência. Para tal, pretende-se analisar, através de uma metodologia qualitativa, alguns filmes, fotografias de estúdio, anúncios publicitários, críticas cinematográficas, artigos de imprensa, excertos de entrevistas, comentários de utilizadores na internet e dados biográficos. Será feita uma análise fílmica, visual e discursiva. A presente investigação centra-se na área dos Estudos Culturais numa interseção com os Estudos de Estrelas e com as Teorias Feministas do Cinema. Apesar de ser uma das atrizes mais respeitadas da sua geração, de Havilland foi, até agora, pouco explorada na investigação académica o que confere originalidade ao projeto e, por conseguinte, dota-o de considerável relevância, contribuindo para o aprofundamento crítico dos Estudos de Estrelas e dos debates sobre a representação feminina no cinema clássico de Hollywood. O presente projeto apresenta os objetivos específicos da investigação, a sua metodologia, bem como as contribuições expectáveis e alguns desafios teóricos e metodológicos que poderão surgir.

Keywords. *Olivia de Havilland; Cinema Clássico de Hollywood; Estudos de Estrelas; Teorias Feministas do Cinema; Ideologia Patriarcal*

[PDEGI] Thesis project defense in engineering and industrial management

Artificial Intelligence and Project Management in the Industry 5.0 Transition: Human Empowerment and Team Performance in Project-Oriented Organizations

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Abstract. The growing adoption of Artificial Intelligence tools is redefining Project Management paradigms in the transition to Industry 5.0, a paradigm that repositions human centrality, sustainability, and organizational resilience at the core of industrial systems [1]. The central question driving this research is how Artificial Intelligence can strengthen, rather than replace, the performance, motivation, engagement, well-being, and resilience of project teams in project-oriented organizations.
A Systematic Literature Review of 64 articles maps the state of the art on Artificial Intelligence integration in Project Management, documenting exponential growth in scientific output and identifying the principal gaps and structural tensions that justify this research. Building on these findings, the study will adopt Design Science Research [2] as its methodological paradigm, developing empirically grounded artifacts through qualitative case studies, expert validation, and quantitative survey research: an integrative conceptual framework, human-centered integration models, and practical responsible adoption guidelines. The expected outcomes will contribute to the theory of Industrial Engineering and Management and to the practice of organizations seeking to adopt Artificial Intelligence responsibly in the context of Industry 5.0.

Keywords. *Project Management; Lean Project Management; Artificial Intelligence; Organizational Leadership; Industry 4.0; Industry 5.0*

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The impact of Lean 4.0 on ESG and financial performance: A case study of energy companies

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Session
PhD students – Engineering and Industrial Management

Abstract. The growing pressure for sustainability, digital transformation and operational excellence has intensified the need for energy companies to simultaneously improve environmental, social and governance (ESG) performance while maintaining financial competitiveness. In this context, Lean 4.0 emerges as an integrated paradigm that combines Lean Manufacturing principles with Industry 4.0 technologies [1], enabling real-time monitoring, process optimization and data-driven decision-making.
This research investigates how the implementation of Lean 4.0 influences ESG and financial performance in energy companies. The study is motivated by the limited empirical evidence regarding the integrated effects of Lean practices, digital technologies and sustainability outcomes in the energy sector [2,3], particularly considering the sector's high capital intensity, regulatory complexity and increasing pressure for decarbonization.
Methodologically, the research adopts a multiple case study approach supported by mixed methods [4]. The proposed framework combines qualitative and quantitative analysis through semi-structured interviews, document analysis, direct observation and performance data collection. The study will evaluate the relationship between Lean 4.0 practices, ESG indicators and financial performance metrics, while also identifying contextual facilitators and barriers affecting implementation success. The research is theoretically grounded in the Resource-Based View, Dynamic Capabilities View and Stakeholder Theory.
The expected contribution is theoretical, methodological and practical. The research aims to extend the literature on Lean 4.0 and sustainable operations management by proposing an integrated framework linking operational excellence, digital transformation, ESG performance and financial outcomes. Practically, the study intends to support energy companies in developing more sustainable, efficient and financially resilient operational strategies aligned with current ESG and digital transformation challenges.

Keywords. Lean 4.0; ESG; Financial Performance; Energy Sector; Industry 4.0; Sustainable Operations

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Developing a context-sensitive evaluation framework for media labs: performance indicators for interdisciplinary and transdisciplinary research environments

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Abstract. Media labs have emerged as interdisciplinary, experimental, and practice-oriented environments that combine research, innovation, creative production, and public engagement. Despite their growing importance for higher education institutions, the most widely used research evaluation models are still heavily based on traditional bibliometric indicators. These models are often unable to reflect the diversity of outputs, collaborative processes and societal contributions typical of these environments [1,2]. This misalignment contributes to a structural discrepancy between the dynamics of media labs and the evaluative regimes used to recognize and legitimize them. This research project aims to develop an adapted assessment framework for media labs with context-sensitive indicators considering institutional missions, interdisciplinary work, experimentation and non-traditional research outputs. The study follows an abductive research approach and is organized in three main phases. First, a systematic literature review conducted according to the PRISMA framework will map existing evaluation models and indicators applied to interdisciplinary research environments [3]. Second, a Delphi study will be conducted to empirically validate and refine the proposed indicators through iterative consultation with experts and media lab representatives [4]. Finally, the framework will be applied to a media lab through an instrumental case study to assess its operationalization and contextual applicability. The expected contributions of this research are theoretical, methodological, and practical. The study aims to foster discussions on how to evaluate interdisciplinary and transdisciplinary research by proposing a more multidimensional and reflexive evaluation framework that can capture the hybrid and practice-based nature of media labs. Finally, it aims to promote more responsive and equitable assessment practices to support larger institutional and societal goals.

Keywords. *Media labs; Interdisciplinary and transdisciplinary research; Research evaluation; Performance indicators; Practice-based research*

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OPERATIONAL AND SUPPLY CHAIN DECISION-MAKING IN THE NATURAL STONE INDUSTRY: FROM DATA TO INTELLIGENT SYSTEMS

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Session
PhD students – Engineering and Industrial Management

Operational and supply chain management in the natural stone industry remains challenging due to uncertainty arising not only from market dynamics, but also from the inherent geological variability of the raw material. Unlike most manufacturing sectors, quarry extraction can be unpredictable, starting in blocks quality, dimensions, and aesthetic characteristics — each carrying distinct commercial value and processing requirements. This variability spreads throughout the value chain: cutting, surface finishing, and final transformation must continuously adapt to material heterogeneity, making standardization difficult and amplifying operational unpredictability across all stages. [1]

This work aims to develop a framework for data-driven operational and supply chain decision-making in the natural stone industry, supporting its transition toward Industry 4.0. This study focuses on how data, analytics, and intelligent systems can improve resilience, efficiency, and risk management along the stone value chain- from quarries to customers. [2,3] A mixed-method approach will be adopted, expecting characterize current supply chain structures and decision processes based on existing optimization and network design models. It will also include the analysis of digital and data infrastructures, such as digital twin and smart manufacturing concepts, as well as the design of an integrated decision-support architecture combining simulation, multi-criteria decision-making, and intelligent algorithms. [4]

The expected outcome is a digital system linking operational data, since production, quality, logistics, and disruptions to higher-level planning, risk, and control decisions. The proposed framework is intended to support the gradual digital transformation of this traditionally fragmented sector, equipping managers with tools to evaluate scenarios, reduce time-to-deliver, and enhance supply chain resilience. Can we get out of the stone age?

Keywords: Industry 4.0; digital twin; supply chain resilience; decision support systems; smart manufacturing

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Inventory optimisation under uncertainty in bio-based supply chains: a decision support system for the cork industry

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Abstract. Inventory management in bio-based supply chains is particularly challenging when uncertainty arises not only from demand, lead times or market volatility, but also from the natural variability of the raw material. In the cork industry, production does not generate a homogeneous output, but rather a distribution of quality classes, dimensions and commercial applications, each with different value, demand and service implications.
This research proposes a decision support system for multi-grade inventory management in the cork industry. The central concept is *quality yield*, defined as a random compositional vector representing the distribution of production output across quality classes. Unlike traditional random yield approaches, which mainly focus on total physical output, this perspective considers the dependence between quality classes, since an increase in one class necessarily changes the relative proportion of the others [1,2].
Methodologically, the study follows a Design Science Research approach [3]. The proposed artefact integrates four components: critical validation of historical quality labels; probabilistic multivariate modelling of quality yield; formalisation of downward substitution as a sequential decision under uncertainty; and discrete-event simulation combined with simulation-optimisation to evaluate alternative logistics policies [4]. The model will use industrial data on production, quality classification, inventory, sales and dispatching, while considering the uncertainty and possible bias embedded in historical quality labels.
The expected contribution is theoretical, methodological and practical. The research extends inventory and random yield literature to bio-based, multi-grade systems; combines compositional data analysis, probabilistic modelling, simulation and decision support; and aims to help cork companies reduce critical stockouts, protect premium inventory, improve service levels and support more robust logistics decisions under natural variability.

Keywords. Inventory Optimisation; Bio-Based Supply Chains; Quality Yield; Cork Industry; Discrete-Event Simulation; Decision Support Systems

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Explainable Demand-Based Material Requirements Planning for perishable items under capacity constraints

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Abstract. The increasing volatility of modern markets has exposed the limitations of traditional inventory management systems [1]. Although Demand Driven Material Requirements Planning offers a robust alternative based on strategic decoupling [2], its effectiveness in spontaneous demand contexts is severely compromised by the absence of advance orders, reducing the system to a purely reactive model. This work aims to address this critical flaw by developing a predictive framework that integrates the precision of machine learning algorithms with the operational robustness of dynamic buffers in a smart kitchen. The proposed methodology will rely on formulating and benchmarking interpretable predictive models based on decision tree ensembles, such as XGBoost and Random Forest, to anticipate intermittent consumption patterns and demand spikes. To ensure the transparency required by Industry 5.0 guidelines [3], the architecture will incorporate explainable artificial intelligence techniques, such as SHapley Additive exPlanations values, to convert complex models into auditable decision-support tools. The core innovation of this research will involve restructuring the system's Net Flow Position equation, integrating the predictive model's forecasts as preventive replenishment triggers. Methodological validation will be structured in two phases: an initial computational simulation of local inventory and multi-level supply chains in Python accounting for ingredient perishability, followed by empirical validation within the smart kitchens of an industry partner. This proactive model is designed to ensure material flow stability, significantly mitigate food waste caused by product expiration, and strengthen decision-makers' trust in automated processes. Ultimately, this research aims to establish new operational benchmarks for highly volatile supply chains, successfully aligning economic efficiency with global sustainability objectives.

Keywords. *DDMRP; Explainable AI; Machine Learning; Perishable Items; Inventory Replenishment; Inventory Management*

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[PDEM] Thesis project defense in mechanical engineering

Computational Mechanics and Intelligent Modeling of Flexible Multibody Robotic Systems Considering Additive Manufacturing Processes

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Abstract. This research addressed the critical requirement for high-fidelity computational frameworks in the Factory of the Future, specifically focusing on the intersection of flexible multibody dynamics and additive manufacturing. Traditional robotic modeling frequently relies on rigid-body assumptions; however, additive manufacturing processes, particularly laser powder bed fusion of maraging steels and extrusion-based continuous fiber reinforcement, introduce complex spatial mass distributions and anisotropic mechanical properties that significantly alter dynamic performance [1]. This project developed and validated comprehensive analytical and computational models for Delta, SCARA, and anthropomorphic robotic architectures [2]. By incorporating process-dependent variables into flexible multibody formulations, the research optimized advanced structural concepts, including lattice, geodesic, iso-grid, and anisogrid geometries [3]. Intelligent modeling techniques were employed to perform parameter identification and to develop surrogate models for the real-time estimation of non-linear behaviors. The study concluded with a multi-scale experimental validation of forces, motion, and structural integrity, ensuring direct alignment with the objectives of the Agenda Drivolution [4]. The results demonstrated that integrating process-aware material data significantly improves vibration settling times and motion accuracy compared to conventional design approaches. This framework provides a robust foundation for the co-design of lightweight, high-stiffness robotic links, ultimately contributing to the energy efficiency and resilience of next-generation industrial manufacturing systems.

Keywords. *Flexible Multibody Dynamics; Additive Manufacturing; Robotic Architectures; Computational Mechanics; Structural Optimization*

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Computer vision and artificial intelligence for adaptive and deployable perception in collaborative robotic systems

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Abstract. Collaborative robotic systems operating in real-world environments face significant perceptual challenges, including dynamic scene variability, sensing uncertainty, real-time constraints, and the demands of safe human-robot interaction [1]. Despite considerable advances in computer vision and artificial intelligence [2], a critical gap persists in the availability of modular, deployable perception frameworks that bridge classical and data-driven perception methods and operate reliably across heterogeneous robotic platforms under real-world conditions. This research investigates adaptive and deployable perception for collaborative robotic systems through the integration of computer vision and artificial intelligence. The proposed methodology adopts a progressive experimental framework for evaluating hybrid perception strategies across varying sensing, environmental, and deployment conditions for collaborative robotic platforms. A chessboard-based structured benchmark provides a reproducible evaluation foundation, enabling systematic comparison of perception approaches across controlled sensing configurations before extension to application-oriented scenarios. A modular perception framework is developed to support vision-guided manipulation tasks, including object detection [3], localisation, and pick-and-place operations [4], across heterogeneous robotic platforms, while enabling platform-agnostic deployment and real-time perception under practical computational constraints. Validation is conducted through simulation and real robotic testbeds, with evaluation focused on perception accuracy, inference latency, robustness, and collaborative task performance. Expected contributions include a deployable and reproducible perception architecture, a structured benchmarking methodology for comparative evaluation of classical and data-driven perception approaches, and experimental validation across collaborative robotic systems in both controlled and application-oriented environments.

Keywords. *Collaborative robotics; Computer vision; Structured benchmarking; Deployable perception; Human-robot collaboration*

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Multi-objective optimization and improvement of offshore structures and wind towers assisted by machine learning and additive manufacturing

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Abstract. The global urgency to decarbonize the energy matrix is driving offshore wind energy. However, these structures face severe marine fatigue and corrosion conditions [1]. The marine renewable energy sector is a critical pillar in the global transition toward a low-carbon economy. This project aims at multi-objective optimization of critical wind turbine components using Wire-Laser Directed Energy Deposition (W-DED) [2] additive manufacturing through the Meltio M600 system at the University of Aveiro. The study will focus on multi-material systems and functional gradients involving Stainless steel 316L and Inconel 625 alloys [3], aiming to improve structural integrity, corrosion resistance, and fatigue performance. The proposed methodology integrates advanced manufacturing, microstructural, mechanical characterization, and Machine Learning models [4], specifically Physically Informed Neural Networks (PINNs), to predict thermal behavior and optimize deposition parameters. Machine learning algorithms will be fed with data from these experiments to simulate the behavior of each material under cyclic stress and saline exposure, identifying the best cost-benefit ratio for structural components. The work will be complemented by experimental validation through microstructural, mechanical, and environmental tests, promoting scientific advancement and approaching higher levels of technological maturity.

Keywords. *Additive Manufacturing (AM); Offshore Wind Tower; Machine Learning; Multi-objective; Wire-Laser Directed Energy Deposition (W-DED)*

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A 3D-Printed Modular Autonomous Mobile Robot for Multi-Environment Operation: Design, Integration, and Experimental Evaluation

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Abstract. This thesis focuses on the design, integration, and experimental evaluation of a modular Autonomous Mobile Robot (AMR) platform based on additive manufacturing, capable of operating in both indoor and outdoor environments. The platform is conceived as a versatile mobile base that can support the transport and mobility of lightweight robotic manipulators, including SCARA and anthropomorphic robots. The research addresses the challenge of integrating heterogeneous subsystems, including mechanical structures, mobility solutions, sensing and perception, navigation, and control, into a coherent and robust robotic system. Building on established principles of autonomous mobile robotics [1] and recent developments in localization, mapping, trajectory analysis, positioning, and control [2,3], the work adopts an incremental validation methodology using existing robotic platforms, progressing to subsystem-level validation and, subsequently, full-system experimental evaluation. Particular attention is given to the relationship between mechanical design, sensing reliability, and control performance, especially for operation in heterogeneous environments. Multi-sensor perception, including LiDAR, inertial sensing, and vision-based systems, is considered together with sensor fusion and SLAM-based approaches for robust navigation [4]. The expected outcome is both a validated AMR platform and experimentally grounded knowledge on the design, integration, and performance of modular robotic systems for multi-environment operation.

Keywords. *Additive manufacturing; Sensor fusion; SLAM; ROS 2; Experimental validation*

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Self-Sensing Technologies for 3D-Printed Multifunctional Structural Robotic Links with Human-Inspired Capabilities

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Abstract. This doctoral research focuses on the development of self-sensing technologies for multifunctional 3D-printed structural robotic links, based on the integration of intrinsic electromechanical sensing capabilities within conductive structures. The core objective is to achieve a rigorous understanding and characterization of piezoresistive behaviour in conductive materials and structures [1], and to establish reliable correlations between electrical responses and mechanical quantities such as strain, deformation, contact, and applied forces. The research includes the design and optimization of distributed electrode networks and multi-channel measurement systems, enabling the acquisition of spatially resolved electrical signals from complex structures. Particular emphasis is placed on experimental methodologies for accurate signal acquisition, calibration, and validation under realistic loading and environmental conditions [2]. Multifunctional 3D-printed robotic links representative of different manipulator architectures (e.g., SCARA, delta, and anthropomorphic systems) will be developed and used as validation platforms. These structures will be instrumented and experimentally evaluated in terms of sensing performance, structural integration, robustness, and repeatability. In addition, data-driven approaches, including machine learning techniques, will be explored to interpret multi-channel sensing data and enable the estimation of mechanical states and detection of interaction events such as contact, impact, and structural anomalies. The expected outcome is a validated and systematic framework for the design and implementation of self-sensing robotic structures, contributing to more integrated, lightweight, and perceptive robotic systems for advanced industrial and collaborative applications.

Keywords: *Soft robotics; 3D printing; Piezoresistive sensing; Electrical resistance measurement; Self-sensing structures;*

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Data-driven material modelling using AI techniques: accurate big data generation through full-field tests and robotics

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Abstract. Numerical simulation has become an essential tool for optimising material-processing operations; however, its reliability strongly depends on the accuracy of the adopted material models. Although advanced calibration techniques can improve the predictive capability of constitutive models, their accuracy remains constrained by their predefined mathematical formulations. Machine-learning techniques offer a promising alternative by enabling material behaviour to be learned directly from data. Nevertheless, their application to constitutive modelling remains insufficiently explored and generally requires large, diverse and representative datasets. Acquiring such experimental data is laborious and time-consuming, while ensuring measurement accuracy, repeatability and reproducibility remains a significant challenge. This project aims to develop accurate data-driven implicit constitutive models using machine learning techniques for the numerical simulation of sheet metal forming processes. The required training data will be obtained through automated heterogeneous mechanical tests combined with full-field measurements. Advanced robotics and automation will be employed to minimise human intervention, reduce operator-induced variability and increase experimental throughput, accuracy and reproducibility. Ultimately, the project seeks to establish an integrated framework connecting automated experimentation, data-rich material characterisation and data-driven-based constitutive modelling for reliable finite element simulations.

Keywords. *Heterogeneous testing; Machine learning; Material modelling; Robotics; Sheet metal forming*

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Optimisation of resistance spot welding for hot-stamped automotive components (OPTIMWELD)

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Abstract. Hot-stamping (HS) enables the production of ultra-high strength steel (UHSS) components with complex geometries, thereby reducing weight and enhancing crashworthiness in automotive structures. These are primarily joined using resistance spot welding (RSW). However, RSW of HS steels is highly challenging due to their alloy composition, mechanical properties, and protective coatings, which hinder weldability and degrade joint performance [1,2]. OPTIMWELD aims to optimise the RSW for enhanced joining of HS steels through an integrated numerical-experimental approach. OPTIMWELD will investigate the influence of process parameters, coatings, phase transformations, and thermal cycles on joint strength and microstructure, hardness, and failure mechanisms. Key issues, such as subcritical heat-affected zone (HAZ) softening and fusion boundary degradation, will be addressed using advanced characterization tools, including digital image correlation and microstructural analysis. Advanced finite element models will be developed to simulate the process and guide the optimisation of RSW parameters. The expected results will be validated on industrial-grade components, with the final goal of improving joint reliability in real automotive components.

Keywords. *Resistance Spot Welding (RSW); Hot Stamping (HS); Joint Performance and Failure Mechanisms; Process Optimisation; Microstructural Evolution and Prediction; Finite Element Modelling;*

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Development of modular hybrid moulds for footwear

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Abstract. Footwear direct soling typically requires dedicated moulds for each sole model and size, leading to high tooling costs, storage requirements and limited flexibility when producing short runs, seasonal collections or personalised products. This work addresses this limitation through modular hybrid mould concepts based on interchangeable moulding inserts integrated into a reusable mould structure [1-2].

Unlike conventional injection moulding, footwear direct soling involves reactive polymer systems, short cycle times and strict requirements regarding sealing, dimensional stability, surface quality and demoulding. In this context, modularity cannot be treated only as an assembly strategy, since the insert/mould interface directly affects heat transfer, contact pressure, deformation, gap formation and defect risk. The research therefore focuses on the thermo-mechanical balance of modular hybrid moulds, considering the interaction between material selection, interface design and insert geometry [3-4].

The proposed approach explores both soft and hard tooling strategies, additive manufacturing of moulding components and thermo-mechanical modelling supported by future experimental validation. Candidate materials, manufacturing routes and interface configurations are considered through performance indicators such as temperature distribution, insert deformation, interface behaviour and expected durability. The expected contribution is a design-oriented framework to support the selection and implementation of modular moulding components in footwear direct soling, enabling more flexible tooling strategies without compromising the functional requirements of industrial moulding processes.

Keywords. *Additive manufacturing; Thermo-mechanical behaviour; Interchangeable inserts; Footwear direct soling; Modular hybrid moulds*

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A framework for modular unit design in industrial automation environments

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Abstract.
This research proposes a structured framework for the design of modular units in industrial automation environments, addressing current limitations related to flexibility, scalability, and interoperability in manufacturing systems. Traditional automation architectures are commonly developed as rigid and application-specific solutions, making system reconfiguration complex, time-consuming, and costly in dynamic production contexts. In response to the increasing demand for adaptable and intelligent manufacturing systems, this work investigates the integration of modular design principles with Industry 4.0 technologies to support more efficient and reconfigurable automation architectures [1,2].
The proposed framework combines concepts from mechanical design, systems engineering, industrial communication, and digital interoperability to establish a unified methodology for modular automation system development. The research methodology follows a Design Science Research approach, including a systematic literature review, conceptual modelling, framework development, prototype implementation, and experimental validation in a representative industrial automation environment.
The expected outcomes include the definition of standardized modular interfaces, implementation guidelines, and a scalable architecture capable of supporting rapid system reconfiguration and improved integration between mechanical, electrical, and control domains. Experimental validation is expected to demonstrate reductions in development effort and increased adaptability when compared to conventional automation approaches.
This research contributes to the advancement of modular and reconfigurable manufacturing systems by bridging the gap between theoretical modularity concepts and practical industrial implementation, supporting the development of more resilient, efficient, and sustainable production systems.

Keywords. *Modular design; Industrial automation; Industry 4.0; Reconfigurable systems*

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Interoperable hybrid digital twins for industry: integrating physics-based models and experimental data

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Abstract. Industry 4.0 introduced the digitalization of industries making them increasingly reliant on data acquisition systems however, the transformation of this information into actionable engineering knowledge remains limited, restricting lifecycle integration and evidence-based decision-making. Digital twins are recognised as key enablers for the integration of physical and digital systems in industrial environments. Still, current implementations remain limited by fragmented and heterogeneous data sources, poor interoperability and insufficient integration between physics-based models and real-world operational data [1,2]. These limitations reduce model fidelity, restrict interpretability and constrain the use of digital twins as reliable decision-support tools. To address these issues, this research proposes the development of an interoperable digital twin framework capable of integrating physics-based models, experimental data and real-world operational information in a structured and consistent manner. The proposed approach focuses on the development of unified data structures and methodologies to ensure data consistency, traceability and reuse across different lifecycle stages. A central contribution of the research is the development of hybrid modelling approaches for mechanical behaviour, combining simulation and data-driven techniques to improve model fidelity while preserving physical interpretability [3]. The framework also incorporates advanced visualisation and immersive tools to support intuitive analysis of complex systems and enhance engineering decision-making. The proposed framework is expected to contribute to the development of more reliable, adaptable and interpretable digital twins, capable of supporting industrial digitalisation and lifecycle-oriented engineering practices by addressing the gap between data availability and actionable engineering knowledge.

Keywords. *Digital twin; Hybrid modelling; Interoperability; Industry 4.0.*

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Tailored steel-copper functionally graded materials for injection mould thermal management via wire-laser directed energy deposition

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Abstract. Thermal management remains a critical bottleneck in injection moulding, where the cooling phase accounts for over 50% of the total cycle time, contributing to energy inefficiency, residual stresses, distortions and premature mould failure under cyclic thermal loading [1]. Conventional monolithic tool steels offer limited thermal conductivity (20-40 W/m·K), while direct steel-copper assemblies introduce severe thermomechanical incompatibilities, including coefficient of thermal expansion (CTE) mismatch, liquid-metal embrittlement, and interfacial instability, that compromise structural reliability under service conditions [2]. This doctoral research proposes the development of steel-copper Functionally Graded Materials (FGMs) via Wire-Laser Directed Energy Deposition (W-DED), using the Meltio M600 system. By promoting a gradual compositional transition between tool steel and copper, this approach aims to mitigate interfacial residual stresses and extend mould service life without compromising thermal efficiency [2]. Physics-Informed Neural Networks (PINNs) will be integrated to predict melt-pool dynamics and thermal histories, shifting process optimisation from empirical trial-and-error towards physically guided material design [3]. The methodology combines a Design of Experiments for W-DED parameter screening, microstructural characterisation via Scanning Electron Microscopy with Energy Dispersive Spectroscopy and X-ray Diffraction, and thermomechanical validation through Highly Accelerated Life Testing and Digital Image Correlation [4]. Industrial benchmarking against Powder Bed Fusion reference inserts will be performed at Edilásio (Iberomoldes Group) under real injection moulding conditions exceeding 10,000 thermal cycles. The expected outcomes include a validated PINN-assisted processing framework for steel-copper W-DED systems and functional mould inserts with measurable reductions in cooling time and improved interfacial integrity. This work targets progression from Technology Readiness Level 2 to TRL 5/6, offering a scalable alternative to current multimaterial manufacturing routes for high-performance injection mould tooling.

Keywords. *Thermal Efficiency; Functionally Graded Materials (FGMs); Injection Moulding; Additive Manufacturing (AM); Wire-Laser Directed Energy Deposition (W-DED)*

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Temperature-dependent mechanical behavior of 3D-printed polymeric structures for precision robotics: Thermal management and control strategies

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Abstract. The fabrication of lightweight, complex robotic systems with tailored mechanical properties is a primary advantage of additive manufacturing. However, the thermomechanical and dynamic behavior of additively manufactured polymeric structures have yet to be studied in more detail, particularly as precision robots operating under varying thermal conditions. Temperature-dependent variations in stiffness, damping, and viscoelastic response can significantly affect transient precision, positioning accuracy, and long-term operational stability [1]. Multiple additive manufacturing processes exhibit varying thermal behavior, including extrusion of ABS, continuous fiber-reinforced composites (e.g., carbon fiber-reinforced nylon), and powder-based processes such as selective laser sintering (SLS) using nylon and carbon-filled materials.
This research focuses on active joints and functional robotic components such as end-effectors used in Delta and SCARA robots, by combining thermomechanical characterization techniques, i.e., Dynamic Mechanical Analysis (DMA), creep, and stress-relaxation testing, alongside finite-element and temperature-dependent viscoelastic constitutive modeling [2]. Moreover, the heat transfer mechanisms in robotic components will be analyzed, aligned with thermal management, and IP65 standards.
Subsequently, suitable control strategies will be integrated into the developed models to compensate for the temperature-induced undesirable changes in robotic system behavior. The expected results include predictive thermomechanical models to maintain performance stability of the robots, experimentally validated control methods to enhance positioning accuracy of the grippers, and design guidelines for thermally stable, environmentally reliable robotic components.

Keywords. *Additive Manufacturing; Robotics; Thermal Management; Control Strategies; Viscoelasticity*

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EMPOWER - Enhancing Methods and Practices in Female Boxing Employing Advanced Computational Methods

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Abstract. This PhD project investigates the biomechanics of traumatic brain injuries (TBI) in female combat sport athletes, with a particular focus on boxing. The research combines computational biomechanics, experimental testing, athlete monitoring, and artificial intelligence (AI) to better understand how repetitive head impacts contribute to acute and long-term neurological conditions such as concussion and chronic traumatic encephalopathy (CTE).
The work will involve the collection of real-world head impact data from female athletes using instrumented mouthguards. These kinematic inputs will be applied to sex-specific finite element head models (FEHMs) to simulate brain tissue deformation, pressure distribution, and injury mechanisms. Existing female head models will be improved through mesh refinement, updated material properties, cerebrospinal fluid (CSF) modelling using Smoothed Particle Hydrodynamics (SPH), and potential neck integration. In parallel, boxing gloves and helmets will be reverse engineered, experimentally characterised, and numerically validated to evaluate their protective performance. Machine learning (ML) algorithms will be trained using both simulation outputs and empirical athlete data to predict injury risk and identify potential risk impact profiles.
The expected outcomes include improved understanding of sex-specific TBI mechanisms, enhanced injury prediction tools, optimisation of protective equipment, and evidence-based recommendations for safer training protocols. The research aims to contribute to athlete safety, injury prevention strategies, and long-term neurological health management in combat sports.

Keywords. *Computational Biomechanics; Traumatic Brain Injury; Finite Element Head Models; Female Boxing; Machine Learning Injury Prediction*

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[PDEQ] Thesis project defense in chemical engineering

Supercritical fluid extraction and purification of cannabinoids

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Abstract. *Cannabis* is a plant with outstanding therapeutic potential, attributed to its rich diversity of bioactive compounds, particularly cannabinoids and terpenes.[1] Among these, tetrahydrocannabinol (THC), the principal psychoactive constituent, and cannabidiol (CBD), the most extensively studied non-psychoactive cannabinoid, are of great clinical interest. In Portugal, the medicinal cannabis sector has expanded considerably since 2017, as evidenced by a steady increase in entities licensed for cultivation, manufacturing, importation, and exportation, as reported by Infarmed I.P., the national health authority [2]. Currently, industrial extraction relies predominantly on maceration, a solid-liquid process using ethanol as solvent [3]. Despite its widespread adoption, this method suffers from poor selectivity, co-extracting undesirable compounds, such as waxes and chlorophylls, that negatively impact the organoleptic properties of the final product [4]. The primary objective of this work is the production of a high-quality oil selectively enriched in cannabinoids and terpenes from two distinct biomass feedstocks: one THC-dominant and one CBD-dominant. To achieve this, an extraction methodology based on supercritical and subcritical carbon dioxide (CO_2) is proposed, followed by an adsorption purification step employing various adsorbent materials. The resulting extracts are subsequently benchmarked against wiped-film distillation, the current industry standard purification technique.

Keywords. *Supercritical fluid extraction; Adsorption; Cannabinoids; Terpenes; Wiped-film distillation*

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Systemic approach to plastic waste management: from technical and entrepreneurial to governance and policy challenges

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Abstract. Global plastic waste generation continues to escalate, yet the implementation of the EU waste hierarchy has yielded results below expectations [1]. Effective management of plastic waste remains a complex challenge, requiring the coordination of multiple factors and diverse stakeholders. A comprehensive approach must address several interconnected dimensions: consumer behavior, circular economy policies, the transition to bio-based feedstocks, incentives for reuse and extended lifespans, product design for minimal plastic consumption and enhanced recyclability, education and communication strategies, efficient waste collection infrastructure, advanced sorting systems, appropriate recycling pathways, and optimized recycling technologies for superior environmental and economic performance compared to virgin plastic production [2].
In Portugal, measures have been implemented to strengthen waste management and reduce plastic consumption. However, the European milestones have not yet been met neither in 2022 nor in 2025. This study plan intents to adopt an interdisciplinary approach, from public policy to technological innovation, to develop a holistic framework for assessing and promoting plastic waste management in the European context, in particular in Portugal, a country that has been facing several challenges in this regard. The primary objective is to develop and validate a comprehensive framework for evaluating plastic waste management performance aligned with the EU waste hierarchy across varying scenarios. The study will build on two analytical tools - the Plastic Management Index (PMI) [3] and the Plastics Integrated Assessment Model (PLAIA) [4] to gather data on governance, systemic capacity, stakeholder engagement, technological developments, life cycle assessments and use in specific regions. Validation will be conducted through a case study focusing on a particular plastic waste stream within a regional area or municipal association in Portugal. Through this systemic approach, the research aims to contribute meaningfully to improved plastic waste management in accordance with EU policy objectives.

Keywords. *Plastic waste management; EU waste hierarchy; Circular Economy*

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Development of data-efficient artificial intelligence and digital chemical spaces for molecular design

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Abstract. Machine learning has become a transformative tool in chemistry, materials science, and molecular design by enabling the quick extraction of structure-property relationships from data and reducing the dependence on costly experiments and quantum-chemical calculations [1]. In this context, molecular descriptors are essential because they convert chemical structures into machine-readable representations that are suitable for predictive modelling. Among available descriptors, sigma profiles are uniquely advantageous because they provide a physically interpretable, fixed-length representation of molecular polarity and non-covalent interactions [2]. Their use in machine learning has expanded from property prediction to the construction of digital chemical spaces, where molecular systems can be explored, optimized, and designed in silico. In these spaces, the utilization of Gaussian processes combined with active learning or Bayesian optimization become particularly valuable because they combine data efficiency with uncertainty quantification, enabling closed-loop search strategies under limited data conditions [3]. Recent studies have shown that sigma profiles can support efficient molecular optimization, solvent screening, and the prediction of thermophysical properties, while deep learning models can now predict sigma profiles directly from structural inputs such as SMILES strings or molecular graphs, reducing the reliance on computationally expensive quantum-chemical workflows. More broadly, this work explores how sigma profiles can serve as a universal and chemically meaningful descriptor for machine-learning-driven molecular design, bridging first-principles thermodynamics and data-driven discovery. The overall goal is to establish sigma profiles as a robust foundation for open, scalable, and intelligently navigable digital chemical spaces applicable to property prediction, inverse design, and the accelerated discovery of molecules and materials.

Keywords. *Sigma profiles; Machine Learning; Gaussian Processes; Reverse Engineering; Bayesian Optimization*

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Desenvolvimento de um processo hidrometalúrgico integrado para a reciclagem completa de materiais catódicos e eletrólitos de baterias de ião de lítio (LIBs) em fim de vida.

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Abstract. As baterias de ião de lítio (LIBs) são essenciais para o armazenamento de energia em dispositivos eletrónicos e veículos elétricos [1], mas o aumento da sua utilização tem intensificado preocupações relacionadas com a escassez de matérias-primas críticas e com os impactos ambientais da gestão inadequada dos seus resíduos.[2]

Apesar dos avanços recentes, os processos hidrometalúrgicos atuais apresentam limitações na recuperação integrada de todos os componentes e na eficiência da separação seletiva de metais críticos [3]. Componentes como o eletrólito e os materiais poliméricos permanecem subvalorizados, o que representa uma oportunidade relevante de inovação.

Este trabalho propõe o desenvolvimento de um processo hidrometalúrgico integrado e sustentável para a reciclagem completa de materiais catódicos e eletrólitos de LIBs, combinando estratégias avançadas de lixiviação, separação seletiva e purificação com solventes sustentáveis. O projeto visa aumentar a seletividade, reduzir o consumo de reagentes e minimizar o impacto ambiental, contribuindo para a economia circular e para soluções com potencial aplicação industrial.

Keywords. *Reciclagem de LIBs, hidrometalurgia, processos sustentáveis, metais críticos, economia circular, solventes verdes.*

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Mycosporine-like amino acids as natural photoprotective compounds from marine resources

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Abstract. Solar radiation, particularly ultraviolet (UV) radiation, is widely recognized as a major environmental risk factor for human health, contributing to DNA damage, oxidative stress, photoaging, and skin carcinogenesis [1]. The increasing incidence of UV-related skin disorders, together with the growing demand for sustainable, naturally derived functional materials, has intensified research into bio-based UV-absorbing compounds.

Among naturally occurring photoprotective molecules, including carotenoids, melanins, flavonoids, and phenolic acids, differences in absorption spectra, mechanisms of action, and physicochemical properties strongly influence their suitability for the development of new biomaterials and cosmetic formulations [2]. Mycosporine-like amino acids (MAAs), which absorb specifically in the UV range, are water-soluble, thermostable, and exhibit both UV-screening and antioxidant activity, with a well-established safety profile [3]. These properties make them particularly attractive candidates for photoprotective applications.

Macro and microalgae are the principal natural sources of MAAs [3]. Their valorization aligns with the broader blue bioeconomy framework, which promotes the sustainable use of marine biomass to recover high-value bioactive fractions while reducing environmental impact [4].

Biorefinery approaches offer an integrated strategy to maximise the exploitation of these compounds, although challenges remain regarding extraction efficiency, compositional variability, and stability during processing and formulation. In conclusion, MAAs represent a promising class of functional biomaterials for the next generation of photoprotective applications, and a deeper understanding of their properties, production pathways, and processing constraints is essential to unlock their full potential in the biomedical and cosmetic industries.

Keywords: *Algae-derived compounds; Natural photoprotective compounds; Secondary metabolites; Sustainable biomaterials; Blue bioeconomy*

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Exploring the structure-performance relationship in deep eutectic solvents for liquid-liquid separation

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Abstract. Deep eutectic solvents (DES) are gaining increased attention as a versatile platform for the development of more sustainable and tunable media for separation processes, extraction, catalysis, and advanced liquid formulations [1–3]. However, despite their advantages, the high viscosity of many DES remains a critical limitation for their practical application, as it directly affects flow, mixing, pumping, and mass transfer in chemical processes [4]. In this context, controlling the viscosity of these systems is essential to transform promising formulations into effectively applicable solvents.
This work experimentally investigated the viscometric behavior of different DES over the entire molar composition range, aiming to understand how variations in the proportion between components influence flow resistance and deviations from ideal behavior. The systems were selected based on their potential application as hydrophobic solvents for liquid-liquid separations and because they spanned a range of intermolecular interaction strength, focusing on trioctylphosphine oxide (TOPO) with various hydrogen bond donors. The samples were prepared by weighing the precursors at different mole fractions, followed by heating at 55 °C for 3 h to promote homogenization. Dynamic viscosities were determined using a LAMY Rheology viscometer at 55 °C for all systems and, additionally, at 60, 65, and 70 °C for selected systems to obtain activation energies to flow. The experimental data were used to calculate excess viscosity deviations from ideal mixing behavior and were subsequently fitted using the Redlich–Kister equation.

The results indicate that the viscometric behavior of the studied DES depends on the chemical identity of the components, molar composition, and temperature, with deviations from ideal behavior observed in specific systems and compositional ranges. These deviations are consistent with differences in intermolecular interactions, local organization, and possible molecular packing effects within the mixtures. Thus, this study contributes to replacing the empirical selection of DES with a more rational approach guided by the relationship between composition, structure, and transport properties.

Keywords. *Deep eutectic solvents; viscosity; molar composition; non-ideal behavior; Redlich–Kister model*

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Development of functionalized membranes for metal separation in hydrometallurgical processes

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Abstract. Poor management of electronic waste, combined with the rapid growth in electronic device usage, is outpacing the expansion of formal metal recycling capacity. Efficient metal recycling technologies are essential to secure critical raw materials for the energy transition and reduce pressure on primary mineral resources and their associated environmental and social impacts. In 2022, only about 22.3% of electronic waste was properly collected and recycled, highlighting the need for improved recycling strategies to reduce reliance on primary mineral extraction [1]. Conventional hydrometallurgical routes based on solvent extraction are a proven and selective technology, but often require large volumes of problematic organic solvents and are very energy-intensive. In contrast, membranes offer compact and continuous separation with lower solvent consumption, large interfacial areas, and reduced energy requirements. Owing to their tunability, membranes can be designed to selectively separate target ions and integrated into diverse processes. This PhD aims to develop intensified, sustainable processes for the selective separation of gold ions from complex leachates obtained from waste CPUs, by combining advanced membrane modification strategies with optimized solvent extraction systems in hybrid flowsheets. Greener solvent systems and functionalized membranes, used either as standalone units or integrated as membrane contactors, will be explored.

Keywords. *E-waste Management; Metal separation; Selective Solvent Design; Greener Solvents; Novel membrane contactors*

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Exploiting early stages of *Porphyra* sp. as sources of bioactive compounds with potential in nutraceutical applications

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Abstract. Marine bioactive compounds have gained significant attention due to the rising demand for safe, sustainable, and eco-friendly ingredients. Among others, macroalgae like *Porphyra* sp., have been recently studied for their high-value compounds. *Porphyra* sp. features a complex, heteromorphic life cycle, alternating between a macroscopic gametophyte (blade) and a microscopic, filamentous sporophyte phase (conchocelis) (1,2).While research and commercial exploitation traditionally focused on the blade phase for food and nutraceutical markets, the early microscopic stages (conchocelis and conchosporangia) remain largely unexplored despite their biotechnological potential (3). Currently, ALGAplus produces the early stages (conchocelis and conchosporangia) for blade production, which can themselves be a consistent source of these bioactive compounds (2). This builds upon ALGAplus' successful track record in investigating other valuable compounds, driving the company to unlock the full potential of its current production.

This project aims to explore the potential of the early stages of *Porphyra* sp (conchocelis and conchosporangia) by optimizing its growth conditions and studying more efficient downstream processes for the recovery of phycoerythrin and mycosporine-like amino acids (MAAs). The workplan will focus on optimizing culture conditions to enhance biomass growth rates, compounds' yield and bioavailability. Additionally, with the goal of applying these compounds as potential nutraceutical ingredients, innovative encapsulation matrices by combining alternative solvents with approved polysaccharides, will be investigated to enhance phycoerythrin's functionality.

The main goal of this project is thus to develop a successful, sustainable, and versatile process to extract and stabilize MAAs and phycoerythrin. Designed for potential future industrial application in other red seaweeds, it will contribute to develop new high-value markets.

Keywords: *Porphyra*; Conchocelis; Phycobiliproteins; Mycosporine-like amino acids; Stability; Encapsulation

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Bio-based optical materials from red macroalgae: towards sustainable sensing of UV/blue radiation and temperature for biomedical applications

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Abstract. Human skin serves as a barrier between the body and its environment, facing continuous exposure to UV radiation, blue light from digital screens, and thermal variations. Prolonged exposure to UV and blue light contributes to premature skin aging and retinal damage. Furthermore, temperature acts as a key biomarker for the body's inflammatory and healing responses. The need for integrated, non-invasive, and sustainable detection of radiative and thermal stimuli is crucial [1]. Although optical devices have been advancing, current sensors rely heavily on synthetic luminescent materials, such as quantum dots and lanthanides, which have well-documented biocompatibility limitations and adverse environmental impacts [2-3].

Among promising natural sources, red algae emerge as an alternative source of active optical centers, potentially effective in a bio-based optical system for radiation and temperature detection. Notably, R-Phycoerythrin (R-PE) and mycosporine-like amino acids (MAAs) hold significant potential in this context. R-PE is a photosynthetic phycobiliprotein with high quantum yield (0.39) and optical conversion efficiency (4.74–6.88%), whereas MAAs are water-soluble molecules with absorption maxima between 310–360 nm and high molar extinction coefficients (~40,000 M^{-1} cm^{-1}) [2,4]. Beyond their optical properties, these compounds exhibit intrinsic antioxidant, antimicrobial, anti-inflammatory, and wound-healing bioactivities, providing the sensor matrix with dual sensing and therapeutic functionality [2,4].

This PhD project covers the optimized cultivation of *Porphyra* spp., a red seaweed, in partnership with ALGAplus S.A., the development of sustainable downstream processes employing aqueous solvents and eutectic mixtures, the optical characterization of the extracted compounds, their incorporation into biocompatible polymeric matrices, and the deposition of the resulting mixtures onto wound dressing membranes using drop-casting.

This work is expected to deliver marine biomass-based optical sensing platforms combining temperature (33–42°C) and UV/blue radiation. By grounding this innovation in circular economy principles, it establishes a scalable, environmentally responsible pathway toward next generation of sustainable biomedical sensing.

Keywords: *Phycoerythrin; Mycosporine-like aminoacids; Eutectic solvents; Bio-based optical sensors; Optical thermometry*

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Salicornia ramosissima as a novel source of bioactive compounds to produce wound-healing bio-based patches

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Abstract. Skin infections and impaired tissue regeneration, namely chronic wounds, remain a significant healthcare challenge, affecting millions worldwide and placing substantial economic burden on public health systems. Current treatments and wound-care materials may present limitations related to biocompatibility and environmental impact, while antimicrobial resistance increasingly limits treatment options. [1] Consequently, there is a growing interest in natural bioactive compounds as alternative sources for developing bio-based biomedical applications with regenerative and antimicrobial potential.

Salicornia ramosissima (*S. ramosissima*) is a halophyte plant native to the Portuguese coast typically used as functional food and in traditional medicine. Recently, it has garnered attention due to its rich composition, particularly in polyphenols such as phenolic acids and flavonoids, associated with antioxidant, anti-inflammatory, antimicrobial, and photoprotective bioactivities.[2] This suggests potential for biomedical applications, particularly in developing wound-healing solutions. However, research on *S. ramosissima* remains limited, particularly regarding the optimization of polyphenol recovery through sustainable extraction methodologies.

Extraction methodologies based on eutectic solvents (ESs), have emerged as a promising alternative to conventional systems due to their versatile and task-specific nature. These systems can be designed to be environmentally friendly, with low toxicity and possess high solubilization power, making them suitable for the selective extraction of polyphenols, while maintaining appropriate characteristics for wound-healing applications.[3] Moreover, extraction can also be enhanced through manipulation of growth conditions to enhance biomass quality and polyphenol yield.

This study aims to explore *S. ramosissima* as a sustainable source of polyphenols for biomedical applications, namely wound-healing patches. The work will focus on the characterization of the bioactive compounds and the development of biocompatible extracts using eutectic solvents. In parallel, cultivation techniques will be evaluated as a strategy to enhance biomass quality. Finally, the polyphenol-rich extracts will be incorporated into biocompatible polymeric matrices to develop bio-based wound-healing patches designed to support antimicrobial activity and tissue regeneration.

Keywords: *Salicornia ramosissima; Eutectic Solvents; Polyphenols; Wound Healing; Bio-based Patches*

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Determination of ion speciation in eutectic solvent – application towards lanthanide recycling

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Abstract. The growing demand for lanthanides in clean-energy technologies and advanced electronics, combined with the geopolitical concentration of primary resources, has intensified the need for sustainable recycling strategies. Deep eutectic solvents (DES) have emerged as promising alternatives to conventional hydrometallurgical media due to their tunability, low volatility, and potential for selective metal extraction. However, the molecular mechanisms governing lanthanide speciation and extraction in DES remain poorly understood, limiting the rational design of efficient solvent systems [1].

This PhD project aims to establish a multiscale framework connecting lanthanide speciation, solvent structure, and extraction performance in hydrophobic DES for rare-earth recycling applications. The work combines computational modelling, advanced spectroscopy, and machine learning to develop predictive design criteria for next-generation extraction media. A new transferable polarizable force field for molecular dynamics simulations will be developed for selected DES systems and lanthanide nitrate complexes, enabling accurate description of polarization, many-body interactions, and charge-transfer effects that are inadequately captured by conventional fixed-charge models. Computational results will be validated against experimental spectroscopic techniques, primarily X-ray absorption spectroscopy (XANES/EXAFS), complemented by UV–Vis, luminescence, Raman, IR, NMR, and SAXS analyses.

The validated molecular descriptors and thermodynamic properties obtained from simulations will be integrated with experimental extraction data to construct a machine-learning model capable of predicting lanthanide extraction efficiency and selectivity [2]. The project will focus initially on TOPO- and TODGA-based hydrophobic DES systems and will ultimately apply the developed methodology to the separation of rare-earth elements from waste permanent magnet leachates [3].

By integrating molecular-level understanding with data-driven solvent design, this work seeks to establish a predictive methodology for sustainable lanthanide separation and recycling. The proposed framework may contribute to the development of greener hydrometallurgical processes and support the transition toward a more resilient and circular supply chain for critical raw materials.

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Keywords. *Deep Eutectic Solvents; Critical Metals; Recycling; Sustainable Processes; Molecular Dynamic simulation; X-ray Absorption Spectroscopy;*

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Design of ionic liquids for high-temperature applications

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Abstract. Ionic liquids (ILs) have attracted significant attention as tunable solvents for intensified reaction–separation processes due to their negligible vapor pressure, structural versatility, and adjustable solvation properties. However, their rational design for applications remains limited by the vast chemical space of possible cation–anion combinations, in special for high-temperature due the scarcity of reliable long-term thermal stability data, and the limited extrapolation capability of existing predictive models under harsh operating conditions. Most IL selection studies still rely on physical-chemical data at moderate temperatures and short-term thermal stability indicators, although these metrics may overestimate durability during prolonged operation [1].

This work proposes a data-guided framework for the design and selection of ILs suitable for high-temperature reaction–separation processes. The approach combines curated experimental data, COSMO-based molecular descriptors, thermodynamic modelling, machine-learning methods, and experimentally validated long-term stability criteria. To achieve this goal, a database of IL properties will include molecular representations, activity coefficients, viscosity, melting temperature, short-term thermal stability indicators, and long-term degradation metrics. Predictive models will be developed and benchmarked to estimate separation performance, operability properties, and long-term thermochemical stability. Attention will be given to the combination of degradation descriptors and uncertainty modelling strategies, allowing candidate selection to account not only for selectivity but also for durability under continuous high-temperature exposure.

The methodology will be validated using CO_2 hydrogenation to methanol as case study, a high-temperature reaction where equilibrium constraints and excess water formation limit conversion and industrial application. In this context, ILs can act as a stable selective absorbent for in situ removal of methanol and water, shifting the reaction equilibrium and improving process yields [2]. The outcome will be an integrated modelling–experimental strategy capable of ranking IL candidates according to separation performance, operability, chemical compatibility, and long-term stability, providing a transferable framework for solvent design in high-temperature intensified processes.

Keywords. *Ionic liquids, COSMO, machine learning, long-term thermochemical stability, predictive models .*

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Integrated computational and enzymatic approach for the biodegradation of polymers in liquid formulations

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Abstract. One of the major challenges today is the widespread use of synthetic organic polymers. Valued for their durability and low cost, their improper disposal and resistance to degradation have led to significant environmental accumulation, making sustainable solutions a global priority. Among polymers, those present in liquid formulations (PLFs) deserve special attention because, unlike conventional solid plastics, they often go unnoticed despite being widely used in everyday products such as paints, detergents, cosmetics, and industrial additives [1]. Acting as thickeners, emulsifiers, binders, stabilizers, and film formers, the production of PLFs still relies heavily on fossil resources, while their structural complexity makes them highly resistant to degradation [2]. Moreover, the Royal Society of Chemistry estimates that annual global production of PLFs exceeds 36 million tons, highlighting the urgent need for circular economy strategies [1]. Due to their dispersed and diluted nature, PLFs frequently evade conventional wastewater treatment processes and can subsequently accumulate in soils through the application of treated sludge [3]. This widespread environmental release, combined with the still limited understanding of their biodegradation pathways, makes PLFs a significant and growing environmental concern.

This work proposes an innovative integrated approach combining predictive computational modeling and experimental enzymatic biodegradation to overcome key challenges in PLFs degradation, specifically poly(vinyl alcohol) (PVA) and polyacrylamide (PAM). Using COSMO-RS-based molecular descriptors and AI models trained on structural features, the first goal is to identify the most promising enzyme-polymer combinations for the effective biodegradation of PLFs in aqueous solutions. Enzymes from hydrolytic (e.g., cutinases) and oxidative (e.g., laccases) classes will be tested. Enzyme-polymer systems that perform well in preliminary validation will then be applied to commercial PLF-containing products (e.g., PVA-based laundry pods and PAM-based flocculants) under formulation-relevant conditions, with optimization of degradation parameters. Degradation products will be characterized and evaluated for biodegradability and ecotoxicity to assess their environmental fate and ensure process safety.

Keywords. *Plastic degradation; Enzymatic degradation; Poly(vinyl alcohol); Polyacrylamide*

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Sustainable and scaled-up technology to extract proteins from *tenebrio molitor* using aqueous solutions of bio-based ionic liquids

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Abstract. The global human population is projected to reach approximately 9.6 billion by 2050, leading to a significant surge in protein demand that conventional livestock production cannot sustainably meet [1]. Traditional agricultural practices are increasingly associated with environmental degradation, necessitating a transition toward alternative, reliable, and socially acceptable food sources [2]. *Tenebrio molitor* (TM), or the yellow mealworm, has emerged as a premier candidate, achieving novel food status from the European Commission. TM farming offers substantial ecological benefits over traditional livestock, characterized by lower greenhouse gas emissions, reduced land and water usage, and high nutritional density, specifically a protein content of 54.95% on a dry weight basis [3]. However, widespread adoption in Western markets is hindered by consumer neophobia and the negative associations with pests and disease. To circumvent these psychological barriers, protein extraction serves as a strategic intervention. By isolating the protein and incorporating it as a functional, invisible ingredient, the visible insect morphology is eliminated, thereby enhancing consumer willingness and overall market integration [1]. For this extraction process, bio-based Ionic Liquids (ILs)—novel "liquid salts"—show significant potential. These designer solvents combine the high extraction efficiency and chemical versatility of traditional ILs with superior environmental profiles, including negligible toxicity and excellent biodegradability [4]. This research focuses on the implementation of bio-based ILs for the selective recovery of TM proteins, specifically addressing the transition from laboratory optimization to industrial settings. Initial laboratory-scale optimizations utilizing aqueous systems demonstrated significant potential, notably achieving enhanced protein yields with a 25-fold increase in process scale. Furthermore, comprehensive ecotoxic assessments of the recovered proteins as feed substitute were conducted using *Daphnia magna*, showing no major impacts and mortality. Such developments are crucial for moving beyond proof-of-concept toward viable, sustainable commercial applications in the global food industry.

Keywords. *Insects; Protein extraction; Ionic Liquids; Sustainability; Novel food*

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Fractionation and purification of terpenes using alternative mass separation agents

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Abstract. Essential oils (EOs) are complex, plant-derived mixtures mainly composed of terpenes and terpenoids. Owing to their antioxidant, antimicrobial, and aromatic properties, they find diverse applications across the food, pharmaceutical, and chemical industries [1]. However, the chemical instability of hydrocarbon terpenes demands their removal from essential oils to preserve product quality [2]. While traditional methods such as vacuum distillation and solvent extraction are widely employed, they often rely on hazardous volatile organic compounds. This has driven the investigation into sustainable alternative solvents, including ionic liquids, deep eutectic solvents, and polyglycols. The separation of the more common citrus EOs (*e.g.*, limonene/linalool) is well-documented [3,4], but research into the fractionation of other economically relevant EOs remains limited. This work takes a step forward by investigating the fractionation of bergamot, savory, oregano, cinnamon, and spearmint essential oils. The purification of these EOs is critical for their market valuation, as many high-value compounds are present at very low concentrations; isolating these trace constituents significantly enhances their utility for specialized applications.
This study starts by integrating experimental and computational solvent screening. Inverse gas chromatography was utilized to determine separation factors (selectivity and capacity), complemented by predictive COSMO-RS modeling. Based on this pre-screening, the most promising mass separating agents were selected for liquid-liquid equilibria studies. These phase-equilibrium data are fed into Aspen Plus® process simulator to design the deterpenation using liquid-liquid extractors. Our findings demonstrate that choline and acetate-based imidazolium ionic liquids show significant potential for the fractionation of these complex mixtures. By replacing conventional volatile organic compounds with more efficient ionic liquids – which offer reduced flammability, lower volatility, and higher biocompatibility – this work aligns with the UN Sustainable Development Goals 9 (Industry, Innovation, and Infrastructure) and 12 (Responsible Consumption and Production).

Keywords: *Terpenes; phase equilibria; new separation processes; sustainability; neoteric solvents*

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[PDPP] Thesis project defense in public policies

Entre o curto e o longo prazo: meios de comunicação social, visibilidade mediática e agenda das políticas de saúde

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Abstract. As políticas públicas enfrentam uma tensão entre responder a problemas imediatos e produzir transformações estruturais. Embora a literatura explique a predominância do curto prazo através de fatores eleitorais, cognitivos e institucionais, permanece por esclarecer a influência dos meios de comunicação social na agenda política e na definição de prioridades. A investigação analisa de que forma a visibilidade mediática dos problemas de saúde influencia a definição das prioridades políticas e o horizonte temporal das respostas adotadas. Centra-se no setor da saúde, onde crises, conflitos e escassez tendem a prevalecer sobre desafios estruturais, como prevenção e desigualdades em saúde. A triangulação metodológica combina análise de documentos de política de saúde e notícias; inquéritos e entrevistas a decisores, assessores de imprensa e jornalistas. Pretende-se clarificar o papel da visibilidade mediática na discussão sobre políticas de curto e longo prazo, e desenvolver mecanismos institucionais que garantam equilíbrio temporal nas políticas de saúde.

Keywords. Curto prazo; Longo prazo; Meios de comunicação social; Visibilidade mediática; Agenda política; Políticas de saúde

References.

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A seletividade do *oversight* no ciclo das políticas públicas: critérios, práticas e implicações

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Resumo. Esta investigação analisa como se estrutura a seletividade do *oversight* ao longo do ciclo das políticas públicas. Por seletividade entende-se aqui a escolha institucional do que se torna visível, auditável e politicamente relevante na ação pública. Diferentes instituições de *oversight*, como controlo externo, controlo interno e agências de avaliação de políticas, entre outras, operam sob restrições de capacidade e pressões institucionais, tornando a seletividade dos objetos a escrutinar condição estrutural recorrente. Apesar da vasta literatura normativa sobre critérios de priorização, permanece insuficientemente compreendido como a seleção opera analiticamente e quais as implicações para a visibilidade institucional da ação pública. O estudo articula contributos das literaturas sobre *oversight*, ciclo das políticas públicas, capacidade estatal, atenção institucional e apoio à decisão. Metodologicamente, combina *scoping review* (PRISMA-ScR), estudo de caso qualitativo na Controladoria e Ouvidoria Geral do Estado do Ceará, análise documental, entrevistas e *framework* analítico-propositivo. A investigação propõe um quadro analítico integrado da seletividade do oversight, contribuindo para o debate sobre *accountability* democrática e estruturação reflexiva dos processos de priorização institucional.

Palavras-chave. *Seletividade do oversight; Ciclo das políticas públicas; Capacidade estatal; Atenção institucional; Instrumentos de ação pública*

Atrair não é reter: capacidade estatal e *policy feedback* de estudantes brasileiros de pós-graduação em Portugal

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Resumo. Esta investigação analisa o paradoxo entre atração e retenção de talento qualificado em Portugal, focando-se em pós-graduandos brasileiros. O problema reside no hiato entre as políticas formais de atração e a (in)capacidade operativa estatal para sustentar a fixação, operacionalizado pelo conceito autoral 'Jornada da Sigla' (cadeia de encargos administrativos na transição para residente qualificado). Mobilizando a *Policy Feedback Theory* e a literatura dos *administrative burdens*, investiga-se como a fricção burocrática molda trajetórias migratórias, induzindo *step-migration* ou *brain waste*. Propõe-se a noção de 'Política de Desincentivo por Exaustão' como contributo teórico central. Metodologicamente, adota-se desenho misto sequencial (QUAN-QUAL) à escala nacional, articulando Modelação de Equações Estruturais (SEM) e entrevistas semiestruturadas para mapear tipping points e contrastes territoriais (alta vs. baixa densidade). Como contributo aplicado, produz-se evidência para informar uma Matriz de Interoperabilidade interinstitucional, num registo de *evidence-informed policy*.

Palavras-chave. *Policy Feedback; Administrative Burdens;* Capacidade Estatal*; Step-Migration;* Retenção de Talento Qualificado

Efeitos das mudanças de governo em políticas ambientais: continuidade e ruptura no estado de Minas Gerais

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Resumo. Este estudo investiga como mudanças de governo se associam à continuidade e ruptura de políticas públicas ambientais em escala subnacional. O estudo centra-se nas políticas florestal e de proteção à biodiversidade de Minas Gerais, no período de 2002 e 2027, analisando sua trajetória político-institucional, capacidade de implementação, implementação e efetividade ambiental. A pesquisa adota uma aborgadem longitudinal, com análise qualitativa predominante e apoio de análise quantitativa descritiva, combinando revisão de literatura, análise documental, indicadores orçamentário-financeiros e indicadores de implementação e de efetividade. O cruzamento analítico de evidências de diferentes dimensões, combinada com fatores contextuais relevantes, permitirá identificar, analisar e interpretar padrões de continuidade e ruptura das políticas ao longo de diferentes ciclos governamentais, contribuindo para o debate sobre estabilidade e fragilidade de políticas ambientais em contextos democráticos de mudanças de governo e pressões econômicas.

Palavras-chave. *Mudanças de governo; Políticas públicas ambientais; Trajetória político-institucional; Continuidade de políticas públicas; Ruptura de políticas públicas*

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Sistemas de Gestão de Desempenho e Integração de Sustentabilidade em Instituições Públicas de Ensino Superior em Portugal

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Abstract. Este projeto pretende explorar como os Sistemas de Gestão de Desempenho (SGD) em Instituições de Ensino Superior (IES) integram a sustentabilidade como uma preocupação política substancial. Com foco nas IES públicas portuguesas, é investigado se a sustentabilidade é operacionalizada por meio de objetivos concretos, indicadores mensuráveis e processos de tomada de decisão que efetivamente influenciem a gestão institucional. O estudo prevê um desenho sequencial multimétodo combinando análise documental comparativa de 31 instituições, entrevistas semiestruturadas com líderes institucionais e pessoal técnico bem como grupos focais. A análise é orientada pelo quadro de Integração de Políticas, que abrange três dimensões (normativa, organizacional e processual) e três planos de integração (vertical, horizontal e articulação externa). A investigação apoia o alinhamento do ensino superior português com os ODS, o Pacto Ecológico Europeu e os principais instrumentos de política nacional, como o ECO.AP 2030, PNEC 2030 e o RNC 2050. Com este projeto, pretende-se desenvolver simultaneamente um quadro de maturidade para a integração da sustentabilidade nos SGD, que possa funcionar como instrumento de diagnóstico para IES, entidades de avaliação e decisores políticos, e que seja transferível para outros contextos nacionais de forma a contribuir para processos mais amplos de harmonização de políticas de sustentabilidade.

Keywords. *Sistemas de Gestão de Desempenho; Integração da Sustentabilidade; Integração de Políticas; Implementação de Políticas Públicas; Governança da Sustentabilidade; Instituições de Ensino Superior*

Políticas públicas e respostas institucionais à saúde mental nas universidades públicas portuguesas

Public policies and institutional responses to mental health in Portuguese public universities

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Abstract. A saúde mental no ensino superior tem vindo a assumir crescente relevância enquanto desafio de política pública e de governação institucional. Apesar da crescente atenção científica ao tema, a literatura tem-se centrado predominantemente nas dimensões clínicas e psicológicas do fenómeno, permanecendo relativamente pouco exploradas as respostas das universidades a este desafio. Esta investigação procura analisar de que forma as universidades públicas portuguesas concebem e operacionalizam políticas de saúde mental, considerando intervenções dirigidas aos indivíduos e mudanças ao nível das estruturas e práticas organizacionais. O estudo assenta numa abordagem qualitativa de natureza comparativa, baseada em cinco estudos de caso, combinando análise documental, entrevistas semiestruturadas e recolha de dados administrativos. A investigação pretende contribuir para a compreensão dos fatores organizacionais e contextuais que condicionam a conceção, implementação e alcance das respostas universitárias à saúde mental, e das potencialidades e limites das políticas institucionais enquanto instrumentos de promoção do bem-estar no ensino superior.

Keywords. *Saúde mental; Ensino Superior; Governação; Policy design; Determinantes sociais da saúde.*

Governação para a integração da literacia em inteligência artificial: políticas públicas de educação em Portugal

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Abstract. A integração da Inteligência Artificial nos sistemas educativos coloca desafios crescentes de governação que os sistemas contemporâneos não estão preparados para responder de forma coordenada. Em Portugal, a ausência de um quadro normativo para a literacia em IA e capacidades institucionais territorialmente desiguais, geram respostas locais fragmentadas que colocam em risco os princípios da educação inclusiva. Esta investigação analisa de que modo a formulação das políticas públicas de educação enquadra a integração da literacia em IA e como as dinâmicas de governação multinível condicionam a sua implementação nas escolas. Partindo da articulação da governação multinível, policy enactment e educação inclusiva como critério de justiça, o estudo combina análise documental, estudo de caso múltiplo com seleção tipológica de contextos contrastantes e entrevistas semiestruturadas. A investigação propõe um quadro analítico para compreender os desafios regulatórios, organizacionais e éticos da integração da IA no sistema educativo português, orientado pela equidade e pela inclusão.

Keywords. *Literacia em Inteligência Artificial, Governação multinível, Capacidade Institucional, Políticas públicas de educação, Educação Inclusiva*

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Plastic forests and absent ecosystems: the institutional design of European funds and performative compliance in regional innovation

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Abstract. Endogenous innovation, understood as the process emerging from a territory's internal capacities and relational dynamics, is crucial for territorial cohesion. In contrast to exogenous logics that generate dependency, rooted innovation requires policies tailored to local specificities. Although the European Structural and Investment Funds are a priority, these investments have not mitigated regional asymmetries, particularly in double-periphery regions. The present study investigates the causes of this persistence, aiming to analyse the extent to which the institutional design of the European cohesion funds (2014–2027) conditions the capacity of territorial actors in Portuguese double periphery regions to develop endogenous innovation trajectories, and through which mechanisms this conditioning operates. The research employs a mixed-methods approach, combining documentary analysis and interviews with regional decision-makers to operationalise a multicriteria evaluation matrix. As main results and theoretical implications, the study introduces "performative compliance" as an analytical category to distinguish substantive from apparent innovation, providing an empirical instrument for comparative evaluation. This approach allows identifying whether the current funding architecture drives real innovation or induces passive adaptation, offering a diagnostic model with high replication potential for other peripheral geographies in Southern Europe.

Keywords. *Double periphery; Cohesion policy; Multicriteria evaluation; Path dependence;*

A Segurança Marítima Em Angola: Estudo Sobre a Eficácia das Políticas de Segurança da Autoridade Marítima Nacional Face a Segurança Nacional em Angola

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Abstract. O presente projeto de tese, analisa as políticas de segurança definidas pela Autoridade Marítima Nacional (AMN), enquanto órgão responsável pelos desenhos das políticas de segurança marítima, sob prisma da prevenção das diversas ameaças mormente, o assalto as embarcações, tráfico de seres humanos e drogas, pesca ilegal, entre outros crimes, no espaço marítimo angolano. Parte-se da pressuposto de que este espaço é de interesse estratégico para Estado angolano por concentrar a exploração petrolífera responsável pela maior contribuição no Orçamento Geral do Estado, além de assegurar a circulação da maior parte das importações e exportações de Angola. Assim assegurar o normalmente funcionamento das atividades marítimas é vital para o Estado angolano. Portanto neste estudo a segurança marítima será definida como questão de segurança nacional. Teoricamente o estudo explorará conceito de segurança numa perspetiva realista destacando as teorias de políticas públicas de segurança, criminalidade organizada e, finalmente, identificará as políticas de segurança marítima aplicadas pela AMN bem como analisar o seu enquadramento com os padrões internacionais e, consequentemente, avaliará a eficácia destas políticas face as ameaças existente. Metodologicamente, a investigação recorrerá à abordagem qualitativa, com recurso à análise documental de leis, normas, diretivas, relatórios nacionais e documentos de organizações regionais e internacionais. O projeto pretende fomentar o debate académico sobre a relação entre as políticas públicas de segurança no espaço marítimo e propor estratégias para o fortalecimento da segurança marítima angolana. Entre essas estratégias, destacar-se-ão a melhoria da articulação institucional, o reforço da capacidade operacional, a prevenção da criminalidade marítima e o alinhamento com boas práticas internacionais.

P. *Ameaça; Autoridade Marítima Nacional; criminalidade organizada; política de segurança; Segurança Marítima.*

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Advancing health equity through spatial policy and impact assessment: a comparative study of Portugal and the Netherlands

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Abstract. This research explores how spatial planning policies can be leveraged to improve public health and health equity. To this end, it addresses the Social Determinants of Health (SDH) through integrated governance and the use of Health Impact Assessment tools. Despite scientific recognition that spatial contexts heavily shape health outcomes, and global support for Health in All Policies (HiAP), implementation and impact measurement remain inconsistent across planning systems, generating divergent health impacts. Thus, this project analyses how the SDH are incorporated into spatial planning systems. Specifically, it focuses on Portugal and the Netherlands, adopting a multi-level, comparative, and participatory approach, by analysing how spatial plans at distinct governance levels consider the SDH, how institutional actors frame health within planning processes, and how HIA tools can influence policy integration and health equity. Methodologically, it combines a cumulative, multi-level approach, including document analysis, interviews, focus groups, and case studies of local urban greening interventions. The research will produce a conceptual and operational framework to guide the integration of health into spatial systems, accompanied by an adaptable HIA tool, peer-reviewed publications, and a policy brief. Ultimately, it aims to inform public policy by demonstrating how spatial planning systems can contribute to healthier, more equitable territorial governance.

Keywords. *Spatial planning; Health in All Policies; Social Determinants of Health; Health Impact Assessment; Comparative policy analysis*

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Medição e análise dos riscos de integridade – o caso português

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Abstract. A presente investigação procura explicar a variação do risco de integridade entre os 278 municípios de Portugal Continental, a partir de fatores institucionais e organizacionais. Afastando-se das abordagens baseadas em perceções e em análises *ex post* da corrupção, o estudo propõe a construção de um Índice de Risco de Integridade Municipal (IRIM) assente em indicadores observáveis de vulnerabilidade institucional na contratação pública, no urbanismo e na atribuição de benefícios. Analisa-se de que modo a pressão urbanística e económica, a concentração de poder político, a capacidade técnico-administrativa e a maturidade digital influenciam o risco de integridade. O IRIM constituirá a variável dependente, permitindo testar empiricamente as hipóteses formuladas. Metodologicamente, o estudo combina revisão sistemática da literatura, análise documental, construção do índice, análise estatística e componente qualitativa. O principal contributo reside na produção de evidência empírica sobre os determinantes do risco de integridade municipal e num instrumento comparável de avaliação do risco.

Keywords. *Risco de integridade; Governação local ;Indicadores de risco; Determinantes institucionais;Prevenção da corrupção*

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Beyond the curse and the blessing: an analysis of public governance in the Angolan oil sector through the lens of environmental justice

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Abstract. This study examined how public governance of Angola's oil sector shaped the production of environmental justice in coastal communities. It was based on the hypothesis that the distribution of risks and benefits depended not only on state regulation or corporate narratives but also on the concrete experience of recognition and participation among affected populations. The research integrated theoretical contributions from resource governance, public policy, and corporate social responsibility within the normative framework of environmental justice. Methodologically, it combined a systematic literature review (2000–2025), documentary and institutional analysis of laws, contracts, and regulatory reports, a legal-corporate study of corporate social responsibility, and empirical fieldwork in Cabinda, Soyo, and Lobito. Data sources included official documents, corporate sustainability reports treated as discursive artifacts, independent reports, and interviews with public officials, corporate managers, and community leaders. Results showed that while regulatory frameworks increasingly referenced equity principles, corporate practices often remained reputational rather than substantive. Community perspectives revealed persistent asymmetries in distribution, limited recognition of local identities, and weak participation mechanisms. The study concluded that environmental justice provided an operative criterion for evaluating governance in extractive contexts and offered a conceptual and methodological model applicable to other African resource economies.

Keywords. *Angola; Resource governance; Corporate social responsibility; Coastal communities; Environmental equity.*

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Efeito da acessibilidade a serviços de interesse geral na distribuição da população nos municípios de Portugal continental (1990–2024)

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Abstract. Em Portugal continental, persistem desigualdades territoriais no acesso a serviços de interesse geral, a par de trajetórias municipais marcadas pela perda populacional e pelo envelhecimento. Contudo, continua por esclarecer em que medida as alterações na acessibilidade a esses serviços se associam, ao longo do tempo e à escala municipal, a trajetórias demográficas diferenciadas. Este projeto centra-se nos 278 municípios do continente, opção justificada pela maior comparabilidade analítica deste universo e pelas especificidades das regiões insulares, que exigiriam um enquadramento territorial distinto. A investigação tem como objetivo analisar a evolução da acessibilidade da população a serviços de interesse geral entre 1990 e 2024, **entendida** em termos de acesso efetivo, e não apenas de presença formal da oferta**,** com particular incidência nos domínios da saúde e da educação. O desenho da investigação articula análise quantitativa longitudinal com aprofundamento qualitativo de casos contrastantes, procurando combinar a identificação de padrões municipais com a interpretação de fatores territoriais, institucionais e de governação. A investigação reconhece que a relação entre acessibilidade e dinâmicas populacionais pode não ser linear nem unidirecional. Espera-se que os resultados contribuam para a produção de evidência longitudinal e comparável e para o apoio à decisão pública e à formulação de respostas territorialmente ajustadas.

Keywords. *Acessibilidade a Serviços de Interesse Geral; Despovoamento; Dinâmicas Populacionais; Portugal Continental; Municípios; Análise Longitudinal.*

[PDT] Thesis project defense in tourism

Understanding consumer decision-making processes in elective medical tourism

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Abstract. Elective medical tourism has become an increasingly significant component of global healthcare and tourism, enabling individuals to travel across international borders to obtain planned medical treatment. Unlike emergency healthcare, elective medical tourism involves deliberate and complex consumer decisions, requiring individuals to evaluate healthcare providers, destinations, treatment options, financial considerations, and perceived risks before selecting treatment abroad. Although existing research has extensively examined medical tourists' motivations, destination attributes, service quality, and treatment outcomes, comparatively limited attention has been given to understanding how consumers construct their decision-making processes throughout the planning journey. Furthermore, the rapid digitalization of healthcare information has transformed the ways in which prospective medical tourists search for, evaluate, and integrate information through a growing range of digital information sources.

This research aims to develop a comprehensive understanding of consumer decision-making processes in elective medical tourism. Specifically, it seeks to examine how consumers organize their decision-making process, identify the factors influencing their choices, investigate the information sources they use, explore how these sources interact in shaping decisions, and examine the role of emerging digital information sources within the broader decision-making process. The study adopts a sequential mixed-methods design, combining questionnaire data with semi-structured interviews. Quantitative data will be analyzed using statistical techniques to identify behavioral patterns, while qualitative data will undergo thematic analysis to explore consumers lived decision-making experiences.

The research is currently in progress, with data collection and analysis underway. It is expected to advance theoretical understanding of consumer decision-making in elective medical tourism by drawing on established consumer behavior and decision-making theories to explain how prospective medical tourists navigate complex healthcare choices within increasingly digital information environments. The findings will also provide practical recommendations for healthcare providers, destination marketing organizations, and policymakers to better support informed consumer decision-making in elective medical tourism.

Keywords. *Consumer behavior; Information search; Digital health; Healthcare decision-making; Mixed methods*

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Territorial integration into bio-regions and the enhancement of tourism attractiveness: residents' perceptions and valuation

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Abstract. The integration of territories into international Bio-Regions/Bio-Districts, also referred to as Eco-Regions, has gained relevance as a strategy for promoting sustainable development, territorial differentiation, and cross-sectoral cooperation [1]. However, its contribution to tourism attractiveness remains insufficiently understood, particularly regarding how such attractiveness is perceived, interpreted, and valued by resident populations. This study examines how participation in transnational Bio-Region networks may enhance tourism attractiveness in rural and low-density destinations, while considering residents as key actors in the social validation of tourism development [3]. Grounded in a pragmatic, problem-oriented approach, the research conceptualises tourism attractiveness as a multidimensional and socially constructed phenomenon. It combines an external dimension, linked to visibility, differentiation, reputation, competitiveness, and the qualification of the tourism experience [2], with an internal dimension, related to perceived value, social acceptance, territorial identity, and local sustainability. Within this framework, Bio-Region integration is analysed as a potential mechanism for strengthening territorial governance, multi-actor coordination, institutional legitimacy, and integrated territorial management, with particular attention to the articulation between organic agriculture, tourism, restaurants, culture, heritage, sustainability, and local development. Methodologically, the study proposes an embedded case study supported by a mixed-methods design. Data collection will combine a questionnaire survey addressed to residents, semi-structured interviews, focus groups, document analysis, and, where relevant, social network analysis, allowing the triangulation of quantitative, qualitative, and relational evidence. The expected contribution is a replicable analytical framework for examining how transnational territorial networks influence tourism attractiveness, while highlighting the role of residents in recognising, validating, and sustaining locally grounded tourism development.

Keywords. *Bio-Regions; Tourism Attractiveness; Territorial Governance; Resident Perceptions; Rural Destinations*

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Determinants of diaspora entrepreneurship in the tourism sector: The case of Angolans in Portugal investing in Angola

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Abstract.

With the advancement of economic globalisation and the increasing complexity of migration flows, it has become essential to recognise the role of entrepreneurs in fostering socioeconomic development in both countries of origin and host countries. In this context, diaspora entrepreneurship has emerged as a relevant mechanism through which migrants may contribute to development in their countries of origin, by mobilising financial capital, knowledge, social networks and transnational connections [1, 2]. Despite the growing scholarly interest in the relationship between migration, entrepreneurship, and society, research on diaspora and transnational entrepreneurship remains relatively fragmented. Existing literature is still largely shaped by qualitative and case-based approaches, while broader quantitative and longitudinal evidence remains comparatively limited [3]. This gap highlights the need for further research into the factors that motivate, enable, or constrain diaspora entrepreneurship, particularly in strategic sectors such as tourism. The purpose of this study is to analyse the determinants of diaspora entrepreneurship in the tourism sector in migrants' countries of origin. The study will adopt a sequential, exploratory, mixed-methods research design, allowing for an initial in-depth exploration of the phenomenon, followed by a broader empirical assessment of the identified determinants. This research is expected to contribute to a deeper understanding of the key determinants of diaspora entrepreneurship in the tourism sector. It also aims to develop a conceptual model that synthesises the main determinants and mechanisms shaping diaspora entrepreneurial intention and action in countries of origin. Finally, the study is expected to provide relevant insights for the design of public policies and diaspora-oriented programmes, while contributing to the academic literature on diaspora entrepreneurship, migration, and tourism development.

Keywords: *Diaspora entrepreneurship; tourism sector; countries of origin; migration; push-pull factors; entrepreneurial determinants*

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Blue creative tourism: A development model for coastal destinations

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Abstract. Coastal destinations face a persistent paradox: although Portugal's national tourism strategy recognises both the sea and creativity as strategic assets, the two dimensions remain largely disconnected. Creativity is framed around urban industries, while the sea is operationalised through conventional products such as sun and beach, nautical sports or marine wildlife observation [1]. This policy gap is compounded by an academic one: creative tourism literature has predominantly focused on urban [2] and rural contexts [3], leaving coastal territories and their specific maritime identities overlooked. This gap calls for a conceptual model that articulates, on the supply side, the conditions for blue creative tourism to emerge, and on the demand side, the motivational antecedents and tourist involvement explaining tourists' intention to choose blue creative tourism activities.
This research aims to develop a conceptual model supply-side conditions for community-based co-creation with demand-side motivational antecedents and tourist involvement. The study adopts a sequential mixed-methods design. Initially, Social Network Analysis (SNA) and semi-structured interviews map the local supply ecosystem, relational dynamics, and maritime identity, human capital and community openness that characterise a destination's capacity to host blue creative tourism. Subsequently, a Delphi process validates a multidimensional measurement scale, which is then tested on the demand side using PLS-SEM to evaluate how motivation and involvement predict tourists' behavioral intentions. The model is applied to multiple coastal destinations selected through purposive sampling based on life-cycle heterogeneity, distinct maritime history, and the baseline existence of creative initiatives. Expected contributions include a validated conceptual model and theoretically grounded governance implications for sustainable blue creative tourism.

Keywords. *Creative Tourism; Coastal destinations; Blue economy; Creative ecosystem*

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Factors influencing sustainable leadership implementation in tourism companies: a multilevel perspective

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Abstract. The growing pressure associated with sustainability, environmental, social and governance (ESG) criteria, and sustainable development policies has reinforced the need to understand how tourism companies incorporate sustainable leadership practices. Although the literature associates sustainable leadership with positive outcomes, including long-term value creation [1], innovation [2], improved organisational performance [3], and stakeholder satisfaction [4], there is still limited understanding of the factors influencing its adoption [5], particularly within the tourism sector. In this context, this study aims to understand how individual, organisational and contextual factors influence and interact in the implementation of sustainable leadership practices in tourism companies. The research adopts a multilevel perspective, conceptualising sustainable leadership as a socially constructed phenomenon shaped by individual (micro-level), organisational (meso-level), and contextual (macro-level) factors. From a methodological perspective, the study follows a qualitative interpretivist approach. Data collection will be conducted through semi-structured interviews, document analysis, and direct observation in tourism companies that were among the first participants in the "Empresas Turismo 360º" programme, developed by Turismo de Portugal to promote the integration of ESG practices within the tourism sector. Data will be analysed using content analysis. The study is expected to contribute to a deeper understanding of the factors and processes underlying the implementation of sustainable leadership in tourism companies, while clarifying the relationships among sustainability policies, organisational practices and leadership. In practical terms, the study is expected to provide practical guidance for tourism managers and policymakers seeking to strengthen ESG integration and sustainable organisational transformation.

Keywords. *Sustainable leadership; Sustainable tourism; Organisational sustainability; Sustainable leadership implementation; ESG criteria; Tourism companies.*

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Conceptualizing tourism destination competitiveness: The residents' perspective

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Abstract. Tourism destination competitiveness has been extensively investigated and positioned as a core area of interest within the tourism literature. [1]. Nevertheless, defining the concept remains challenging, since its inherent multidimensionality has led to a lack of consensus regarding the specific attributes that should constitute it [2]. Despite these conceptual ambiguities, the literature over recent decades has firmly established competitiveness as a critical determinant of tourism destination success [3]. To date, this area has been predominantly examined through a dual framework: the demand side (focusing on tourist desires), and the supply side (encompassing offerings from the government and other tourism businesses). Consequently, there is limited integration of the residents' perspective in the analysis of tourism competitiveness, within both theoretical frameworks and empirical investigations. In this regard, the principal aim of this study is to explore how local residents conceptualize tourism destination competitiveness. Specifically, this study seeks to identify the key determinants that residents within the Centro de Portugal region perceive as imperative for evaluating destination competitiveness. Given the verified need to deepen this research and develop further studies, indicators and determinants from the residents' perspective, this study adopts a Grounded Theory methodology. With this approach, it is possible to expand knowledge based on the development of theories grounded in data that are collected and analysed through a simultaneous, systematic and constant comparative process [4]. Ultimately, this research expects to underscore the significance and pivotal role of residents in co-constructing the concept of tourism destination competitiveness, with a specific emphasis on sustainability. Integrating residents' authentic and empirical understandings of competitiveness provides destination managers and other stakeholders with insights for enhanced management and governance that align with local well-being.

Keywords. *Competitiveness; Grounded theory; Residents; Sustainability; Tourism destinations*

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Critical success factors in active and adventure tourism companies

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Abstract. Active and adventure tourism has seen significant growth both globally and in Portugal, establishing itself as a strategic segment for the sustainable development of regions of high natural value [1]. In the national context, this sector is primarily composed of micro-enterprises that face challenges related to increasing competition, as well as the need for innovation and professionalisation [2, 3]. In this sense, this project aims to address the limited research on the internal management of these organisations (micro-level) and to identify and analyse the critical success factors (CSFs) that influence their competitiveness and sustainability. To achieve this aim, the study will examine key issues, including the theoretical definition of these enterprises in the Portuguese context and the conceptualisation of CSFs from a supply-side perspective. Methodologically, the study adopts a mixed-methods sequential approach structured in three phases: a systematic literature review to establish the theoretical framework, a qualitative study based on semi-structured interviews with selected experts and managers of active and adventure tourism companies, to test and validate the identified factors, and a final quantitative study using a questionnaire administered to these companies, to validate the model at a national level. This work is expected to make an original contribution to the field by incorporating strategic perspectives into the management of niche businesses in Portugal. In addition to its academic value, the project aims to provide practical guidance and decision-making tools for managers and entrepreneurs, promoting the resilience, competitiveness and long-term sustainability of the sector.

Keywords. *Critical success factors, Adventure tourism, Active tourism, Competitiveness, Sustainability, Tourism companies*

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Participatory Strategic Planning for Reviving Underutilized Tourism Destinations in Africa: The Case of Nigeria

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Abstract. Tourism holds significant potential for economic diversification and community development in Africa, yet many destinations remain severely underutilized due to governance fragmentation, infrastructure deficits, security constraints, and non-inclusive planning practices (Hall, 2011). In Nigeria, this persists despite abundant natural and cultural assets. Existing tourism planning models, largely developed in the Global North, inadequately address the informal, fragmented, and post-colonial realities of African contexts, frequently reducing community participation to rhetorical consultation rather than operational decision-making (Tosun, 2000). This research investigates how participatory strategic planning can be adapted to revive underutilized tourism destinations in Africa, using Nigeria as a case study. Grounded in Costa's (2019) Integrated Tourism Planning Systems framework, the study aims to diagnose institutional fragmentation, evaluate the feasibility of established planning models, and develop mechanisms that transition from passive hosts to active co-creators and primary economic beneficiaries. Employing a qualitative comparative case study design, the research integrates a desk-based analysis of successful participatory models in Zanzibar and South Africa with empirical fieldwork at Yankari Game Reserve and Obudu Mountain Resort. Data will be collected through 30–40 key informant interviews, 4–5 focus group discussions, and policy document analysis, with thematic analysis used to map participation quality, benefit-distribution transparency, and institutional alignment. The study will produce an empirically grounded, context-sensitive Participatory Strategic Planning Framework tailored to informal African tourism systems. Expected contributions include theoretical advancements in adaptive destination planning, actionable policy guidelines for Nigerian and African tourism authorities, and practical strategies for equitable benefit-sharing and sustainable destination revival.

Keywords. *Participatory planning, Community-based tourism, Nigeria, African tourism development*

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The role of lifestyle entrepreneurs in regenerative rural tourism: the case of the central region

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Abstract.

This study examines the role of lifestyle entrepreneurs (LSE) in regenerative rural tourism (RRT) in the Central Region of Portugal. It investigates how LSE contribute not only to the economic viability of rural businesses, but also to social well-being, cultural revitalisation and ecological regeneration (Kastenholz, Lane & Todt, 2025; Aquino, Folter & Forné, 2024). The research explores key issues related to the motivations, practices and impacts of LSE, including how motivation (Cunha, Kastenholz & Carneiro,2020) and management practices such as regenerative innovation strategies (Kastenholz et al., 2025), and integration with local communities and stakeholders (Dredge, 2022) influence the quality of visitor experiences (Cunha et al., 2020) and the regenerative potential of rural destinations (Kastenholz et al, 2025). Through qualitative methods, such as participant observation, semi-structured interviews with EEVs, stakeholdersin the tourism ecosystem, the local community, tourists and visitors, content analysis of their respective discourses, as well as customer feedback, the study seeks to identify EEVs as actors who act ascultural mediators and catalysts for community revitalisation. The results will offer theoretical contributions: the concept remains, but the potential of EEVs as regenerative agents is analysed. This is not clear from the outset, being merely a hypothesis. Priority was given to cases where this hypothesis appears to hold true, and it is important to understand which motivations, strategies and business visions, as well as which personal and environmental contexts, may facilitate or hinder the realisation of this potential, by expanding the concept of lifestyle entrepreneurship to include environmental and community conservation initiatives, practical contributions to public policy and destination management, and methodological contributions through multidisciplinar qualitative approaches. In summary, the research highlights the transformative potential of lifestyle entrepreneurs in driving positive net impacts on rural tourism and in the transition towards regenerative tourism models.

Keywords. *Lifestyle entrepreneurship; Regenerative rural tourism; Management practices; Motivations;*

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Regenerative industrial tourism as a tool for territorial regeneration in rural areas

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Abstract.

Regenerative tourism has emerged as an evolution of sustainable tourism, with the aim of generating a net positive impact on destinations. This approach emphasises the active regeneration of territories, the strengthening of relationships between communities and ecosystems [1] and the co-creation of value between visitors, local communities and the environment [2]. Rural areas constitute strategic contexts for the development of regenerative tourism, due to their wealth of natural and cultural resources and their potential to generate positive social, economic and environmental impacts [3].
At the same time, existing studies on industrial tourism tend to focus on the preservation and revitalisation of industrial heritage as factors relevant to cultural regeneration and community bonding [4]. However, in rural contexts, industrial tourism can play a broader role, supporting local productive activities, strengthening endogenous value chains and contributing to territorial regeneration. Despite this potential, its contribution from a regenerative tourism perspective remains largely unexplored.
This research aims to analyse how industrial tourism might evolve towards a regenerative approach, contributing to the enhancement and development of rural areas and to the creation of regenerative experiences for visitors. In terms of data collection and analysis, the research will use a mixed-methods approach, based on interviews with managers of industrial tourism sites and questionnaires for visitors to these sites, with the aim of perceptions of territorial regeneration and the attainment of regenerative experiences, as well as the factors that may influence these perceptions. The project aims to develop a conceptual model of Regenerative Industrial Tourism, integrating practices, impacts and experiences. This model will be validated across three rural destinations with significant industrial heritage resources. This study will provide relevant theoretical and empirical contributions, particularly in terms of territorial development and the creation of transformative experiences in rural contexts.

Keywords. *industrial tourism, regenerative tourism, rural areas, local development, regenerative tourism experiences*

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Digital Assistive Devices in Accessible Tourism: Impact on Perceived Accessibility, Well-Being, and Satisfaction of Tourists Mobility Impairment

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Abstract. Digital assistive devices are increasingly central to accessible tourism, yet their role in shaping the experiences, wellbeing, and satisfaction of tourists with mobility impairments remained under-examined. Previous research indicated that mobility-impaired tourists frequently encounter physical and informational barriers and that digital tools (such as navigation apps and accessibility-tagged platforms) can improve route planning and reduce uncertainty, although their impact on emotional states and overall satisfaction under explored. This study addressed that gap by exploring how digital assistive devices influence travel experiences, perceived accessibility, emotional wellbeing, and overall satisfaction among tourists with mobility impairments. A mixed-methods design is adopted, the research combined semi-structured interviews, real time experiences, and short surveys to measure emotional wellbeing and satisfaction across before trip, on-site, and the after-trip stages. Findings are expected to reveal how these tools either reduce or reproduce barriers, enhance autonomy and security, and shape satisfaction and loyalty intentions. The study will contribute to existing studies for destination managers, app developers, and policymakers by proposing design and communication guidelines that align digital assistive devices with the real-world needs and wellbeing of mobility-impaired tourists, thereby advancing more inclusive and emotionally supportive tourism environments. [1-2]

Key word.; Satisfaction; Barriers; Autonomy; Mixed-method design; Semi structured interview

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ESG-Driven Transformation in Tourism: Assessing the Impact of Turismo de Portugal's Empresas Turismo 360° Program on SMEs' Operational Performance

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Abstract. The European tourism industry is undergoing a significant transformation driven by increasing global demands for sustainability, digitalization, and corporate accountability [1]. In the last decade, Environmental, Social, and Governance (ESG) frameworks have emerged as strategic instruments for improving organizational competitiveness. However, tourism small and medium-sized enterprises (SMEs) often face substantial operational challenges in adopting these digital workflows due to technical barriers, managerial expertise gaps, and limited resources required to structure and report ESG data [2, 3]. This research evaluates how a national tourism organization (NTO)-led program is driving ESG-based transformation among Portuguese tourism SMEs. It assesses how the Empresas Turismo 360º Programme by Turismo de Portugal, through its digital ESG reporting tool (FOREST), targeted training, and governance support mechanisms, influences ESG integration and operational performance in tourism SMEs. Grounded in Institutional Theory and the Resource-Based View [4], the study adopts a mixed-methods approach to investigate the impacts of these NTO-led initiatives. Quantitative data will be collected through a census-level survey of the 700 participating companies in the program. Concurrently, qualitative data will be obtained from in-depth interviews with 16 owners and managers across four tourism subsectors. Structural Equation Modeling (SEM) and thematic analysis will examine causal relationships and implementation experiences. The study is expected to develop a novel explanatory Multi-Level ESG Institutionalisation Framework (MEIF) for understanding how NTOs facilitate the internalization of ESG practices in tourism SMEs. It also advances tourism research by integrating digital transformation with operational performance, providing practical policy insights into strengthening SME competitiveness and resilience globally.

Keywords. *ESG; Sustainable Tourism; Turismo de Portugal; FOREST Platform; SME Operational Performance; Empresas Turismo 360º; National Tourism Organisations.*

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The role of tourism in promoting social innovation: proposal of a conceptual model for community development in tourist destinations

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Abstract. Tourism has traditionally been associated with the economic development of destinations and territories. However, the social challenges faced by local communities call for a broader understanding of its potential as a driver of social transformation. In this context, social innovation has emerged as an approach capable of fostering new forms of participation, collaboration, and collective value creation, thereby addressing social and territorial needs in a more inclusive and sustainable manner. Despite the growing interest in the social dimensions of sustainability within tourism studies [1,2], there remains a limited understanding of the mechanisms through which tourism activities can stimulate social innovation processes and generate lasting benefits for local communities.
This research aims to propose a conceptual model explaining how tourism can act as a catalyst for social innovation and community development in tourist destinations. More specifically, it seeks to identify the mechanisms, processes, and enabling conditions that facilitate the creation of socially innovative solutions through tourism activities, while also examining the role of the various stakeholders involved in these processes. In parallel, emerging approaches such as regenerative tourism will be considered as complementary perspectives that reinforce community participation, value co-creation, and the strengthening of local capacities.
The study will adopt a qualitative and exploratory approach, drawing upon a review of the literature and an analysis of relevant theoretical contributions concerning tourism, social innovation, community development, and regenerative tourism. Based on this analysis, the research will seek to identify and systematise the key mechanisms and relationships that explain tourism's potential to generate social innovation processes within tourist destinations.
The study is expected to contribute to a deeper understanding of the relationship between tourism and social innovation by providing a theoretical framework capable of informing future empirical research. Furthermore, it aims to offer an analytical structure that highlights the mechanisms through which tourism activities can generate social value and contribute to sustainable community development.
Keywords. Social Innovation; Local Communities; Regenerative Tourism; Social Sustainability; Community Development.

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Anthropomorphism and tolerance to service robot failure in restaurants: extending the technology acceptance model

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Abstract. The Technology Acceptance Model (TAM) is a theoretical model that originated from information systems and has been widely used to measure user acceptance. Nevertheless, this model has some limitations when it comes to understanding recent technologies, such as service robots, which has led to its theoretical expansion. However, before expanding these models, it is essential to understand their theoretical application in various settings, testing them to their theoretical limits. Therefore, an opportunity is identified to extend the TAM (from 1989) to the restaurant industry in Portugal, focusing on waiter robots in a scenario for which this model was not developed, service failure, while also understanding the possible role that the robot's anthropomorphism (human-like characteristics) may play in these relationships. Recently, research indicates that anthropomorphism may cause an increase in negative reactions. Thus, this study's objective is to expand the TAM to the context of service robots, considering the role of service failure and robots' appearance. The study will follow an experimental and quantitative approach: scenarios will be presented to customers with no prior experience with service robots, who will be subsequently asked to evaluate the constructs through a questionnaire. The study is expected to contribute theoretically to the expansion of TAM in crisis (failure) scenarios and, more practically, to assist managers in selecting the appropriate type of robots for their establishments.

Keywords. *Service Robots; Social Robots; Service failure; Anthropomorphism; Technology Acceptance Model*

References.
Not applicable.

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Transforming european thermal spa towns: governance, legitimacy and territorial adaptation

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Abstract. European thermal spa towns have experienced increasing pressures for transformation due to changing tourism markets, evolving wellbeing cultures and the decline of traditional cure-oriented thermalism. Although existing literature has extensively examined the transition from thermalism to wellness tourism, research has remained predominantly focused on tourism demand, product diversification and destination repositioning. Limited attention has been devoted to the territorial mechanisms through which transformation is negotiated and operationalised within historically embedded thermal destinations, particularly regarding how local actors interpret these changes and translate them into strategic adaptation decisions.

This research investigates how governance arrangements, actor perceptions and legitimacy dynamics influence territorial adaptation processes in mature thermal spa towns. Drawing upon tourism studies, evolutionary economic geography, governance theory and heritage studies, the research conceptualises thermal spa towns as complex territorial systems shaped by historical trajectories, institutional embeddedness and symbolic identities. Methodologically, the study adopts a sequential mixed-methods approach combining systematic literature review, comparative qualitative case studies, semi-structured interviews with supply-side actors and quantitative questionnaire analysis.

The research aims to develop and test an integrated conceptual framework explaining how governance capacity, stakeholder collaboration, legitimacy and heritage reinterpretation facilitate or constrain territorial transformation. The study contributes to tourism and territorial development literature by proposing a territorially grounded model of transformation specifically adapted to mature thermal spa towns. It further provides practical insights for policymakers and destination managers regarding governance, strategic adaptation and sustainable territorial repositioning.

Keywords. *thermal spa towns; wellness tourism; governance; territorial transformation; path dependence*

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Regenerative gastronomy tourism: a framework for rural economic sovereignty in west java tourism villages

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Abstract. Previous studies have extensively examined rural community participation, the role of rural tourism stakeholders and sustainable practices, [1]. However, a critical research gap remains regarding how the integration of regenerative gastronomy development can actively counter systemic crises in rural areas, particularly when connected to regional development plans [2]. The existing tourism model in West Java, particularly within the Bandung region, causes significant economic leakage through external supply chain reliance and foreign capital dominance, Digital leakage resulting from the high commissions charged by payment booking platforms [3]. Concurrently, rural territories suffer from acute food heritage erosion, including shallow commodification of local cuisine [4] and the loss of ancestral seed varieties due to forced modernization [5]. Conventional sustainability frameworks fail as they merely focus on minimizing negative impacts rather than actively restoring broken socio-ecological systems. Therefore, this research project aims to fill this gap by formulating an integrated model of regenerative gastronomy development to shift the paradigm from tourism for gastronomy to gastronomy for rural economic sovereignty. This qualitative study employs a multiple case study design across three tourism villages in West Java: Cireundeu, Lebak Muncang, and Alamendah. Data collection is aligned with the regional integrated participatory tourism planning frameworks pioneered [6], linking policymakers, community leaders, and local producers through semi-structured interviews and participant observation. Simultaneously, netnography is applied to examine how digital innovation bridges traditional food networks with global tourism markets. All data are systematically analysed using webQDA qualitative software through systematic coding (free and tree codes), cross-tabulation matrix analysis, and concept mapping to ensure robust data triangulation. The findings are expected to deliver a strategic framework for territorial innovation that transforms rural communities into independent stewards of their socio-economic heritage. Mirroring the framework of the University of Aveiro's Food Zone Project, this model bridges the agriculture, digital, and tourism sectors to restore broken socio-ecological food networks, mitigate digital economic leakage, and build resilient, inclusive rural tourism ecosystems.

Keywords; *Regenerative Tourism, Gastronomy Tourism, Economic Sovereignty, Rural Tourism, Territorial Innovation.*

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An analysis of the aesthetic dimension of the experience economy in the world's most visited art museums, mediated by online travel reviews and large language models

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Abstract. The aesthetic dimension of heritage assets serves as a fundamental driver of destination competitiveness and value creation within the contemporary experience economy [1]. However, a critical research gap exists due to the strategic underutilization of granular narrative feedback by management organizations [2] and the methodological limitations of traditional surveys, which are frequently constrained by small sample sizes and memory bias. The primary objective of this investigation is to analyze the digital "portrait" of aesthetic immersion, defined by Pine and Gilmore as the realm of passive absorption, through the Electronic Word-of-Mouth (e-WOM) of the world's 20 most visited art museums in 2024. Adopting a pragmatist framework, the methodology integrates Natural Language Processing (NLP) and advanced data mining techniques to process an estimated corpus of 400.000 TripAdvisor reviews. The research protocol applies Latent Dirichlet Allocation (LDA) for automated topic modelling to identify latent aesthetic attributes, such as lighting, layout, and curatorial atmosphere, that emerge organically from tourist discourse. Furthermore, the study employs Explainable Artificial Intelligence (XAI), specifically the SHAP technique, to "open the black box" of the predictive models and quantify the asymmetric importance of these features in determining revisit intentions. Intended contributions include the establishment of a transparent and replicable methodological protocol for textual big data, a theoretical expansion of the Experience Economy into the digital ecosystem where guests act as narrators of personal transformation, and practical insights for Destination Management Organizations to optimize placemaking investments [3]. The research's originality resides in its unprecedented global scale and the innovative application of explainable machine learning to decipher the inherent subjectivity of aesthetic experiences.

Keywords. *Experience Economy; Electronic Word-of-Mouth (e-WOM); Natural Language Processing (NLP); Placemaking Strategies; Predictive Modeling*

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[PIIC] Introductory scientific research projects from all research units

Reproduction and carotenoid coloration: effects on face recognition memory

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Abstract. Reproduction plays a pivotal role in evolution, yet the influence of reproduction-related contexts on memory remains unclear, with prior research yielding mixed findings. In this study, we looked for additional evidence on this topic and explored another characteristic with potential mate-choice implications: carotenoid coloration. This diet-derived skin coloration is linked to facial health [1] and attractiveness [2], immune function, and photoprotection, making it a potential cue of mate value.

In Experiment 1, employing the procedure used by Pandeirada and collaborators [3], female participants evaluated opposite-sex faces paired with brief descriptors under one of two contexts: searching for a long-term romantic partner (mating) or a coworker (non-mating). Crucially, the faces varied in carotenoid coloration (high vs. low). Following a distractor task, participants completed a surprise face-recognition task and attractiveness ratings. Results revealed that face recognition discriminability was significantly higher in the mating condition, replicating previous findings [3]. No coloration effect or interaction with context was found, possibly due to high overall performance. Additionally, high carotenoid coloration increased face attractiveness ratings in both conditions, reinforcing previous findings [2]. A follow-up experiment was conducted using an online format, with a longer distraction period between encoding and the memory test, aiming to reduce the high-performance levels obtained in the previous study. Data collection has recently been completed, and results will be presented at the event.

Keywords. Adaptive memory; reproduction; carotenoid coloration; face recognition

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The science-technology-society/environment perspective in initial teacher education in Portugal: an analysis of internship reports

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Abstract. The Science-Technology-Society/Environment (STS/STSE) perspective is widely recognised as a key framework in science education, fostering the development of scientifically literate, critically engaged, and socially responsible citizens. In the context of initial teacher education, this perspective is particularly relevant, as it supports pre-service teachers in connecting scientific knowledge with real-world contexts and complex societal challenges [2, 3]. Previous studies emphasise the importance of integrating STS/STSE orientations into teacher education policies and practices, highlighting their role in promoting reflective, critical, and context-sensitive teaching approaches. Furthermore, the analysis of internship reports has been identified as a valuable approach to understanding how pre-service teachers mobilise educational perspectives and translate theoretical principles into pedagogical practice [1]. This exploratory study focuses on the Master's programme *Mestrado em Ensino de Biologia e de Geologia no 3.º Ciclo do Ensino Básico e no Ensino Secundário* at the University of Aveiro, Portugal. It aims to characterise how the STS/STSE perspective is incorporated into internship reports submitted between 2014 and 2024. The documentary corpus consists of $N \geq 37$ reports identified in the institutional repository. The ongoing analysis examines the presence, distribution, and articulation of STS/STSE elements across different sections of the reports, including title, keywords, abstract, table of contents, body text, and references. By identifying patterns and trends in the integration of STS/STSE principles over the past decade, this study seeks to provide robust insights into how future Biology and Geology pre-service teachers engage with this educational framework. The findings are expected to inform curriculum development, supervision practices, and quality enhancement processes within the programme. Additionally, this research aims to support institutional reflection in the context of programme evaluation, contributing to the strengthening of teacher education aligned with the promotion of informed, responsible, and critically engaged citizenship.

Keywords. *Initial teacher education; STS/STSE education; Internship reports; Documentary analysis; Science education*

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Digital citizenship in language education: a literature review on inclusive and multilingual pedagogies

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Abstract. This literature review was conducted as part of the LiTE Academy project and aimed to map recent literature at the intersection of digital citizenship education, language education, inclusive practices, and multilingual pedagogies with technology. A systematic search was conducted across databases and repositories, namely Taylor & Francis and RCAAP, using a combination of predefined keywords, alongside a chronological filter (2020-2026). Publications in English and Portuguese were considered, resulting in a final corpus of 41 studies that were analysed according to previously established thematic categories. The analysis revealed a growing emphasis on integrating digital citizenship into language education through technology enhanced pedagogies. The studies reported improvements in digital literacy, intercultural competence, communicative competence, and learners' engagement. However, the review also identifies gaps in teacher preparation, a disconnect between formal curricula and learners' actual digital practices, methodological limitations, and the need for more critical and inclusive approaches to digital citizenship education.

Keywords. *Digital citizenship education; Language education; Inclusive practices; Multilingual pedagogies*

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Beyond instrumental uses of generative artificial intelligence: towards an epistemic-didactic framework for initial teacher education

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Abstract. Generative Artificial Intelligence (GAI) is transforming the ways teaching, learning, and knowledge production are conceived and enacted [1,2], extending far beyond its use as a mere technical tool for supporting educational processes [2]. Within initial teacher education, its integration raises pedagogical, cognitive, and epistemic challenges related to the uncritical acceptance of AI-generated outputs, epistemic delegation, automation bias, and the increasing automation of pedagogical decision-making [2,3]. This work presents a conceptual framework designed to support the critical, context-sensitive, and pedagogically grounded integration of GAI into teacher education. Methodologically, it is based on a narrative conceptual review of the literature on GAI, teacher education, AI literacy, distributed cognition, cognitive load, epistemic authority, and epistemic agency [1–3]. The analytical process was supported by GAI tools, which were used to organize reading notes, construct comparative matrices, identify convergences across studies, and assist in conceptual synthesis, while human critical judgement and validation were maintained throughout all stages of the research process [2,3]. The analysis enabled the identification of a set of strategic dimensions for the pedagogical integration of GAI, including scaffolding, adaptive feedback, simulation and responsive practice, collaborative inquiry, epistemic verification, epistemic mentoring, and critical AI literacy [1–3]. These dimensions were integrated into a conceptual model centered on the relationship between epistemic agency and instructional decision-making, particularly in contexts where the management of cognitive load is of critical importance [2,3]. The main contribution of this work lies in the conceptualization of an epistemic-didactic approach to GAI that moves beyond a purely instrumental perspective, framing it simultaneously as a pedagogical resource, a cognitive artefact, and an object of critical scrutiny. In doing so, it contributes to a more reflective and epistemically responsible approach to teacher education [2,3].

Keywords. *Generative Artificial Intelligence; Initial Teacher Education; Epistemic Agency; Epistemic-Didactic Framework.*

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Conceção e implementação de uma plataforma web acessível para promoção da inclusão digital e acesso a tecnologias de apoio

A acessibilidade digital constitui atualmente um dos principais desafios das instituições de ensino superior, assumindo um papel central na promoção da inclusão, da participação e da igualdade de oportunidades para pessoas com deficiência ou incapacidade (Times Higher Education, 2026; Lazar et al., 2021). A literatura científica tem evidenciado que muitas plataformas digitais universitárias continuam a apresentar barreiras de acessibilidade (ADA National Network, 2021; Lazar et al., 2021), dificultando o acesso à informação, aos serviços e aos recursos institucionais, particularmente para utilizadores com necessidades específicas.

Neste contexto, os princípios de design inclusivo, acessibilidade web e comunicação acessível assumem-se como elementos fundamentais no desenvolvimento de ambientes digitais mais equitativos e centrados na diversidade humana (World Wide Web Consortium [W3C], 2025; ADA National Network, 2021; Lazar et al., 2021; Gronseth, 2018).

O presente trabalho apresenta o projeto de conceção e implementação de uma plataforma web acessível para o Lab UAInclusive, laboratório da Unidade de Investigação DigiMedia – Digital Media and Interaction – da Universidade de Aveiro, dedicado à promoção da inclusão digital, da acessibilidade e da disponibilização de soluções tecnológicas dirigidas a pessoas com diferentes tipos de deficiência ou incapacidade (Rocha Lourenço et al., 2025). O trabalho incide, assim, sobre o processo de desenvolvimento da plataforma, destacando as decisões metodológicas, comunicacionais e técnicas que orientaram o seu desenvolvimento.

A plataforma assume-se como uma interface digital orientada para a disseminação de recursos, serviços, iniciativas e soluções associadas à acessibilidade e inclusão digital. Os principais objetivos passam por promover o laboratório, divulgar os seus recursos, equipamentos, atividades, projetos e parcerias, facilitar a comunicação e o agendamento de visitas, bem como aumentar a sensibilização para a inclusão digital junto da comunidade académica e da sociedade em geral.

Metodologicamente, o projeto adota uma abordagem participativa e centrada no utilizador, integrando a análise de plataformas digitais de referência, benchmarking de plataformas digitais de espaços congéneres, com foco na identificação de requisitos para a comunicação e divulgação do laboratório, bem como reuniões com responsáveis por iniciativas inclusivas e diagnóstico das necessidades do laboratório ao nível da comunicação institucional, da divulgação de informação, da organização de conteúdos, das funcionalidades digitais e da acessibilidade web.

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An automated platform for studying cognition and behaviour in fish

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Abstract. Fish are valuable models for investigating behavioural and cognitive processes due to their vast ecological, anatomical, and behavioural diversity. Yet, they remain comparatively underrepresented in psychological and cognitive research when contrasted with other vertebrates. To contribute to this field, we developed an experimental platform inspired by the GoFish system, designed to replicate and adapt the original setup. The system consists of an experimental tank equipped with a monitor for the presentation of visual stimuli, an automated food dispenser for reward delivery, and a camera-based tracking system. Invisible regions of interest can be defined within the aquarium to enable automated detection of fish movement and task-related behaviours. This allows the implementation of a wide range of behavioural and cognitive tasks, including discrimination learning, reversal learning, and choice paradigms. The entire experimental procedure is automated through the Bonsai software platform, enabling closed-loop integration of stimulus presentation, behavioural tracking, and reward delivery. This platform provides a flexible and accessible tool for studying cognition and behaviour in fish.

Keywords. fish cognition; behavioural analysis; automated experimentation; Bonsai; animal behaviour; behavioural tracking

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Animacy and attention in free recall: comparing pure and mixed lists

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Abstract. People tend to remember animates (e.g., "dog") better than inanimates (e.g., "chair"), an empirically-robust phenomenon known as the "animacy effect" [1]. However, its underlying mechanisms remain unclear. One possible explanation is the attention prioritization hypothesis [2], which proposes that animates automatically capture attention, leading to their superior recall. This account predicts a stronger animacy effect in mixed lists (lists of to-be-remembered words presenting both animates and inanimates), where animates outcompete inanimates for attentional resources. Conversely, the effect should be reduced or eliminated in pure lists (only animate or inanimate words-are presented), where such competition is absent. Participants (N=146; Mage=19.9, SD=2.2; 29% males) were randomly assigned to the pure-list or the mixed-list condition. In both conditions they studied and then recalled two lists of 16 words [3]. Contrary to the prediction, the animacy effect prevailed in both conditions with no significant Animacy X List Type interaction, suggesting that attention prioritization is unlikely to drive the animacy effect [4].

Keywords. *Animacy; List Composition; Attentional Prioritization; Free Recall; Adaptive Memory*

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E GALENO ATRAVESSOU O ATLÂNTICO. O SINCRETISMO DAS PRÁTICAS E DOS SABERES MÉDICOS LUSO-BRASILEIROS (1500-1716)

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RESUMO

Quando os Portugueses desembarcam no Brasil em abril de 1500, o galenismo constitua o paradigma médico dominante na medicina europeia. Herdeiros de uma tradição velha de vários séculos, os profissionais de saúde portugueses organizam as suas práticas principalmente, mas não só, em torno dos saberes hipocrático-galénicos e de uma farmacopeia mediterrânica. Contudo, um problema aparece rapidamente frente às realidades do Novo Mundo : que fazer quando Galeno não descreveu tal doença, tal planta ou tal clima ? Esta interrogação, encontrada desde os primeiros documentos historiográficos do Brasil colonial, constitui um dos pontos de partida da minha tese, consagrada principalmente ao estudo da hibridização dos saberes médicos luso-brasileiros entre os séculos XVI e XVII. O recorte cronológico da tese, inicialmente fixado em 1650, foi alargado até 1716 por três razões : a relativa escassez de fontes relativas ao Brasil anterior à chegada dos Jesuítas em 1549 ; a necessidade de integrar as fontes neerlandeses da segunda metade do século XVII, e nomeadamente as duas edições da *Historia naturalis Brasiliae* de Wilhem Piso (1648 e 1658) ; a vontade de estudar a transição iatroquímica na farmacopeia luso-brasileira a partir do final do século XVII.

Esta comunicação propõe em particular analisar os fatores e vetores da difusão das conceções iatroquímicas na farmacopeia luso-brasileira entre finais do século XVII e início do século XVIII. Mais precisamente, surgem as perguntas seguintes : de que forma a circulação atlântica de novos saberes científicos europeus substituiu progressivamente o paradigma galénico nas práticas farmacêuticas do império português, e em particular no Brasil ? Em que medida esse processo de renovação epistemológica se traduz num ato concreto de política sanitária colonial ?

Para responder a estas questões, esta parte da minha investigação mobiliza uma metodologia de análise comparativa de fontes primárias. O corpo documental é constituído por um conjunto de obras farmacêuticas portuguesas do período, que expõem de forma explícita uma visão dual da farmácia : a *Polyanthea medicinal* (1697) de João Curvo Semmedo, as duas edições da *Pharmacopea lusitana* de D. Caetano de Santo António (1704 e 1711), o *Thesouro appolineo* (1714) e a *Pharmacopea ulyssiponense, galénica e chymica* (1716) do francês João Vigier. Estas obras distinguem, cada uma ao seu modo, o método galénico centrado na mistura de simples segundo a tradição humoral, da farmácia química que recorre à análise para extrair essências mais ativas e concentradas. Como manuais de instrução e catálogos terapêuticos destinados aos praticantes da época, estes volumes constituem testemunhos privilegiados da evolução dos saberes médicos em Portugal na virada dos séculos XVII e XVIII e da sua disseminação. O corpus é também cruzado com as obras francesas diretamente citadas na edição de 1711 da *Pharmacopeia lusitana* : o *Cours de chymie* (1675) e a *Pharmacopée universelle* (1679) de Nicolas Lémery, bem como a *Pharmacopée royale, galénique et chimique* (1676) de Moyse Charas. A análise comparativa deste corpus documental permite identificar com precisão os eixos de rutura e continuidade entre a tradição galénica e a nova química farmacêutica de origem francesa e europeia.

Os resultados desta investigação demonstram que o período 1697-1716 corresponde a um momento de transição epistemológica claramente documentável na produção farmacêutica portuguesa. Se obras como o *Polyanthea medicinal* de Semmedo (1697) e a primeira edição da *Pharmacopea lusitana* (1704) ainda articulam teoria humoral e elementos químicos de forma relativamente equilibrada, as publicações posteriores evidenciam uma integração progressiva e massiva da química farmacêutica europeia, traduzindo-se numa marginalização do paradigma galénico. Esta viragem não é apenas intelectual : representa uma atualização concreta das práticas terapêuticas recomendadas aos praticantes de ambos os lados do Atlântico, num contexto colonial marcado neste momento pela

Experimental approaches to sexual decision-making in sexuality research: A scoping review

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Abstract. Sexual decision-making refers to the cognitive and behavioral processes involved in initiating or inhibiting sexual behaviors and is relevant to understanding sexually transmitted infections, sexual coercion and aggression. Sexual decision-making processes are typically studied through experimental tasks involving sexual risk, delay or conflict, although methodological and conceptual heterogeneity limits comparisons across studies. Therefore, following PRISMA guidelines for scoping reviews, a systematic search was conducted in PubMed, Scopus, Web of Science and EBSCOhost databases, identifying 1,310 records, assessing 898 full-text reports and including 93 studies. Preliminary findings indicate that sexual decision-making is assessed through choices between immediate unprotected sex and delayed protected sex, response times to interrupt risky or sexually aggressive situations, and hypothetical scenarios involving risky sexual behaviors. Alcohol consumption and sexual arousal are associated with unprotected sex intentions and reduced recognition of risk cues. By identifying methodological patterns and limitations, this review informs future research and sexual health interventions.

Keywords. *Decision-making; Sexual behavior; Experimental studies; Sexual health; Scoping review*

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Lipid profiling and plasticity in the marine fungus *Fusarium limianum* as a response to abiotic factors

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Abstract. Marine fungi are a ubiquitous and diverse group of organisms that play roles as decomposers and recyclers of organic matter, thereby contributing to the marine carbon and nitrogen cycles. More recently, these fungi have been recognized as promising sources of novel bioactive compounds. Among these metabolites, lipids are particularly sensitive to environmental conditions. However, comprehensive lipidomic studies on marine fungi remain scarce, and the influence of abiotic factors on their lipidome is still poorly understood. The objective of this work is to characterize the lipidome of *Fusarium limianum* MUM 24.43, a recently described marine fungal species, under different salinities (0 % and 3 % sea salts) and temperatures (20, 25, and 30 ºC). Total lipid and phospholipid contents were determined by gravimetry and colorimetric methods, respectively, while fatty acid (FA) profiles were characterized by GC-MS. Lipidome profiling was performed by LC-HR-MS/MS. The results showed that fungal growth and total lipid content were higher under saline conditions, regardless of temperature. Phospholipid content was influenced by both factors, with the highest levels observed at 0 % sea salts and 30 ºC. Fourteen FA were identified, including the omega-3 FA α-linolenic acid (FA18:3 *n-3*). Polyunsaturated FA were more abundant at 3 % sea salts and 20 ºC, while monounsaturated FA predominated under non-saline conditions and 30 ºC. Preliminary lipidomic analysis revealed the presence of several major polar lipid classes, such as phosphatidylcholines, phosphatidylethanolamines and ceramides, and neutral lipid classes. Overall, these results emphasize the lipid plasticity of *F. limianum* in response to abiotic stressors and reinforce the biotechnological potential of its lipid extracts.

Keywords. *Abiotic factors; Biotechnological potential, Marine fungi; Lipidomics; Lipid plasticity; Polar lipids*

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Job demands and resources as burnout and well-being predictors: Evidence from the fiscal administration sector

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Abstract. The fiscal administration sector is demanding, namely for the assigned responsibility and frequent interactions with the public (Despacho n.º 12670/2023, de 12/12), that may increase vulnerability to burnout syndrome and reduce well-being. However, the specific psychosocial factors that contribute to this vulnerability have remained insufficiently examined. This study analyzed the psychosocial factors associated with burnout and well-being in fiscal administration workers in Aveiro's region, identifying job demands and resources that significantly affect mental health in the professional context. A sample of 235 workers (Mage = 55.25; 55.7% women) completed self-report surveys measuring burnout (Shirom-Melamed Burnout Measure; Rui Gomes, 2022), well-being (Mental Health Continuum–Short Form; Fonte et al., 2020), and psychosocial risk factors (Copenhagen Psychosocial Questionnaire III; Cotrim et al., 2022). The results of multiple regression analysis show that burnout arises mainly from the combination of high demands (e.g. workload, work pace and quantitative demands) and insufficient resources (low control, weak support from supervisors, reduced organizational justice and lack of predictability), consistent with the Job Demands–Resources model (Bakker & Demerouti, 2007). Work-life conflict emerged as a transversal risk factor, affecting all dimensions of burnout and well-being. Meanwhile, cognitive demands have a protective effect, being linked to higher well-being when framed in an environment with suitable resources, functioning as a challenge rather than hindrance demands (Crawford et al., 2010). The practical implications point to the necessity of multilevel interventions (Antunes & Pereira, 2023), combining actions centered in the individual with actions centered in the organization, including transformational and participative leadership practices (Breevaart & Bakker, 2018), promotion of psychological safety (Edmondson, 1999), role clarification and policies of work-family balance (Kossek et al., 2006).

Keywords: burnout; well-being; job demand-resources; tax-workers; psychosocial factors

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[RISE-HEALTH] RISE in action: next-gen minds, real-world health impact

Two-week balneotherapy in a spa setting for chronic low back pain in older adults: a single-blind randomized controlled trial

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Abstract. Chronic low back pain (CLBP) is a prevalent and disabling condition in older adults, frequently associated with functional limitation and fatigue. In this population, multimorbidity and polypharmacy limit pharmacological options, emphasizing the relevance of non-pharmacological strategies. Balneotherapy, based on exposure to thermo-mineral water and hydrostatic stimuli, has been proposed as a complementary intervention for chronic musculoskeletal disorders. This study evaluated the short-term effects of a standardized two-week balneotherapy program on pain intensity, physical function, fatigue, and mechanical pain tolerance in older adults with CLBP, and explored potential changes in lumbar skin temperature using infrared thermography. [1-4]

A single-blind randomized controlled trial was conducted in a spa setting. Participants aged ≥65 years with CLBP were allocated to either a balneotherapy group or a control group. The intervention included daily thermal pool immersion with hydromassage, steam application, and localized shower massage over two weeks. Outcomes assessed at baseline and post-intervention included pain intensity (Numerical Rating Scale), fatigue and functional questionnaires, spinal mobility (Schober test), lumbar pressure pain threshold (algometry), and infrared thermography. Non-parametric analyses were applied ($p < 0.05$).

In the balneotherapy group, resting low back pain decreased in 50% of participants, while pain during movement and average pain over the previous seven days decreased in 78%. A significant improvement in lumbar flexion was observed using the Schober test ($p = 0.041$). Fatigue improved, with reductions in fatigue annoyance (94%) and mental exhaustion (75%). No statistically significant pre–post differences in lumbar skin temperature were observed.

Short-term balneotherapy was associated with clinical improvements in older adults with CLBP, without detectable thermal changes. Larger trials are warranted to confirm these findings.

This trial was prospectively registered at ClinicalTrials.gov (Identifier: NCT05078008) on 30 September 2021.

Keywords. *Balneotherapy; Chronic low back pain; Elderly; Thermography; Randomized controlled trial*

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Communicating genetic cancer risk within families: a study on the responsibility to inform at-risk relatives

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Abstract. Genetic testing for hereditary cancer risk carries significant implications for patients and their biological relatives. Current clinical practice relies on patients to inform family members about their increased genetic cancer risk[1]. However, effective communication of this information remains challenging, resulting in many at-risk relatives being left uninformed and unable to prevent or mitigate future morbidity[2]. The optimal approach for notifying relatives of patients with hereditary cancer is still under debate. To address this gap, this project comprises four main phases: i) conducting a mixed-methods systematic review to synthesize evidence on attitudes toward the responsibility of sharing genetic risk information about hereditary cancers; ii) developing a questionnaire adapted for the Portuguese population, to explore the attitudes toward the responsibility of sharing genetic cancer risk information, grounded in the findings of the systematic review and refined through a Delphi panel and cognitive interviewing; iii) assess the attitudes toward the responsibility of sharing genetic cancer risk information to all key stakeholders, including the general population, patients, at-risk relatives, and healthcare professionals; iv) formulating practical recommendations, through expert panel discussions based on the study findings. The study will provide insights to optimize access to life-saving genetic testing and promote health equity. The project is presently in the first phase, mixed methods systematic review, which undergoes data extraction, focusing on systematically capturing study characteristics, methodological features, and key findings relevant to attitudes toward cancer genetic risk communication.

Keywords. Attitudes; Genetic information; Family communication; Hereditary cancers

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Ageing and intellectual disability in social solidarity cooperatives supported by fenacerci: profile of older adults with intellectual disability in portugal

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Abstract.
Life expectancy among people with intellectual disabilities (ID) has increased significantly due to advances in healthcare and psychosocial support [1]. This relevant achievement creates new challenges for support services, namely responding to an ageing population with ID [2]. This presentation reports the progress of an ongoing doctoral project in Gerontology and Geriatrics focused on ageing among people with ID supported by Social Solidarity Cooperatives and similar entities affiliated of FENACERCI. The project is organized into three complementary studies using a mixed-methods approach. The first study aimed to characterize organizations with social services directed at people with ID aged+ 45 years. It was a quantitative, observational, cross-sectional study involving 31 organizations. Main findings indicate that between 2008 and 2024, older adults (45+ years old) with ID quintupled in the participant organizations. The second study aimed to characterize the profile of older adults with ID, using a cross-sectional approach. The sample comprised 234 participants with ID aged 45+ (mean = 53.3, range 45–77), mostly male, single, childless, and living with family or in residential homes. Main findings indicate: (i) 52.1% had moderate ID; (ii) epilepsy and dementia were the most prevalent comorbidities (22.6%); (iii) 39% were polymedicated; (iv) 44,9% were in nutritional risk and 4.7% were malnourished; (v) 35.9% had moderate dependence in ADLs; (vi) 85.5% showed severe dependence in IADLs; (vii) 44.9% were classified as frail. The third study aimed to identify needs and good practices, using a qualitative approach throughout focus group with all actors (families, people with ID, and staff). Data is currently under analysis. These findings highlight the need to address the specific needs of older adults with ID, using person-centered care and planning adjusted social services.

Keywords. *intellectual disability; ageing; profile; model of care; policies*

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Explicit syntactic intervention in preschool-age children with Developmental Language Disorder and Autism Spectrum Disorder

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Abstract. Children with Developmental Language Disorder (DLD) and children with Autism Spectrum Disorder (ASD) frequently present syntactic difficulties that may negatively impact communication, literacy, academic achievement, and social participation (1–3). Although international literature supports explicit intervention approaches, research examining syntactic intervention and spontaneous syntactic production in European Portuguese-speaking children remains scarce (4). This research aimed to contribute to the understanding of syntactic impairment and to evaluate evidence-based syntactic intervention in EP-speaking preschoolers with DLD and ASD through a sequence of interconnected studies. The research began with a national cross-sectional survey examining the clinical practice and needs of Speech and Language Therapists (SLTs) working with preschoolers with syntactic impairment (n=359). Findings highlighted reduced confidence in syntactic assessment and intervention, alongside the need for additional academic and practical training.

Subsequently, language sample analysis (LSA) studies characterized the syntactic production of preschoolers with DLD (n=32) and ASD (n=32), compared with typically developing peers (n=32). Across studies, children with ASD and DLD showed significantly shorter utterances, lower syntactic diversity, reduced grammatical accuracy, and limited syntactic complexity. LSA measures additionally demonstrated moderate-to-strong correlations with standardized assessments, supporting their clinical relevance.

The effects of PROsyntax, an explicit syntactic intervention program, were then examined in a non-randomized controlled study with 64 children aged 3-6 years with DLD (n=32) and ASD (n=32), equally allocated to an experimental group (EG) and a waiting-list control group (CG). Children in the EG received 24 individual sessions in kindergarten, twice weekly. Significant improvements were observed in expressive ($F(1,60)=362.84$, $p<0.001$, $\eta p^2=0.33$) and receptive syntax ($F(1,60)=328.50$, $p<0.001$, $\eta p^2=0.33$) in the EG. Children in the CG demonstrated comparable outcomes after intervention, while follow-up analyses suggested maintenance of gains over time. Overall, findings support PROsyntax as an effective intervention for syntactic difficulties in neurodevelopmental disorders.

Keywords. *Developmental Language Disorder; Autism Spectrum Disorder; Syntax; Intervention; Preschool-age children*

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From community needs to action: immediate effects of a parental digital literacy workshop on healthy screen use in early childhood

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Abstract. Excessive and poorly mediated screen use in early childhood has become a growing concern among families, educators, and health professionals. In response to concerns identified by a local municipality regarding families' difficulties in managing children's digital media use, a brief parental workshop was developed through a community-based initiative to promote digital literacy and healthier screen-related routines.

A ninety-minute parental workshop was developed to address healthy screen use, adult mediation, content quality, limit-setting and practical alternatives to screen time within daily family routines.

Thirty participants completed a 12-item questionnaire immediately before and after the workshop. Items were rated on a 5-point Likert scale and addressed perceptions regarding screen use, adult mediation, content selection, confidence in managing children's digital media exposure, alternative strategies, and motivation to change family digital routines. Pre- and post-workshop responses were compared using the Wilcoxon Signed-Rank test. Effect size was calculated using Cohen's r.

Statistically significant improvements were observed in most items following the workshop, particularly in participants' understanding of healthy screen use, the importance of adult mediation, content quality, and motivation to change family digital routines. Effect sizes were generally moderate to large. No significant changes were found in items related to established daily routines and immediate behaviours, suggesting that behavioural change may require longer-term support and opportunities for implementation.

These findings suggest that a brief community-based parental workshop may support awareness and motivation regarding healthier family digital practices, although no conclusions can yet be drawn about sustained behavioural change due to the absence of follow-up assessment. The study also highlights the potential of collaborations between researchers and local public institutions to translate community needs into evidence-informed actions to support children and family digital well-being.

Keywords. *Screen usage; Early childhood; Parental digital literacy; Parental workshop; Community-based intervention*

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Evaluating a theatre-based intervention for older adults living in residential care facilities with and without dementia: a mixed-methods study protocol

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Abstract. Population ageing and the increasing prevalence of dementia in long-term care settings pose significant challenges to the psychological well-being and social participation of older adults. Arts-based interventions, particularly theatre and drama-based approaches, have been recognised as non-pharmacological strategies that promote emotional expression, social engagement, and person-centred care. However, evidence regarding the impact of theatre-based interventions among institutionalised older adults with and without dementia remains limited.

This study aims to evaluate the impact of a theatre-based intervention on life satisfaction, emotional well-being, and social interaction among 80 older adults living in four residential care facilities in Portugal, including participants without dementia and those with mild to moderate dementia. A quasi-experimental mixed-methods design with pre- and post-intervention assessment will be implemented.

The intervention will be conducted over six months through weekly structured sessions involving body and vocal expression exercises, improvisation activities, and the collective creation of a theatrical performance. Quantitative measures will assess psychological well-being, life satisfaction, cognitive functioning, and social networks, while qualitative data will be collected through semi-structured interviews with participants and family members, and focus groups with direct care assistants.

Expected outcomes include improvements in emotional well-being, social participation, and perceived quality of life among participants. This study aims to contribute to the development of practical and theoretical guidelines for implementing theatre-based interventions in geriatric care settings, reinforcing the role of arts-based approaches in promoting person-centred care and active ageing.

Keywords. *Ageing; Dementia care; Drama therapy; Person-centred care; Social participation*

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LGBTQIA+ affirmative residential assisted living homes for older adults in Portugal: a multiphase mixed-methods study

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Abstract. Older LGBTQIA+ adults often anticipate discrimination, invisibility, and non-inclusive environments in residential assisted living homes, which may contribute to fear and avoidance of long-term care services [1,2]. This presentation reports the work developed so far within an ongoing doctoral project in Gerontology and Geriatrics focused on contributing to an empirically informed framework for LGBTQIA+-affirmative care in residential assisted living homes. A multiphase mixed-methods design grounded in the socio-ecological model is being adopted. Three studies have been conducted to date. First, a case study explored Eternamente Sou (São Paulo, Brasil) and how this community-based organization created by and for older LGBTQIA+ adults developed inclusive and affirmative practices. Findings showed that the organization functioned as a space of visibility, social and political affirmation, and care, promoting belonging, identity affirmation, resilience, and community participation despite structural and financial fragilities. Second, a concept analysis based on a scoping review clarified the antecedents, attributes and consequences of affirmative care for older LGBTQIA+ adults in long-term care settings, highlighting the importance of identity affirmation, cultural competence, intersectional approach, inclusive and safe environment. Third, a qualitative focus groups study with LGBTQIA+ adults ≥ 40 years (n=13) explored perspectives regarding affirmative care in residential assisted living homes. Preliminary findings suggest that participants perceive residential care settings as potentially unsafe and non-affirming, marked by risks of discrimination, invisibility, and identity concealment. Participants emphasized that affirmative care requires respectful interpersonal interactions, as well as organizational commitment, staff training, inclusive policies, recognition of LGBTQIA+ identities, relationships, and life trajectories. Ongoing work includes in-depth analysis of focus groups and will move on to examine the interpersonal, organizational, and policy dimensions through studies involving residents, staff members, and policymakers. Overall, these findings support the development of evidence-informed policies, workforce training, and institutional practices capable of promoting safety, belonging, and identity affirmation in later-life.

Keywords. *Aging; Affirmative care; LGBTQIA+; Long-term care; Socio-ecological model*

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Advancing gerontogeriatric nursing education: competencies, ageism, and career intentions among newly graduated nurses

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Abstract. Population ageing challenges nursing education and requires newly graduated registered nurses (NGRNs) to be prepared for gerontogeriatric care. Evidence among NGRNs remains limited. To address this gap, three studies undertaken within this doctoral research examined the influence of nursing education and ageism on gerontogeriatric competencies and intention to work with older adults [1–3]. A nationwide cross-sectional study was conducted among 242 Portuguese NGRNs who graduated in 2021–2022. Data were collected through an online survey including the Gerontogeriatric Competency Scale (GGC), the Ambivalent Ageism Scale (AAS), and variables related to nursing education, clinical training, and intention to work with older adults. Analyses included non-parametric tests, multiple linear regression, and exploratory structural equation modelling.
Longer clinical placements and curricula with explicit gerontogeriatric content were associated with higher competency scores ($p < 0.01$). In contrast, role-model supervisors who reinforced stereotypes and placements focused on basic care were associated with lower competency levels ($p < 0.01$) [1]. Confidence in working with older adults emerged as the strongest predictor of gerontogeriatric competencies ($\beta = 0.114$), and the final regression model explained 15.2% of the variance in overall competency scores ($R^2 = 0.152$) [1]. Hostile ageism predicted the competency domains of Interdisciplinarity ($\beta = 0.025$; $p = 0.047$), Health Promotion and Disease Prevention ($\beta = 0.027$; $p = 0.036$), Management ($\beta = 0.033$; $p = 0.020$), and Professional Development ($\beta = 0.027$; $p = 0.031$), although explanatory power was minimal (adjusted $R^2 < 2\%$) [2]. Structural modelling showed a significant positive association between nursing education and gerontogeriatric competencies ($\beta = 0.437$, 95% CI [0.31, 0.57], $p < 0.001$), while no direct associations were found between competencies, ageism, and intention to work with older adults [3].
These findings highlight the importance of nursing education in developing gerontogeriatric competencies and support strengthening gerontogeriatric content, clinical supervision, and learning experiences within undergraduate nursing programmes.

Keywords. *Gerontogeriatric nursing; Nursing education; Ageism; Gerontogeriatric competencies; Newly graduated registered nurses; Older adults*

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Immediate effects of the finger kazoo exercise with and without oropharyngeal enlargement in the operatic singing voice: A randomized crossover clinical trial

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Semi-occluded vocal tract exercises are widely used in voice training and rehabilitation, but evidence in classically trained singers remains limited. This study examined the immediate effects of the Finger Kazoo exercise, performed with and without intentional oropharyngeal enlargement, on acoustic, self-perceptual, and auditory-perceptual outcomes in operatic singing voice. Fifteen classically trained singers completed a randomized, single-blind, crossover trial with three conditions: baseline, Finger Kazoo without oropharyngeal enlargement, and Finger Kazoo with oropharyngeal enlargement. Outcomes included self-perception via the EAI Scale, acoustic measures of maximum phonation time (MPT), fundamental frequency (F0), jitter, and shimmer for vowels /a/ and /i/, and blinded auditory-perceptual ratings of operatic excerpts by a 15-member expert panel. Analyses used paired and nonparametric tests, robust statistics, and Bayesian comparisons.
Both intervention modes significantly improved MPT and reduced jitter and shimmer, with large effect sizes. Mean MPT increased by 12–15%, jitter decreased by 13–16%, and shimmer by 18–20%, while F_0 remained stable. Self-perception scores improved substantially after both conditions, and auditory-perceptual ratings showed significant gains across all EAI domains, especially resonance balance, ring, vibrato, and pitch accuracy. No statistically detectable differences were found between the two exercise configurations. The Finger Kazoo exercise produced immediate, clinically meaningful improvements in vocal stability, resonance, and efficiency in the operatic singing voice. Its similar performance with and without oropharyngeal enlargement supports its use as a practical, evidence-based tool in singing pedagogy and voice science.

Keywords. Finger Kazoo; Singing voice; SOVTE; Voice training; Voice therapy.

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[TEMA] Data, modelling and decision-making

Numerical modelling for regenerative cooling design in liquid propellant rocket engines

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Abstract. Liquid propellant rocket engines operate under extremely demanding thermal conditions, requiring effective cooling strategies to ensure structural integrity and reliable operation. Among the available thermal management approaches, regenerative cooling is widely adopted in modern propulsion systems due to its ability to cool the combustion chamber while simultaneously preheating the propellant. Furthermore, the use of next-generation propellants operating under supercritical conditions introduces additional complexity, increasing the need for accurate and efficient thermal modelling tools during the development and design process [1].

This work focuses on the development and implementation of custom numerical models for regenerative cooling analysis and simulation in liquid propellant rocket engines. The proposed framework combines thermofluid and heat transfer modelling techniques to predict the thermal and fluidic behavior of propulsion systems under a large range of operating conditions. Compared with conventional computational fluid dynamics (CFD) solutions [2], the developed and implemented approach significantly reduces computational time and cost while maintaining predictive accuracy, making it suitable for rapid and low-cost evaluation of design alternatives [3].

Validation against experimental data and reference numerical results shows that the proposed model predicts the pressure drop with good accuracy, achieving outlet pressure deviations of 9.87% and 10.91% relative to experimental measurements in the two selected validation cases. When compared with commercial CFD tools, the model shows very close agreement, with outlet pressure differences of only 2.26% relative to RTE–TDK and 0.36% relative to ANSYS Fluent results, demonstrating comparable predictive capability at a significantly lower computational cost in a considerably shorter time.

These results enable the model application within optimization workflows aimed at improving cooling performance, reducing pressure drops, and enhancing overall system effectiveness and efficiency. Beyond this, the developed tool accelerates the design process and supports engineering decision making in early-stage propulsion systems development, where fast and reliable evaluations of multiple configurations are required, significantly reducing development costs and time.

Keywords. *Liquid propellant rocket engine; Regenerative cooling; Modelling and simulation; Heat transfer; Supercritical fluid flow.*

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Validation of the numerical simulation of a bubbling fluidized bed reactor behavior

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Abstract. The gasification process has gained increasing attention as a sustainable alternative for fuel production due to growing concerns regarding fossil fuel depletion and greenhouse gas emissions. Numerical simulation is a valuable tool for improving understanding of the complex physical phenomena occurring inside bubbling fluidized bed gasifiers. In this work, a Computational Fluid Dynamics – Discrete Element Method (CFD-DEM) methodology is validated for the simulation of a bubbling fluidized bed reactor.

In this simulation methodology, the gaseous phase is described using the Navier–Stokes equations coupled with the internal energy conservation equation, while the behaviour of particles is modelled considering Euler's translational and rotational motion laws together with Newton's heat transfer models for the heat transfer interactions. In this study, the simulations are performed using Ansys Fluent to solve the fluid phase and Ansys Rocky to calculate particle interactions and dynamics [1]. The two-way Fluent coupling approach was adopted to account for the mutual interactions between particles and fluid flow, which is considered in the literature as one of the most recommended methods to represent the real behaviour of a bubbling fluidized bed reactor [1]. The validation procedure is based on operating conditions and numerical parameters reported in a scientific study [2]. The methodology adopted allows evaluation of the particles' dynamics in the bed, particularly bed expansion and heat transfer between particles and the surrounding fluid.

The obtained results showed good agreement with published data regarding bed expansion, particle dynamics, and heat transfer behaviour. The validation was supported by the close agreement between the simulated and reference results, with both studies reaching an average particle temperature of approximately 80 °C after 10 s and exhibiting a similar maximum bed expansion of around 120 mm under stable operating conditions. These findings confirmed the reliability of the adopted CFD-DEM methodology for future studies of biomass gasification in bubbling fluidized bed reactors.

Keywords. *Gasification; Heat transfer; Particles interaction; CFD-DEM; Gas-solid flow*

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Stochastic model predictive control for pump scheduling in water supply systems using differentiable machine learning models

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Abstract. Water Supply Systems (WSS) are crucial for the proper functioning of society, and their operation must ensure reliability and sustainability. Their management is becoming increasingly complex, as they must account for climate change and increased water demands caused by population and socio-economic growth. As reviewed previously in [1], several strategies exist to improve the management efficiency of WSS, ranging from network redesign to component retrofitting. Although effective, these solutions can be costly. Alternatively, the focus can be shifted toward optimization strategies that leverage existing infrastructure.

The Pump Scheduling Problem (PSP) is addressed in this work with the objective of reducing operational costs while respecting hydraulic constraints. Model Predictive Control (MPC) algorithms rely on models to estimate future system behavior and plan optimal operational schedules. However, these predictions are affected by uncertainties (e.g., water demand uncertainty and sensor noise) and imperfect model calibration, leading to uncertainty in future system behavior. Stochastic MPC (SMPC) emerged as a solution to this limitation by explicitly incorporating probabilistic representations of uncertainty directly into the optimization process [2]. Sequential Monte Carlo methods can accurately produce this uncertainty propagation throughout the time-horizon, but require producing several samples, becoming computationally expensive. Additionally, this output is not compatible with gradient-based optimizers. The contributions of this work are two-fold. First, a novel Machine Learning architecture is developed to produce differentiable sample-based distributions representing uncertainty propagation throughout a time-horizon, with low computational cost. Second, a chance-constrained SMPC formulation leverages these distributions to incorporate uncertainty directly into the optimization constraints. This formulation is compatible with gradient-based optimizations since each particle from the distribution is differentiable. Additionally, water demand uncertainty is included either through Monte Carlo sampling or a scenario-based formulation.

Keywords: *Water Supply Systems; Stochastic Model Predictive Control; Machine Learning; Pump Scheduling Problem*

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Thermo-energetic characterisation of a domestic gas oven with natural gas and hydrogen-enriched blends: an experimental and data-driven approach

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Abstract. Domestic gas ovens account for a significant share of residential energy consumption [1,2], and the transition to hydrogen-enriched fuel blends introduces new thermal and energetic challenges at the appliance level. Despite this relevance, systematic experimental characterisation of the internal thermal field and energy performance of domestic gas ovens under realistic operating conditions remains limited in the literature.

This work addresses that gap through a comprehensive experimental campaign on a domestic gas oven prototype with a vertically oriented burner, instrumented with 14 thermocouples per level across five vertical positions. Tests were conducted with natural gas and hydrogen-enriched blends over a representative range of setpoint temperatures. Raw signals were processed through an adaptive denoising pipeline, and key indicators were extracted for transient response, spatial temperature uniformity, and energy performance.

Results show a consistent three-stage transient response across all conditions, with stabilisation times of approximately 18–20 minutes regardless of setpoint and overshoot energy increasing nearly tenfold between 165 °C and 220 °C. The vertically oriented burner generated a sharply localised central hotspot with peak-to-peak temperature differences of 45 °C, while vertical temperature stratification affected spatial uniformity far more than mean temperature, with the coefficient of variation decreasing by a factor of ten from the burner-proximal level to the cavity top. Setpoint temperature was identified as the dominant driver of gas consumption, with fuel composition as a secondary factor.

A sensor independence analysis further demonstrated that spatial distribution of the measurement network is more critical than sensor count alone, providing guidance for reduced-instrumentation protocols. Together, these findings provide a validated experimental and methodological baseline for the design of hydrogen-ready domestic ovens and for the calibration of future CFD models.

Keywords: *Domestic gas oven; Natural convection; Fuel consumption; Thermal characterisation; Sensor redundancy; Natural gas + Hydrogen*

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Real-time performance of WSS simulators in digital twins using a diagnostic digital model

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Abstract.
Digital Twins offer significant potential for water supply systems (WSS), providing utilities with tools for real-time leakage detection, predictive maintenance, and operational optimization. However, despite their theoretical benefits, their implementation and validation remain limited [1]. It has been demonstrated that some of the barriers to adoption are rooted in cultural resistance. Moreover, a lack of confidence regarding the calibration, reliability and long-term accuracy of the underlying hydraulic simulators is a significant contributing factor [2]. To address these challenges, this work presents a standardized methodology for evaluating the simulator component of a digital twin through a Diagnostic Digital Model based on a multi-KPI framework, providing a transversal evaluation framework directly applicable to multiple WSS. The methodology assesses system performance at the hydraulic component level using dedicated indicators for pump efficiency, leakage detection, frictional losses, and water demand accuracy. To validate the proposed approach, controlled synthetic modifications were introduced into the Anytown benchmark model [3], including changes in pipe friction, pump curve, leakage additions and demand changes. The analysis quantified the sensitivity of each metric to each type of modification, thereby validating Digital Twin's responsiveness and building credibility for utilities. In the near future, this methodology will be applied in a real-world network to test noise and complexity. In a subsequent phase, these metrics can be used as calibration indicators of water distribution networks, contributing to the development of more robust and reliable digital twins for real-time implementation.

Keywords. *Diagnostic Digital Model; Digital Twins; Hydraulic Simulator Evaluation; Water Supply Systems*

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Mechanistic simulation for synthetic data-based calibration of wastewater machine learning models

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Abstract. Digital twins are becoming an important tool for the intelligent operation and optimisation of wastewater treatment plants (WWTPs). By integrating mechanistic simulation, data analytics, and real-time monitoring, operators can virtually reproduce process behaviour, test alternative operating conditions, predict failures, and optimise energy-intensive units such as aeration and pumping systems. However, the development of reliable WWTP digital twins remains limited by scarce, fragmented, and low-quality operational datasets, as noted by Wang et al. [1]. To address this limitation, synthetic data generated through process simulations can provide a reproducible and privacy-safe basis for training, calibrating, and validating machine-learning (ML) models. This work investigates the use of SUMO [2], a commercial software for WWTP modelling, to generate synthetic datasets representing the dynamic behaviour of WWTP process units. A BSM2 benchmark model is implemented and verified in a mechanistic model by reproducing reference operating conditions and expected process responses. The verified model is then used as a controlled scenario generator for ML development. This study focused on an aeration system composed of blowers, air-distribution manifolds, control valves, and an aeration tank with variable oxygen demand. Simulated variables, including airflow, valve position, dissolved oxygen, temperature, suspended solids, and energy consumption, were recorded under different operating scenarios. This time series data were used to train regression-based ML surrogate models to predict aeration dynamics and energy use. To improve realism, Gaussian and autoregressive noise can be added to the synthetic signals to approximate the typical SCADA sensor uncertainty, following concepts previously applied in the literature for wastewater pump control [3]. Model performance is assessed using k-fold cross-validation, RMSE, and R^2, while transferability is evaluated using limited measured WWTP data. Building on recent hybrid modelling advances, this work proposes a structured mechanistic-ML calibration pipeline for developing transparent, transferable, and data-efficient digital twins for WWTPs with limited monitoring data.

Keywords. *Wastewater treatment plants; Digital twin; Machine learning; Synthetic data*

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Hydraulic model calibration for leak detection and localization in water supply systems

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Abstract.
Water Supply Systems (WSS) are essential infrastructures. However, water leakage, energy consumption and operational optimization remain significant challenges in these critical systems. Water leakage is responsible for the loss of approximately 126 billion cubic meters of water per year, equivalent to around 345 million cubic meters per day. This represents a significant volume of treated water that is being lost, leading to additional energy losses and increased operational costs [2]. To improve energy efficiency and reduce leakage, it is essential to identify and locate potential leaks while implementing more efficient management strategies. To achieve this, hydraulic modelling and simulation are powerful tools enabling a virtual representation of the physical system, where several operational scenarios can be explored and evaluated several operational scenarios. To ensure an accurate representation of the real system as a digital twin, calibration is crucial. However, this requires considerable investment of time, empirical expertise and case-specific analysis, thus not representing an efficient and automated process [3]. Consequently, the implementation of a diagnostic model and calibration framework may represent a paradigm shift for such systems, since it enables the identification of parameters requiring calibration and the detection of model errors. In addition, a reliable and well-calibrated model allows a more precise representation of the real system and supports the prediction of operational behaviour. It also ensures that any deviation observed in the simulation can be as well indicative of potential leaks rather than calibration issues. Therefore, this work aims to define a methodological workflow for hydraulic modelling calibration in WSS, as well as for potential leaks detection and localization. The proposed framework applies optimization methods to minimize residuals between observed and simulated data, and updates selected hydraulic parameters, such as pipe roughness, pump curves, and/or demand patterns, to improve the analysed KPIs.

Keywords. *Water Supply Systems; Hydraulic modelling; Calibration models; Leak detection*

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DECODE-ESS: coverage-driven synthetic sampling for explainable tree-based surrogate models

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Abstract.
Within smart manufacturing, Explainable AI (XAI) has become increasingly important for building trust in complex Machine Learning (ML) models. However, within the literature, most XAI methods remain limited to feature-relevance scoring [1]. Although well established, these are often instance- or data-dependent, explaining the data rather than the model's broader behaviour. Surrogate modelling addresses this limitation by approximating a black-box model's decision function through a simpler, interpretable model. Among surrogates, tree-based models are particularly promising, striking a great balance between performance, interpretability, and deployability [1]. In this work, a novel tree-based surrogate model, DEcision tree Capturing Opaque DEcisions (DECODE) combined with an Empty Space Search (ESS) synthetic dataset generation process [2], DECODE-ESS, is proposed. Unlike common tree-based surrogates, which either rely on the original dataset or use synthetic sampling constrained to the original data distribution or specific decision regions, ESS aims to maximise coverage across the feature space [3]. Synthetic sampling enables the surrogate to characterise model behaviour in low-density regions, learn how it extrapolates during training, and explore decision behaviour under rare or abnormal conditions. Validation experiments were conducted on multiple low-dimensional benchmark datasets using different black-box teacher models. Results indicate that DECODE-ESS substantially improves alignment with the original model. For the benchmark Iris dataset, DECODE-ESS achieves 0.916 fidelity and 0.829 Jaccard similarity, compared to 0.481 and 0.321 for a surrogate trained on the original dataset, with fidelity measuring the ability to mimic the teacher model's decisions and Jaccard the decision boundary overlapping. In addition, DECODE-ESS maintains comparable performance with its teacher model, and a feature relevance analysis showcases that DECODE-ESS produces importance rankings highly aligned with those of the original model. Overall, these results highlight the importance of high-coverage feature-space exploration when training surrogate models, enabling more faithful representations of the original model's behaviour.

Keywords: *Explainable AI, Surrogate model, Synthetic dataset generation, Empty space search, Model transparency*

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Advances in computational bone regeneration models: existing frameworks and future directions

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Abstract. Bone fractures affect more than 178 million people annually, with more than 455 million prevalent cases per year, resulting in a significant socioeconomic burden [1]. Computational models for predicting fracture healing hold strong potential to optimize therapeutic management and reduce disability-adjusted life years. To address the need for systematic evaluation of existing approaches, this study provides a comprehensive comparative analysis of computational modeling approaches for bone fracture healing, evaluating methodologies, mathematical frameworks, validation techniques, and predictive capabilities across different biophysical domains. Sixty computational models were systematically selected from the Scopus database (2000–2025) and rigorously evaluated based on predefined inclusion and exclusion criteria. These models were categorized into five primary groups: mechanical, biological, mechanobiological, ultrasound, and bioelectric, based on their primary physical principles simulated through Finite Element Method (FEM) and artificial intelligence (AI) techniques. The effectiveness of each model was evaluated by analyzing computational frameworks, accuracy, validation methods, and limitations. Comparative analysis revealed that mechanical and biological models, the first ones developed, provided essential insights into stress distribution, fixation stability, vascularization, and tissue formation. However, because these factors are typically treated separately, these models often lack the required physiological complexity needed for clinical practice, where the interplay between mechanics and biology is essential. In contrast, mechanobiological models better predict tissue differentiation by integrating these mechanical and biological factors, demonstrating superior qualitative agreement with *in vivo* histological patterns. Ultrasound models proved effective for non-invasive structural assessment, despite simplified boundary conditions. Notably, bioelectric models demonstrated high sensitivity for assessing fracture healing through dielectric property changes. Based on these findings, this review suggests that combining mechanobiological and bioelectronic models represents a promising direction for future research. Bridging this gap could enable more dynamic simulations and support the development of new smart, instrumented implants. These innovations have the potential to provide personalized treatment [2].

Keywords: *Bone fracture healing; Bone remodeling; Computational modeling; Healing simulation; Artificial intelligence*

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[TEMA] Society, policy and health

Advanced tumor-on-a-chip platform with integrated electrodes for personalized electrochemotherapy

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Abstract. Cancer remains one of the leading causes of death worldwide, with breast cancer representing the most commonly diagnosed malignancy. Despite advances in treatment, chemoresistance remains a major clinical challenge due to tumor heterogeneity and the complexity of the tumor microenvironment. In this context, electrochemotherapy (ECT) has emerged as a promising strategy to enhance chemotherapeutic drug uptake through controlled electric pulses, thereby improving treatment efficacy while reducing systemic toxicity [1]. However, current chemotherapy dosing strategies are still based on the maximum tolerated dose principle, resulting in toxicity, treatment interruption, and reduced drug efficacy. Consequently, recent studies have focused on developing continuous, dynamic, and adaptive therapeutic approaches [2] that aim to inhibit the evolutionary dynamics governing resistant tumor phenotypes [3]. Nevertheless, recent research still lacks physiologically relevant platforms capable of reproducing tumor dynamics observed in vivo. Based on these limitations, this work aims to develop an innovative tumor-on-a-chip (ToC) platform integrating recirculation, vascular-like structures, and relevant tumor models for ECT assessment under physiologically relevant conditions. The ToC platform was designed using CAD and fabricated using stereolithography printing. The microfluidic channels were structurally characterized using micro-computed tomography (micro-CT), followed by integration with a micro-infusion pump to establish dynamic recirculation conditions. Biocompatibility and imaging capability were evaluated using A549 lung cancer cells and LIVE/DEAD assays with human umbilical vein cells. Finite element simulations were also performed to model electroporation dynamics and support future ECT optimization. Preliminary results demonstrate the successful fabrication of structurally stable ToC devices with well-defined microfluidic channels, as confirmed by micro-CT analysis. The platform exhibited high biocompatibility, with A549 cell viability remaining close to 100% after 48 h, while LIVE/DEAD assays confirmed high cell survival and imaging capability under dynamic 3D culture conditions. Overall, this platform shows potential as a physiologically relevant tool for personalized electrochemotherapy testing and future precision oncology applications.

Keywords. *Tumor-on-a-chip; Breast cancer; Electrochemotherapy; Microfluidics; Precision oncology*

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Integrating Hydrostatic Pressure and Neural Crosstalk for Advanced Bone Regeneration

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Abstract. Bone defects affect an estimated 1.71 billion people worldwide, posing a major challenge in regenerative medicine and a significant socio-economic burden [1]. Bone tissue engineering (BTE) has traditionally focused on osteogenesis, yet bone is highly vascularized and innervated. Only in the past five years has the role of the peripheral nervous system (PNS) in bone regeneration gained recognition, highlighting bone-nerve crosstalk in fracture healing, angiogenesis, and immune modulation. Denervation delays healing, reduces osteoblast activity, and leads to trabecular bone loss, underscoring the need for nerve regeneration [2], [3]. An ideal BTE scaffold must balance mechanical strength, porosity, biocompatibility, osteoconductivity, and osteoinductivity. Despite advances, scaffold designs rarely integrate mechanisms supporting both bone and neural repair [4]. We propose the development of a multifunctional scaffold integrating osteogenic and neurogenic components to enhance bone-nerve crosstalk. Using volumetric printing, we will fabricate GelMA-based scaffolds incorporating an osteoconductive additive to support bone regeneration. Additionally, the effects of hydrostatic pressure (HP) on human bone marrow-derived mesenchymal stem cells (hBM-MSCs) and human Schwann cells (hSCs) will be investigated in both 2D and 3D cultures. The study will optimize scaffold architecture to balance bone and neural regeneration needs, utilizing computational modeling to refine mechanical and biological properties. This research is expected to advance biofabrication techniques, uncover HP's impact on neuro-bone regeneration, and establish fundamental design principles for next-generation bone scaffolds.

Keywords. *Bone-nerve crosstalk; Hydrostatic pressure; Bone regeneration; 3D volumetric printing*

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Process–property relationships in electron beam welded copper tubes for heat pump applications

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Abstract. Heat pump systems contain several copper tube joints in the refrigerant line, and the quality of these joints plays a significant role in the system's long-term reliability. However, variations in electron beam welding (EBW) conditions can produce very different weld responses. At the same time, the link between process parameters and mechanical performance is not always clearly defined for copper tube joints. To address this issue, this work proposes a simple classification of electron-beam-welded copper-to-copper tube joints based on tensile behaviour and hardness variation. Sixteen welds were manufactured using beam currents between 8 and 11 mA and welding speeds between 55 and 70 deg/s, yielding heat inputs of 78.62-188.86 J/mm; representative welds were then evaluated by tensile testing and microhardness profiling. The experimental results showed three repeatable categories of weld behaviour: (1) low strength and low elongation, (2) high strength and stiffness with limited ductility, and (3) very large elongation with continuous hardening during deformation. Hardness results showed that lower coefficient of variation values were associated with more uniform weld zones, whereas higher values indicated greater metallurgical variation across the joint. This proposed classification helps define practical welding windows for copper tube joining in heat pump refrigerant circuits. It supports selecting process conditions to achieve the required balance of strength, ductility, and weld consistency. These findings are consistent with recent systematic reviews highlighting the dominant influence of beam current on weld quality in copper EBW [1], as well as studies demonstrating that optimised process parameters can achieve joint strengths approaching those of the base material [2]. Furthermore, research confirms that careful control of welding variables is essential for minimising defects and ensuring reliable mechanical performance in copper tube applications [1,2].

Keywords. *Electron Beam Welding; Copper Tube Joints; Heat Pump Systems; Mechanical Behaviour; Weld Quality*

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Piezoelectrets in intelligent systems: recent advances, emerging applications, and technological challenges

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Abstract. Recent advances in materials, device architectures, and manufacturing processes have significantly expanded the potential of piezoelectret-based transducers, also known as ferroelectrets, for applications in intelligent systems, self-powered devices, and sustainable technologies. Despite this progress, the diversity of materials, manufacturing techniques, and application domains makes it difficult to establish an integrated view of the current state of the art and the main technological challenges limiting their practical implementation. In this context, this work presents a systematic literature review aimed at identifying, analysing, and synthesising recent technological advances, emerging applications, current challenges, and future perspectives of piezoelectret-based transducers. The review was conducted using the Web of Science, Scopus, and IEEE Xplore databases, considering studies published between 2014 and 2024 that experimentally validated the piezoelectric or magneto-piezoelectric behaviour of these devices. The literature synthesis shows that recent developments have been driven by the integration of novel materials, advanced manufacturing processes, and multifunctional device architectures, leading to improvements in electromechanical performance, structural flexibility, and integration into intelligent systems. Among the main material platforms identified are polypropylene (PP), fluorinated ethylene propylene (FEP), expanded polytetrafluoroethylene (ePTFE), polylactic acid (PLA), and polyvinylidene fluoride (PVDF). In parallel, corona charging, thermoforming, additive manufacturing, multilayer lamination, and irradiation cross-linking have contributed to improving device performance, stability, and mechanical robustness [1,2]. The analysed studies also reveal a significant expansion of applications, including wearable sensors, biomedical monitoring, acoustic sensing, vibration energy harvesting, magneto-piezoelectric current transducers, and Internet of Things (IoT)-enabled systems, as well as ferroelectret nanogenerators (FENGs) for self-powered electronics [3]. Despite these advances, important challenges remain regarding long-term electrical stability, charge retention, durability under harsh operating conditions, and electromechanical conversion efficiency. Overall, piezoelectrets are evolving from functional materials into multifunctional technological platforms for intelligent, sustainable, and self-powered systems. This review provides an integrated perspective on the relationships among materials, manufacturing processes, applications, and technological challenges, highlighting research trends that may guide the development of the next generation of piezoelectret-based transducers.

Keywords: *Energy Harvesting, Wearable Sensors, 3D Printing, Multifunctional Transducers, Electromechanical Coupling*

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Experimental comparison of continuous and oscillating welding using blue laser light fiber

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Abstract. Blue Laser Light Fiber (B-LLF) welding has recently attracted increasing attention due to its shorter wavelength compared with conventional infrared lasers. While this technology has been widely applied to materials such as copper and aluminum [1,2], the application of B-LLF welding to Advanced High Strength Steels (AHSS) remains underexplored, and direct comparisons between continuous and oscillated welding modes are still lacking. Owing to its lower heat input, B-LLF welding may represent a promising solution for automotive applications, particularly in the production of tailor-welded blanks (TWBs). In this study, two welding modes, continuous and oscillated, were investigated in 0.8 mm thick DP1000 steel sheets. In continuous mode, the laser power ranged from 400 W to 1600 W, whereas in oscillated mode the power was maintained constant at 400 W. Welding speeds varied between 30–40 mm/s for the continuous mode and 13–28 mm/s for the oscillated mode. A focal distance of 83 mm was kept constant in both cases. The results show that oscillated welding achieved full penetration at a heat input as low as 8.27 J/mm. In contrast, continuous welding required a higher heat input of 16.67 J/mm to obtain full penetration nonetheless, this resulted in higher joint efficiency - 89%. These findings indicate that the selection of welding mode should depend on the intended application: oscillated welding offers advantages in terms of lower heat input and greater tolerance to joint imperfections, whereas continuous welding provides superior mechanical performance.

Keywords. *Blue Laser Light Fiber, Oscillated Laser Welding, Continuous Laser Welding, Heat Input*

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Assessing the viability of laser transmission welding for joining solid and foam thermoplastics

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Abstract. Morphologically dissimilar thermoplastic structures are in high demand in the automotive industry, widely used in bumpers, dashboards, and door panels. Currently, joining a solid thermoplastic part to a foam relies heavily on adhesives. However, these compounds are toxic, non-recyclable, and involve processes with limited flexibility and impractical curing times. Laser transmission welding (LTW) emerged as a clean, environmentally friendly, and highly flexible alternative for joining these components in an overlap configuration. While LTW is well-established for solid polymers, its application to morphologically dissimilar structures (solid-to-foam) remained largely unexplored due to the complex thermal, chemical, and structural discrepancies between the materials. Addressing this gap in current research, this study aimed to assess the parametric interplay and optimize two distinct dissimilar joint configurations: polypropylene (PP) to polyethylene (PE) foam and PP to expanded polypropylene (EPP). The comprehensive methodology was divided into three main areas: thermal and chemical analysis; mechanical behaviour; and morphological analysis. Initially, a laser power and scanning velocity study proved the weldability of the assemblies, followed by a process optimization which involved systematically varying clamping pressure, laser frequency, scanning patterns, and laser wobble, alongside testing masking agents and up-scaled welds. The results demonstrated that high joint strength, comparable to the base foam, could be successfully achieved in both assemblies, though they required distinct approaches. For the PP-PE foam configuration, optimal strength was primarily governed by fine-tuning laser power and scanning velocity. Conversely, the PP-EPP assembly required a more complex optimization strategy, relying on higher clamping pressure and modified scanning patterns to ensure weld quality and consistency. Ultimately, this research provided novel insights into the specific mechanisms governing LTW in solid-foam assemblies. By establishing these unexplored parametric relationships, this study confirmed LTW's viability as a highly efficient, adhesive-free joining method for morphologically dissimilar thermoplastics structures.

Keywords. *LTW; Thermoplastic joints; Dissimilar morphologies; Parametric study*

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Multi-objective optimisation of injection moulding parameters for in-mould electronics components

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In-Mould Electronics (IME) integrates printed electronic circuits into injection-moulded plastic parts, enabling lightweight, multifunctional smart surfaces. While defects such as sink marks, warpage and non-uniform shrinkage are common in conventional injection moulding, the embedded electronic insert locally modifies flow behaviour, heat transfer and pressure distribution, affecting defect formation and adding insert-polymer adhesion as an additional requirement. Although injection-moulding simulation has been applied to IME, prior studies have focused on preventing film or ink damage, whereas the simultaneous optimisation of part quality, insert-polymer adhesion and machine clamping-force limits remains little explored. To address this gap, this study presents a multi-objective simulation-based optimisation framework that simultaneously balances part quality, insert-polymer adhesion and machine operating constraints in IME manufacturing. Injection moulding of a polycarbonate IME component with a polycarbonate electronic insert was simulated using Autodesk Moldflow Insight. A full-factorial Design of Experiments evaluated melt temperature, coolant inlet temperature and packing pressure, each at three levels, giving twenty-seven runs. Multi-objective optimisation in OriginLab used two scenarios. The first, based on four part-quality criteria, identified an optimum at 295 °C melt temperature, 110 % packing pressure and 90 °C coolant temperature, achieving 45.9 % of the insert thickness above the glass transition temperature (Tg) with sink mark depth 0.014 mm, Z-warpage 5.00 mm and shrinkage 1.12 %. However, clamping force reached the machine limit. Including clamping force as a fifth optimisation criterion shifted the optimum to 315 °C melt temperature, increased the insert fraction above Tg to 49.7 % and reduced clamping force by approximately 25 %, returning it within safe limits, though defects rose moderately. By jointly optimising part quality and insert adhesion, this work contributes a simulation-based methodology for selecting robust IME processing windows, supporting more reliable and sustainable manufacturing of smart-surface components.

Keywords: *In-mould Electronics; Moldflow simulation; sustainable manufacturing; Design of Experiments; Film insert*

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X-ray microcomputed tomography post-processing for internal feature analysis in dense and porous steel structures

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Abstract. X-ray micro-computed tomography (micro-CT) enables non-destructive three-dimensional characterization of internal features in metals [1,2]. However, the interpretation of reconstructed datasets strongly depends on post-processing and material-related detectability. To date, only a few studies [2] have investigated damage characterization in dense steels using laboratory micro-CT because reliable detection of small voids remains particularly challenging. This work compares the same micro-CT post-processing approach in two contrasting steel systems: dense dual-phase DP1000 [3] and porous I-WP triply periodic minimal surface structures [4]. DP1000 and I-WP specimens were subjected to interrupted tensile and compressive loading, respectively, and analysed at different strain levels. For DP1000, post-processing focused on identifying low-density regions in a low-contrast material with small defects. SEM supported damage interpretation. In the porous structures, the same approach improved framework–pore differentiation, enabling visualization of pore deformation and collapse. This work provides a comparative evaluation of the applicability and limitations of the same micro-CT post-processing approach in steel systems with fundamentally different detectability conditions. The results demonstrate that micro-CT detectability in steels is governed not only by spatial resolution, but also by material architecture, image contrast and segmentation strategy, providing insight into the interpretation of micro-CT datasets in steel materials**.**

Keywords. *X-ray microcomputed tomography; Dual-phase steel; Triply Periodic Minimal Surface Structures; Image Processing*

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Applying MT2.0 on classical standard tests: limitations and opportunities

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Abstract. Classical mechanical testing standards have traditionally relied on global force–displacement measurements and homogeneous strain evaluation to characterize material behavior. While these approaches have ensured robustness and industrial reproducibility for decades, they remain limited in their ability to capture the spatial evolution of deformation and localized phenomena during loading. The emergence of Material Testing 2.0 (MT2.0), supported by full-field measurements and virtual experimentation techniques, provides new opportunities for richer constitutive characterization beyond conventional scalar interpretations.

This study investigates the application of MT2.0 concepts to classical standardized tensile, shear, and biaxial bulge tests through finite element-based virtual experimentation using a DP600 steel. Full-field strain evolution, principal deformation paths, localization behavior, and statistical field quantities were extracted and analyzed throughout deformation. The responses obtained from the classical framework were compared with MT2.0-based full-field responses and true finite element responses. The results revealed that conventional standardized tests contain significantly richer mechanical information than is typically exploited using classical global measurements alone. While the classical framework provided smooth global mechanical responses, the MT2.0 approach enabled a more detailed analysis of deformation heterogeneity, strain localization, and multiaxial deformation evolution across the different loading conditions. The study highlights both the limitations of conventional characterization approaches and the opportunities offered by MT2.0 toward digitally integrated and physically richer material characterization methodologies.

Keywords. *Virtual experiment; Finite element simulation; Full-field measurement; Strain localization; Material characterization.*

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Information classification: Internal

Integrated Assessment of CO_2-to-Liquid Fuel Pathways: Process Simulation, Multi-Impact Life Cycle Assessment, and Dynamic Renewable Energy Analysis

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Abstract. Power-to-Liquid (PtL) processes provide a promising solution for reducing greenhouse gas emissions from sectors that cannot be easily electrified, such as aviation, shipping, and heavy transportation, by converting renewable electricity, water, and carbon dioxide into synthetic fuels. Although there is increasing academic interest in PtL, the literature on PtL systems, typically, has only considered individual systems in isolation, single process chains with continuous energy input, and environmental impacts that are limited to global warming potential. To overcome these research gaps, the following study proposes an integrated evaluation approach, where performance mapping will be performed for a broader range of process routings, including new electrochemical assisted CO_2 conversion process routings in addition to the benchmark reverse water gas shift Fischer Tropsch synthesis process routing, using process modeling to evaluate heat integration effectiveness, carbon conversion percentages and leveled fuel costs. Multi-impact life cycle assessment will be conducted for six environmental impact areas: global warming potential, water consumption, land use, impact on human health, acidification, and formation of particulate matter. An integrated model based on process simulation, techno-economic considerations, and dynamic models of renewable energy production based on wind and solar power generation systems is also planned to examine the influence of intermittent energy supply on system performance and environmental footprint. Through this approach the results aim to provide a benchmark data set on the performance of several PtL systems under practical conditions and to highlighting potential complex trade-offs between the efficiency of energy utilization, degree of carbon conversion, cost of production, and other environmental implications. The findings aim to provide useful information for scientists to make decisions on the use of Power-to-Liquid technologies.

Keywords. *Fischer Tropsch synthesis; life cycle assessment; techno economic analysis; electrolysis; carbon capture and utilization;*

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Phase Stability of Ruddlesden-Popper Stannate-Based Oxides under Reducing Conditions Relevant to Proton Ceramic Cells.

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Abstract. The Ruddlesden–Popper (RP) family of compounds, with general formula A_2BO_4 corresponding to the $n = 1$ member of the $A_{n+1}B_nO_{3n+1}$ series, consists of layered perovskite structures exhibiting mixed ionic and electronic conductivity. Their crystal structure comprises single perovskite (ABO_3) blocks separated by rock-salt (AO) layers stacked along the *c*-axis. Among candidate materials, layered Ruddlesden-Popper oxides, such as $Ba_2SnO_{4-\delta}$, have emerged as promising due to their structural versatility and the presence of redox-active Sn cations; furthermore, there is still a lack of comprehensive understanding of the phase stability of this material under fuel-relevant reducing conditions in protonic ceramic cells (PCCs) [1,2].

This study systematically investigates the structural evolution, defect chemistry, and phase stability of $Ba_2SnO_{4-\delta}$ using powder X-ray diffraction, bond valence analysis, and thermodynamic modelling under relevant fuel atmospheres. Reducing $Ba_2SnO_{4-\delta}$ under a dry H_2 atmosphere (up to 700 °C) preserves its tetragonal structure via a topotactic mechanism involving anisotropic lattice relaxation, resulting in c-axis contraction and apical Sn−O bond shortening. This process predominantly generates oxygen vacancies in equatorial sites, partially reducing Sn^{4+} to Sn^{2+}, as confirmed by bond valence analysis. The observed stability window is based on tolerance-factor analysis, which suggests that moderate reductions in the network preserve its structural integrity, whereas more severe reductions induce collapse.

In a humid atmosphere, exposure to H_2 causes the material to partially decompose at 600 °C, unlike in a dry atmosphere. Meanwhile, CO_2 promotes complete degradation of the material into $BaSnO_3$ and $BaCO_3$ by carbonating the BaO layers. However, superior stability was observed under a dry CH_4 atmosphere. This demonstrates that the composition of the gas phase has a critical effect on the phase stability of $Ba_2SnO_{4-\delta}$, suggesting that the chemical reactivity of the BaO layers is the primary cause of degradation. These findings provide fundamental guidelines for improving the durability of layered barium stannates for PCC applications.

Keywords. Proton Ceramic Cells, Ruddlesden-Popper Oxides, Barium Stannate, Phase Stability

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Techno-economic and environmental analysis of waste-to-fuel using electrochemical conversion and Fischer–Tropsch synthesis

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Abstract. Decarbonization of the transportation sector and the disposal of municipal solid waste (MSW) are two of the major challenges of the 21st century [1,2]. This doctoral research investigates a novel waste-to-fuel production route that converts the organic fraction of MSW (OFMSW) into low carbon liquid fuels using methane assisted co-electrolysis and Fischer-Tropsch (FT) synthesis. Process simulation, techno-economic analysis and life cycle assessment (LCA) were performed using Aspen Plus, Excel, and SimaPro to evaluate the performance of the proposed system.

The integrated electrochemical configuration partially oxidizes biomethane (from biogas) at the anode of a solid oxide electrolyzer (SOEC) while simultaneously co-electrolyzing CO_2 and H_2O at the cathode for syngas generation. This configuration reduces the electricity demand by 68% as compared to conventional SOECs and achieved a biogas to fuel carbon conversion efficiency of 50.2%, which is relatively higher than steam reforming and dry reforming. The economic analysis of the baseline plant configuration indicated a minimum selling price (MSP) of 4.3 USD /kg FT-diesel, decreasing to 2.7 USD/kg when the plant size is scaled-up tenfold.

LCA showed that the FT-diesel produced through this pathway has a 40% lower global warming potential (GWP) than fossil diesel. Reductions were also seen in ozone formation (96%), fine particulate matter formation (84%), and terrestrial acidification (79%). The hotspots in the environmental impacts were the electricity used by the SOEC and the diethanolamine (DEA) used for CO_2 removal from the syngas along with fugitive CH_4 emissions from the anaerobic digester. The key drivers of the MSP of the fuel were found to be the cost of electricity used at the facility and the MSW tipping fee. This demonstrates the potential of this novel pathway in the decarbonization of transportation fuels.

Keywords. *Biomass-to-fuel, electrochemical conversion, Fischer-Tropsch synthesis, solid oxide electrolyzers, electro-partial oxidation of methane*

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Geometry-driven optimization of finned heat exchangers for outdoor electronic cabinets

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Abstract. Outdoor electronic cabinets require efficient thermal management solutions capable of dissipating significant internal heat loads while satisfying environmental, mechanical, and acoustic constrains [1]. Within the framework of the FOCO project, this work addresses the thermal optimization of the finned heat-exchanger subsystem integrated into the indirect free-cooling architecture of PHBP outdoor cabinets.

The study begins with the thermal and acoustic characterization of both the current full-scale cabinet and a reduced-scale prototype, establishing an experimentally validated baseline for subsequent design comparisons. Based on this reference configuration, the outgoing PhD research develops a constrained geometry-driven optimization methodology for the finned heat exchanger.

Building on this baseline, the PhD research investigates a constrained geometry-optimization framework for the finned heat exchanger. However, existing studies rarely couple thermal, acoustic, and manufacturability constraints within a single design framework. Fin spacing, fin profile, and effective heat-transfer surface area are treated as design variables, while manufacturability limits, minimum clearances, airflow requirements, and noise-related operating conditions are imposed as constraints [2, 3, 4]. The goal is not to pursue a single algorithmic solution, but to define a physics-based design methodology that combines heat-transfer modelling with experimental validation and iterative refinement, ensuring that the selected geometry remains compatible with industrial fabrication and installation requirements [2, 5].

The expected outcome is a compact and industrially viable thermal solution that improves effective heat rejection, preserves fin efficiency, and reduces the likelihood of acoustic non-compliance relative to the current cabinet configuration. More broadly, the proposed workflow aims to provide a reusable design methodology for the thermal redesign of outdoor electronic enclosures in which thermal performance, acoustic behavior, and manufacturability must be balanced simultaneously. This constitutes the main scientific contribution; a physics-based, experimentally validated framework bridging heat-exchanger optimization and industrially feasible enclosure design.

Keywords. *outdoor electronic cabinets; indirect free cooling; finned heat exchanger; forced convection; thermal optimization.*

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[WJCR] William James Center for Research: Ongoing projects from emerging researchers

Many cues, one tag: the contamination effect in recognition, recall and the role of multimodal contamination cues

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Abstract. The contamination effect (CE) describes a mnemonic tuning for neutral objects that acquire contamination potential through their association with sick (vs. healthy) individuals[1]. This effect has been established in free recall, but two questions remained open: whether the CE extends to recognition memory (Goal 1) and whether its magnitude depends on the sensory modality in which contamination cues are presented (Goal 2). To address Goal 1, participants encoded neutral objects paired with faces displaying signs of disease or not, using the standard CE paradigm. After a short distractor, they completed a surprise recognition task. In one online U.S. sample and one laboratory Portuguese sample, objects previously associated with sick (vs. healthy) faces were recognized more accurately, replicating the CE in recognition memory[2]. Goal 2 required several steps. First, the Matched Multimodal Action Database (MMAD) was developed and characterized. Actors were recorded performing sick (coughing, sneezing) and healthy actions (yawning, whistling), from which matched videos, audio clips, and pictures were derived. Sick (vs. healthy) actions were rated as more arousing, negative, disgusting and discomfort-evoking, with higher contagion-risk and the actor perceived as sicker; the largest differences often emerged in the video format[3]. Using MMAD stimuli, a subsequent experiment showed that sick actions framed in a disease (vs. allergy) context generally increased arousal, disgust, discomfort, and contagion-risk, whereas providing no context often elicited similarly strong negative evaluations; for healthy actions, framing effects were weaker. Finally, MMAD stimuli characterized in the disease context were used in a free-recall CE paradigm to test the influence of cue modality in the CE. Action type was manipulated within-subject and cue modality between-subjects. Objects associated with sick (vs. healthy) actions were recalled better across all modalities, suggesting that once an object is conceptually tagged as a potential contaminant, the CE operates largely independently of sensory format.

Keywords. *contamination effect; adaptive memory; multimodal stimuli; contextual framing*

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Protocol for a pilot randomized controlled trial evaluating the CanCOG®-Cognitive Rehabilitation in Cancer program in Portuguese cancer survivors

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Abstract. Cancer-related cognitive impairment (CRCI) is a highly prevalent condition, affecting up to 75% of survivors of non-central nervous system (non-CNS) cancers and significantly impacting cognitive functioning and everyday activities [1]. Cognitive rehabilitation has emerged as a promising approach to mitigate these difficulties [2]. This pilot randomized controlled trial (RCT) aims to primarily assess feasibility and acceptability of the CanCOG® Cognitive Rehabilitation Program in Portuguese cancer survivors, while also secondarily exploring preliminary effects on cognitive and psychosocial outcomes [3].
A total of 60 adult non-CNS cancer survivors will be randomly allocated to either the CanCOG® intervention group or a treatment-as-usual control group. Feasibility will be evaluated using predefined quantitative indicators, including recruitment and retention rates, adherence to the intervention, and completion of assessment timepoints. Acceptability and participant satisfaction will be explored through semi-structured qualitative interviews. Exploratory clinical outcomes will include subjective and objective measures of cognitive functioning, as well as anxious and depressive symptomatology and quality of life. These outcomes will be assessed at baseline, immediately post-intervention, and at 3- and 6-month follow-ups. Qualitative interview data will be analyzed using thematic analysis, while exploratory quantitative outcomes will be examined using linear mixed-effects models and the Hageman and Arrindell Index. The study is currently awaiting ethical approval and registration on ClinicalTrials.gov.
This pilot trial is expected to provide key evidence regarding the feasibility of implementing the CanCOG® program within a Portuguese oncology context, as well as survivors' acceptability and satisfaction. In addition, exploratory analyses will offer preliminary insights into potential improvements in perceived cognitive difficulties, cognitive performance, emotional distress, and quality of life compared to usual care. Overall, findings from this study will inform the refinement of the intervention and contribute to the design of a future fully powered RCT, with potential implications for improving cognition, well-being, and quality of life in cancer survivors.

Keywords. *Cancer-related cognitive impairment; cognitive rehabilitation; psycho-oncology; cancer survivors*

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When testing falls short: psychometric evaluation of a cognitive failures measure and contributions to neuropsychology and sleep medicine

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Abstract. Sleep is a major determinant of daily functioning and health, and broader consequences of its disruption include impairment in cognitive functioning [1]. Among sleep disorders, insomnia represents the most prevalent clinical condition, and accumulating research has identified discrepancies between patients' self-perception of daytime impairment and objective cognitive measures (i.e., standardized neuropsychological tests, cognitive tasks), which often fail to detect corresponding deficits [2]. In this context, cognitive failures emerge as a relevant construct, as they are everyday subjective lapses that may reflect compromised cognitive functioning and be sensitive to factors such as sleep quality, fatigue, or circadian influences [3]. This study aimed to evaluate the psychometric properties of the European Portuguese version of the Cognitive Failures Questionnaire (CFQ) 2.0, a revised and abbreviated version of the original CFQ, while discussing its relevance for neuropsychology and sleep medicine. The adaptation process involved expert review, cognitive debriefing interviews, and back-translation procedures. A community sample of 309 adults (M =38.10; SD =14.89) completed the CFQ 2.0 and related measures of memory failures, multidimensional fatigue, and insomnia severity. The findings supported a unidimensional structure of the scale and excellent internal consistency. Significant positive correlations were observed with memory failures, multidimensional fatigue, and insomnia severity, whereas negative associations were found with the vigor subscale of multidimensional fatigue. Overall, these findings provide evidence for the reliability and validity of this version of the CFQ 2.0 as a brief measure of everyday cognitive failures. Beyond its psychometric adequacy, this work underlines the importance of considering both subjective and objective measures when assessing cognitive functioning. Although objective measures remain the gold standard in research and clinical settings, subjective and objective measures provide non-redundant information. Additionally, the brevity of this measure may represent an advantage, especially in neuropsychology and sleep medicine, where ecologically valid and time-efficient instruments are critically needed.

Keywords. *Subjective cognitive functioning; cognitive failures; neuropsychology; sleep medicine*

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Carotenoid coloration and its role in attractiveness and mate selection

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Abstract. Humans have evolved sensitivity to cues signaling mate quality [1]. Carotenoid coloration, the skin color reflecting intake of carotenoid-rich foods, may be one such cue, linked to facial health [2], facial attractiveness [3], immune function, disease resistance, photo-protection, and reproductive success in other species. While higher carotenoid coloration generally boosts attractiveness judgments, the optimal level and whether preferences vary by mating context remain unclear. This study aimed to identify such an optimal level and examined whether preferences shifted by mating context (short-term vs. long-term) and across cultures. English and Portuguese participants completed an interactive task in which they adjusted the carotenoid coloration of 50 opposite-sex faces to maximize attractiveness in both mating contexts, using a coloration continuum ranging from low to high levels. Both samples showed significant preferences for higher carotenoid coloration in male and female faces. English participants preferred higher levels for short-term than long-term mates, while Portuguese participants showed no such context effect, revealing cross-cultural variation. Across both cultures, male faces received significantly higher optimal coloration than female faces, independently of mating context. Participants generally rated their own coloration as relatively low yet consistently preferred higher levels in potential partners. These findings replicated the carotenoid attractiveness link cross-culturally [3]. The sexual dimorphism in optimal coloration may reflect preferences for sex-typical skin color, as male skin is darker than female skin across ethnicities [4]. The mating context effect in the English sample supports the role of health cues in short-term mate selection. In contrast, its absence in the Portuguese sample suggests that cultural or typicality factors warrant further investigation. A follow-up rating study presenting faces varying around the optimal coloration levels identified here is ongoing, and preliminary data will be presented at the event.

Keywords. *Skin coloration; carotenoids; mate choice; attractiveness; cross-cultural*

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Characterization of the impact of the COVID-19 pandemic on neuropsychological correlates and mental health in healthy older adults

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Abstract. Healthy aging is a multidimensional process influenced by cognitive, emotional, sociodemographic, and lifestyle-related factors. The COVID-19 pandemic created additional challenges for older adults, including social isolation, disrupted routines, fear of infection, and changes in perceived quality of life [1,2]. This doctoral study in Psychology aimed to characterize the impact of the COVID-19 pandemic on neuropsychological correlates and mental health in healthy older adults, while comparing different age groups. Participants were adults aged between 65 and 100 years, divided into three groups: younger-old adults, aged 65 to 74 years; middle-old adults, aged 75 to 84 years; and oldest-old adults, aged 85 to 100 years. Data were collected in nursing homes, day centers, and senior universities. All participants were willing and able to complete the assessment procedures and agreed to participate in the follow-up study. After an initial screening phase to verify inclusion criteria, participants completed three assessment sessions of approximately 60 minutes each. Two follow-up assessments were subsequently conducted at three-month intervals, using the same protocol. The assessment included sociodemographic data, eating and sleeping habits, depressive and anxious symptomatology, fear of COVID-19, COVID-19-related anxiety, subjective memory perception, quality of life, coping with isolation, adherence to protective measures, and neuropsychological performance. Cognitive domains included attention, memory, executive functions, language, and verbal abilities. Data collection has been completed, and quantitative data are currently being prepared for analysis using SPSS, while qualitative data will be analyzed with MAXQDA. This study is expected to contribute to a better understanding of healthy aging during and after the pandemic, supporting future strategies to promote cognitive health, emotional well-being, and resilience among older adults.

Keywords. *Healthy aging; Longitudinal assessment; Cognitive functioning; Emotional well-being; Quality of life*

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Promoting executive functions in preschool and primary school children: a systematic literature review

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Abstract. Executive Function (EF) refers to a set of processes responsible for the intentional regulation of behavior, cognition, and emotion in goal-oriented contexts [2] and is a central construct in development psychology and cognitive neuroscience. The preschool period is widely recognized as a critical phase for the development of EFs, due to the high neurobiological plasticity associated with the maturation of the prefrontal cortex and the intense socialization experiences characteristic of this stage of development [1]. During primary school, EF continue to develop and are reflected in how children solve problems, maintain focus on tasks, cooperate with others, and make friends [3]. Given the importance of promoting EFs in childhood, a systematic review is essential to better understand the available programs and their efficacy. It allows for a rigorous and comprehensive synthesis of current findings, clarifies the strength and consistency of the evidence, identifies gaps in the literature, and highlights methodological limitations that should be addressed in future work. By integrating the results of studies, a systematic review on this topic also helps to analyze the importance of promoting EF in childhood for child development. Ultimately, synthesizing the existing literature is a critical step toward understanding the effectiveness of promoting EF in childhood and guiding future research directions in this field. We will present preliminary results of a systematic review that we are conducting to summarise the literature on programmes aimed at promoting executive function (EF) in typically developing preschool and school-age children. We are currently conducting title and abstract screening.

Keywords. *Executive Functions; Intervention; Preschool children; Primary school children*

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