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Textual, Visual and Computational Interpretation Moments in a Diffusion-Powered Architectural Design Process

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Abstract: More and more architects are starting to experiment with diffusion models – artificial intelligence models initially used as text-to-image generators. Since Open AI’s first diffusion model Dall-E (Ramesh et al., 2021), new models to generate images based on text, images, or both, are launched regularly. Plugins such as ControlNet (Zhang et al., 2023) allow architects to gain more control over the generation process through masks and control images, to enable rapid pixel-perfect image generations. This paper studies the integration of diffusion models in a computational workflow: how does the designer translate the brief into architectural images and how do these generated images lead to a computational design concept. This paper belongs to a series of experiments conducted to analyse various moments of interpretation between designers and computed artefacts in a diffusion-powered architectural design process. A diffusion-powered architectural design experiment is conducted with 18 master students of architecture and engineering. The students were asked to design a nature-inspired bicycle bridge, a structural design strategy called biomimicry. Stable Diffusion, including the ControlNet plugin, was utilized to merge biologic and structural concepts to formulate the design idea, which was then parametrically built using Rhinoceros/Grasshopper. We study the interpretation moments that occurred during this workflow. Firstly, a series of textual and visual interpretation moments arise during the usage of Stable Diffusion: which vocabulary was used to merge nature with structure, were certain design decisions made through that vocabulary, and which design criteria were used to select the final images? Secondly, we analyse the computational interpretation moments: how did the architect translate the generated images into a computational concept, and did Stable Diffusion impact this translation? Lastly, we study the biomimicry process as an instance of ‘style transfer’ from nature to structure. The collected research data includes the design brief, the generated images and matching prompts, and answers from a questionnaire. From the questionnaire we deduce the criteria which the architects used to evaluate and discriminate the generated images, as well as the methods they used for intermediate representation. We document their experience with diffusion models as a design tool, as well as the ControlNet functions they used in order to generate more computable results. A personal description about how they would describe the transition from a generated image to a computational concept completes the questionnaire.

The paper provides an empirical definition of the computational interpretation moments during a diffusion-powered architectural design workflow. The challenges of the computational interpretation moments are identified, along with the design decisions and design criteria that are relevant at this stage in the diffusion-powered workflow. Additionally, our results map the strategic choices to ‘transfer a style’ onto generative and computational algorithms. This research studies the potential of diffusion-powered workflows for architectural implementation beyond initial inspiration and ideation, as has been studied extensively in previous research (Çiçek et al., 2023; Dokonal W., 2023; Dortheimer et al., 2023; Guida, 2023). In this paper we identify challenges together with relevant design decisions and criteria, steering future research and experimentation in practice towards a maximum impact.

Keywords: Diffusion Models; Computational Design; Artificial Intelligence; Design Support; Human-Machine Feedback.

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The Formation of the Civil Engineering in the Ottoman Empire

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Abstract: The early 20th century witnessed the rise of the civil engineering identity in the Ottoman Empire. This study investigates the formation of civil engineering in the Ottoman Empire by focusing on the construction of scientific and technical knowledge. More specifically, this research examines the multi-layered interactions that are closely related to the process towards professionalization, exposing the conceptual exchange in science and technology through various textbooks, and the processes of implementation through the collaborations between the various actors in the construction sector.

In the first part, the focus of analysis is mostly on a theoretical discussion and relies on the book called *Mecmuai Ulum-i Riyaziye* (A Collection of Mathematical Sciences). The study offers an interpretive lens that, in a novel way, expounds the difference between simply translating scientific knowledge, and adopting it to Ottoman intellectual structures as a dynamic knowledge through the case study of İshak Efendi the educator-translator who had a profound impact on modern Ottoman scientific knowledge and his compilation book. The prologue and epilogue sections in the fourth volume of the book will be examined from the original text. Regarding the scientific terms of the period, the content and method of creating the terminology used by İshak Efendi will be interpreted. Besides, investigating the connected such as the complex interplay of local institutions and various actors, in addition to textual analysis, allows the research to reveal the network and interconnected discussions in the early 19th century.

The second part of the thesis follows two different trajectories. Primarily, it investigates, the Hejaz Railway Project's (1900-1908) catalysing role in the development of Ottoman civil engineering in the Empire. Archival research into diplomatic documents and foreign companies sheds light on the intertwined connections with European enterprises, particularly German ones. The discussion traces construction knowledge and organization, offering a better understanding of the technical, economic, and cultural impact of Ottoman control over foreign enterprises and highlighting the multifaceted implications of infrastructure projects in the complex execution of Ottoman railway projects. Secondly, the study will delve into the factors that expedited this transformation, particularly following the completion of the Hejaz Railway Project in 1908, and its long-lasting impact on the Ottoman civil engineering community. In doing so, it will attempt to paint a broader picture while moving away from biased narratives that oversimplify non-Western cultures through precise and well-documented microstudies. A fruitful integration of the micro approach necessitates an examination of the broader institutional context. This allows for a nuanced understanding of how micro-level phenomena intersect with the larger structures and processes shaping institutional operation at the time. Accordingly, the study will navigate permanently between two scales. The selected case studies will be enhanced with autobiographical memories of distinguished engineers, which are considered complementary sources as well as private companies and state archives. Both strands of this part aim to illuminate the unique ways in which construction knowledge was produced, disseminated, and valued within the Ottoman context as a mutually beneficial knowledge exchange in the sites. By repositioning itself within broader political, economic, and cultural contexts, this study examines how the history can be seen as a dynamic knowledge movement that fosters dialogue and mutual learning.

Keywords: Civil Engineering; Ottoman Empire; İshak Efendi; Hejaz Railway Project; Scientific and Technical Knowledge.

Creating Healing Spaces: A Biophilic Framework for Designing the Physical Interior Environment of Healthcare Facilities

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Abstract: In previous centuries, hospitals placed comprehensive emphasis on holistic approaches to healthcare, encompassing not only the medical treatment of disease but also patients' psychological well-being and sense of belonging. However, the advancement of contemporary construction technologies has diminished the focus on a holistic approach. Recent modern hospitals have prioritised disease treatment over the human aspect of healing, neglecting the significance and profound influence of a healthy and aesthetically pleasing interior-built environment on patients' health, sense of well-being, and broader societal and ecologically connected factors. This has led to an increased isolation from nature and a growing sense of 'placelessness', as Orr (1999) describes. Accordingly, research recommends that it is beneficial to incorporate nature and its elements into interior spaces, also referred to as the 'biophilic approach' (Ulrich, 1983; Wilson, 1984; Kellert, 2008; Zhong, 2022; McGee, 2022). The biophilic approach was first empirically described by Heerwagen and Hase (2001) and later developed into a systematic matrix by Kellert (2008). Various initiatives have emerged to construct a biophilic matrix that aims to put the biophilic approach into practice. Nonetheless, these matrices have been unsuitable and have hampered the clarity of implementation procedures in the hospital's interior environment. This paper aims to develop a new biophilic matrix that is suitable for oncology hospital interior design, with a specific focus on the chemotherapy department. The objective is achieved by conducting a systematic literature review of published biophilic matrices between 2001 and October 2023. The findings from the systematic literature review are then analysed and evaluated using a sophisticated mixed methodological framework: 'A. What advancements have already been made to the existing matrix? B. What are the challenges when utilising the existing biophilic matrices in oncology hospitals? C. How can we adapt the existing biophilic matrices for implementation into the interior design of oncology hospitals?' The result of this research is a new matrix specifically designed for hospital interior design and applicable for implementation, especially in the chemotherapy department.

Keywords: Biophilic Design; Biophilic Matrix; Interior Design; Oncology Hospitals; Chemotherapy Department.

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The Approach of the Domestic Environment within Interior Architecture Education: Towards an Intersectional Feminist Framework of Objects, Pedagogies and Practices

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Abstract: This research aims to interrogate and redefine the dynamics of sociability, conviviality, familiarity, creativity, and imagination within domestic environments, advocating for a more intersectional gender-sensitive and inclusive design in interior architecture education. Recognizing that architecture and interiors often adhere to outdated spatial concepts influenced by the Vitruvian man in floor plans of churches for example or Le Corbusier's Modulor, there is a pressing need to establish a new paradigm rooted in an intersectional feminist approach to design. Interior architects and designers, educators and students should engage in the conversation about the role of post-contemporary design and its contribution to creating interior spaces and objects that emphasize the social, critical, and political aspect of it and certainly serve the needs of individuals in all their diversity. In light of this, this project aims to critically assess the extent to which interior architecture education, and particularly the design studios, effectively approach the concept of domesticity through an intersectional feminist lens, and how to enhance this approach. The research aims to prove that the interior architecture can activate the behavior of both users and designers towards an intersectional gender inclusive design approach taking into account the socio-political, economic, ethnic and cultural aspects of domesticity. It involves an in-depth analysis of the backgrounds of educators and students, their collaborative dynamics, active involvement in the design process, and an analysis of the power dynamics within the classroom setting having as a primary focus the Interior Architecture Department of the University of Antwerp. The research seeks to identify and analyze current pedagogies and practices in interior architecture education, with a special emphasis on the design of domestic environments. This exploration will involve examining key pedagogical aspects, both theoretically by an extensive literature study and practically, within the design studio, as these are crucial for shaping the design process and its outcomes from the perspective of intersectional feminism. The primary objectives are based on documentation of tools and methods currently employed by educators and students as well as to assess whether these tools and methods have the capacity to generate a design process and outcomes that promote inclusivity and equality. Moreover, the research aims to develop alternative tools and methods, informed by the insights gained, that are firmly rooted in an intersectional feminist framework and can be effectively applied to the design of domestic environments and to assess whether tools and methodologies rooted in intersectionality and feminism have the potential to reshape current curricula, leading to design outcomes that reevaluate the domestic space from a radical perspective. The research proposes as design outcome the creation of a comprehensive lexicon that encapsulates design definitions grounded in an intersectional feminist framework. The research methodology encompasses a comprehensive literature review divided into four parts (Domesticity in Interior Architecture, Feminist Theories and Intersectionality, Feminism and Interior Architecture, and Feminist Pedagogies in Interior Architecture and Design Practice), desk research, in-depth fieldwork, semi-structured interviews and practical applications in design studios.

Keywords: Domesticity; Education; Intersectional Feminism.

Development and Evaluation of Earth as a Sustainable Building Material for Energy Efficiency and Resilience: A Case Study in Jordan

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Abstract: In today's world, the pressing demand to uncover and advocate for sustainable building materials capable of mitigating construction's environmental footprint is more urgent than ever. Earth, as a resource, demonstrates sustainability, economic efficiency, and accessibility, making it a vital component of sustainable housing development, especially in regions with limited availability of other natural materials like wood. This study presents Jordan as a case where concrete construction significantly impacts the carbon footprint, mainly due to energy and waste. Despite the historical significance of earthen constructions, favored for the region's climate and abundant natural materials, modern practices rely on concrete and steel, overlooking the sustainable potential of such materials. The primary focus of inquiry revolves around the barriers and limitations encountered in earthen construction. To address this, case studies of earthen constructions are conducted in various regions relevant to Jordan's climate, assessing the potential impact of these methods on Jordan's specific building practices. Furthermore, stakeholder engagement includes structured interviews with key figures in the construction industry to gather perspectives, needs, and barriers to earth adoption. Lastly, a comprehensive policy analysis will scrutinize existing policies on sustainable building practices, identifying opportunities and obstacles for integrating earth practices. The study aims to develop a framework for integrating rammed earth into current construction practices by analyzing and proposing updates to sustainability policies. It advocates for a strategic shift towards environmentally friendly methods that can be applicable across various locales.

Keywords: Rammed Earth Construction; Sustainable Building Materials; Environmental Policies.

Sustainable Scenography: Applying Circular Design Principles to Temporary Exhibitions

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Abstract: There is a lot of willingness among museum professionals to implement more sustainable practices as to limit negative environmental impacts. There have been efforts to decrease energy consumption, reduce carbon emissions and reuse materials and scenographic elements, such as display cases and modular construction systems. These efforts are often experimental and initiated via a bottom-up approach by exhibition designers and production teams. Multiple sustainable initiatives to reduce and reuse materials associated with temporary exhibition scenography align with principles of the circular economy. In this research, we have examined those initiatives in Flanders (Belgium) to assess the potential for and effect of implementing the principles of circular design in temporary exhibitions. First, we analyzed the decision-making processes currently in place to plan and create exhibitions by interviewing the three most influential stakeholders involved in the process: museum staff, designers, and contractors. Second, the tenders that museums put out were analyzed to identify to what extent these tenders include criteria related to sustainability and circularity, as well as how the museums interpret these concepts. Third, the case-study of museum M Leuven (Belgium) was studied more in depth. In this case, all data relating to the production of exhibitions were archived meticulously, allowing us to map out the initiatives. Our research has shown that tenders offer an excellent communication tool to align partners' expectations and ambitions towards sustainable scenography design. The case study of museum M Leuven made clear that museums are willing to put time, money, and effort into sustainable choices and that there is a non-exhaustive list of possible initiatives to adapt and improve the sustainability of scenography. Though each case is different and has unique needs and solutions, there are general assumptions that show potential for implementation on a larger scale, including principles that facilitate a circular economy.

Keywords: Circular Economy; Sustainable Scenography; Exhibition Design.

Architectural Empowerment: Exploring the Emancipatory Power of Critical Architectural Designs

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Abstract: This paper delves into the potential emancipatory power embedded within co-created architectural designs, particularly within the framework of participatory action research. Focused on Ten Eekhoelei, a post-war neighbourhood in northeast Antwerp, the study transitions from examining co-created drawings to participatory design processes, aiming to illuminate the transformative impact of collaborative design endeavours. Drawing from Lefebvre's theory on the reciprocal relationship between society and space, the paper underscores the significance of involving communities in urban planning processes to promote social and spatial justice. Despite the advocacy for inclusivity in architectural discourse, policy initiatives often overlook underrepresented groups, and conventional architectural visualisation methods can alienate outsiders, impeding effective participation and decision-making. However, the paper highlights the concept of "counter-representation" in architectural theory, which challenges traditional modes of representation to amplify marginalised voices and critique societal norms. Critical architectural representations offer a platform for expressing political and social viewpoints, fostering alternative subjectivities, and promoting spatial justice through inclusive designs. The study employs a participatory design process in Ten Eekhoelei, a neighbourhood undergoing transition, to address issues of vacant properties and displacement. Through roundtables, meetings, and design workshops, the community's spatial practices and aspirations are explored, culminating in proposals for neighborhood-oriented alternatives to city plans. Moving forward, the paper emphasizes continued community engagement, collaboration, and capacity-building to realize the co-created vision. This entails refining design proposals based on community feedback, facilitating skill-building workshops for residents, and exploring funding opportunities for implementation. In conclusion, the paper advocates for the synergistic relationship between critical drawing, design, and practice in challenging conventional paradigms, fostering reflection, and effecting positive societal change. Through participatory approaches, architecture can transcend its traditional boundaries to empower communities and promote spatial justice.

Keywords: Architectural Drawings; Research by Design; Participatory Research; Community Empowerment; Spatial Practices.

From Splintered Salvages to Oak Antiquaire: Circular Material Suppliers on Reusing Structural Timber

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Abstract: While wood is considered a natural and renewable resource, the carbon sink idea depends on keeping the components in use for over 100 years (Ximenes et al. 2012). The average age of a building in Belgium is 58,8 years ('Average Age of Buildings – CE Monitor', n.d.). Current practise is mostly burning or landfilling reusable demolition wood. There are few examples of structural reuse of timber. However, to envision a circular economy, strategies to enhance the reuse of timber should be developed. Circular Economy (CE) research for construction proposes design for disassembly solutions, focussing on the technical aspects (Pomponi and Moncaster 2017, 9). CE also favours specific actors in the circular construction network, such as the architect, client and contractor (Osmani, Glass, and Price 2008; Olanrewaju and Ogunmakinde 2020; Piccardo and Hughes 2022; van den Berg, Voordijk, and Adriaanse 2020). This study finds that today's reuse practice of the circular material supplier, material broker or reseller and their view on factors and processes driving reused timber has been neglected (Marin and De Meulder 2021; Marin, Alaerts, and Van Acker 2020). However, the pivotal position of the circular material supplier could be central in the transition, and should therefore be incorporated in policies aiming for a circular economy.

By using a generic qualitative approach to integrate existing research on actor's perspectives on secondary materials, semi-structured interviews with 8 circular material suppliers in Belgium trading in post-consumer wood are conducted. A thematic analysis identified key aspects to investigate their strategies in response to the factors that affect the technical and economic value of reused timber. What are the barriers, drivers and strategies for implementing reuse of structural timber in the Belgian circular building economy?

The technical aspects determining the technical value are humidity, density, biological damages, mechanical damages, knots, deformations, treatments, cracks and fissures and dimensions. In order to overcome these barriers, circular material suppliers acquire in-house strength certification and technical expertise and rework the timber elements to more standard products. Circular material suppliers mention these economic aspects for timber reuse: location, bulk availability, manoeuvrability, certification, rework and cultural value. All material brokers use social employment and volunteers in order to keep the costs down. Most actors shift towards the B2B-market and sell and buy their reused timber directly from contractors. The demolition sites are situated at a maximum distance depending on the value of the acquirable goods. The Corporate Sustainability Reporting Directive (CSRD), together with a sustained government support, is declared to be the most realistic strategy to keep the circular material suppliers economically viable.

Currently, circular material suppliers are yet to define the strategies to overcome the technical and economic barriers for reuse of structural solid wood, let alone engineered wood products. In the CE frameworks for design for disassembly, these barriers should be taken into account and strategies adopted.

Keywords: Reused Timber; Circular Economy; Circular Material Supplier; Structural Timber; Salvaged; Reclaimed; Recovered Wood.

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Beaux-Arts & Crafts: tracing the roots of officially subsidised and state-run interior design education in Belgium

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Abstract: Within historiographies of interior design, the Arts and Crafts Movements occupy centre stage. Beaux-Arts traditions are either discussed in architectural terms (e.g. building facades, arcades, etc.) or in terms of interior decoration, rather than interior design. In Anne Massey's *Interior Design of the 20th Century*, the Beaux-Arts are only represented in the 'grander' type of interiors, like train stations or theatres (Massey, 1999). In contrast, in Belgium, many interior design programmes originated from the Beaux-Arts educational system and have occupied themselves with domestic interiors since their inception (De Vos, 2013). This incongruity raises two questions: Why are Beaux-Arts interiors attributed a rather marginal place within the historiography of interior design? And is this related to the position of interior design within Beaux-Arts historiography?

This research, which is part of the larger PhD project about the role of interior design education on the formation of its disciplinary identity, focuses on the precursor of the interior design programmes in Belgian Beaux-Arts Academies during the nineteenth and early twentieth centuries. It employs discourse analysis as a main research method and combines it with archival research of interior design programmes. By looking at the educational history of interior design, this research not only uncovers the roots of the discipline of interior design but also provides nuances and critiques to the existing discourse on interior design history and within interior design theory.

In contrast to the dichotomy between Beaux-Arts and Arts and Crafts perpetuated within interior design historiographies, the educational programmes of interior design are, in fact, less informed by their schools of thought (and the differences between them). Other parameters, such as location, language, and time of emergence, appear to be much more influential. At the same time, this research demonstrates that there are, at least in the case of interior design, much more commonalities between Beaux-Arts and Arts and Crafts than the available interior design historiographies report and that these historiographies are themselves influenced by either Beaux-Arts or Arts and Crafts discourse.

Keywords: Interior Design; Beaux-Arts; Arts and Crafts; Discourse Analysis; Educational Histories.