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Digital Ornaments Thesis – P4 Reflection

The following thesis is an exploration on the topic of contemporary ornamentation in architecture through the lens of *Artificial Intelligence* (AI). Being that AI is a recent technological innovation, and being implemented into many aspects of varying industries, the scope to explore it in the realm of architecture and design, was a clear fasciation and interest I wanted to pursue in this thesis.

Throughout history, ornament was an integral part of architecture, creating a sense of craft in the design. It was the key component to constructing buildings that symbolized a sense of beauty as well as expressing social values, hierarchy, and order. The historical conception of ornament was interwoven with the history of architectural style, each of which produced its own ornaments with a clear definition and set of rules for its design, production, and application. With the advancement of digital technology over the years, it developed an impact on the design and construction processes of architecture. Through such advancements, the construction and craft of ornaments has also evolved with it, affecting its presence and design in the future design of cities, while linking the contemporary ornament to the digital and fabrication processes. The following thesis is a complex topic requiring multiple disciplines of design and construction to assess whether contemporary ornament should be re-introduced to modern day architecture. Thus, it is an opportunity for this graduation project to properly assess its value within the discipline, as well as create a clear definition and set of rules for the current period of design.

Contemporary ornament lacks a clear definition, and its renewed interest emerged due to the advancement of digital design and fabrication. Its value lies in the fact that the contemporary ornament serves as a tool to a very image and digital driven society. Its potential qualities of being structural, digital, sensual, representational, and symbolic stratify ornament metaphorically and literally, making it a powerful instrument of “impression and expression”. It emerged as a concept to explicitly express the symbolic dimension of form it holds. Form is understood symbolically, and ornament is a primary means of its expression. Thus, ornaments express something other than their material existence—a dimension that people understand symbolically. It has the potential to create a bond between people and their surroundings, where it seeks to captivate the viewer with something else, an abstraction that will create an appreciation for the space. The goal is not to resurrect the ornament from the past and look back on it as it was, but instead to find a deeper abstraction of the lost craft situated in the digital era. Studying ornament in relation to AI is unavoidable based on the trajectory and acceleration AI has had within every facet of our lives. Undoubtedly, writing and drawing skills will begin to fade and AI will become an indispensable tool and invisible assistant to the design and construction process. The current thesis topic is also one that is recent and unexplored. Not enough research and design explorations have been done on it, which can initiate a wave of new processes and uses of such tools to use in the future of design.

The following paper will reflect on the conducted research and preliminary design results of the following thesis. Throughout the thesis year, my approach, methods, and methodologies have changed and shifted, adapting to the process, whilst reaching a better understanding of the topic and what the project needs, as well as what is doable within the span of a year. The choice of methods to conduct the research results required the use of historical and contemporary definitions and perspectives on ornament, AI, and digital technology. The literature and case studies have produced a good background in the historical timeline, significance, and uses of AI and ornamentation. It provided a decent understanding of the AI world, using the perspective and language of architecture, to make it understandable to those who do not study computer programming. However, the contemporary writings and examples of the relationship of architecture with AI are limited. There is not a lot of research done on the topic. AI has been explored in various industries and facets, but its use in architecture has been relatively new, especially when involved in the earlier stages of the design process. There exist very few books written on the conjoined topic and practices of AI within the industry, and the ones written contain similar information and examples of its possibilities and uses within the architecture realm. The case studies researched have shown how AI can be beneficial within architecture as a tool for visual representation and uses in robotics and fabrication processes. However, the literature and case studies also stress the difficulty of translating 2d images into 3d forms and spaces, which is how architecture is experienced and is essentially what I am trying to explore in my thesis. Because of this, it made it difficult to draw conclusions on how artificial intelligence can help contemporary ornament be reintroduced as more than just an aesthetic element, requiring to really think creatively for innovative approaches. Because of this, the conclusion reached is that although results are achievable, AI is only a starting point for the architectural design process, allowing for new, innovative, and creative design ideas, and these results still require aid from other sources and means of designing and construction.

In terms of the preliminary results of the design, by getting acquainted with AI software and combining it with the processes of other digital software used within architecture, it allowed me to find initial iterations of how AI can be integrated to explore and optimize new forms of ornaments. The design focuses on generating text-to-image visuals, which will be then inputted into a grasshopper script which will transform them into 3d forms, and architectural spaces. The current design requires a lot of post-production in other software because AI currently does not provide a seamless translation of images to form. The design is also based off dividing the image into basic sub-geometries, which creates a more pixelated image, rather than a clear translation of what the ornament is to be as if it were a 2d image. This requires strong computer processors that can handle such levels of complexity and subdivision, where most stationary computers do not. The geometry of the image must be subdivided into numerous and smaller sizes in order to get a large level of definition and accuracy for the image of the ornament to be visible and legible, otherwise it looks very ambiguous and unrecognizable compared to the starting image. The following result was reached after many trial-and-error runs. If a stronger computer was used for the process, other conclusions, with potentially better results could have been reached. The evolution of creating the ornament from text in the AI software, to grasshopper to be

experienced 3-dimensionally, to finally reaching Karamba to assess its structural potential, uses generative techniques, which provide a more flexible design process, where the result no longer has a definitive form, but rather a form based on descriptive visuals, mathematical function, and rule-based reasoning. The final forms are created with a complexity that would be impossible to create otherwise or requiring hours of work. Every component of the images produced is generated through these customized algorithms with minimal human intervention.

When approaching the following thesis topic, it was done so from an architectural perspective. The project could have been dealt with in various ways, however, being that my knowledge comes from an architectural background, the scope and design decisions were influenced by knowledge of architectural design, rather than computer programming and artificial intelligence. If my background in that domain was stronger, the approach may have verified and produced different results for the project. The final results achieved in this thesis are based off of the plan, process, and resources that I have set out for this thesis. The beauty of this project's results is that based off my findings and explorations, the script generated can be applied and transferable to any project, using any image, creating an infinite number of results and iterations. This thesis research is the beginning of the discussion and exploration of such topic and can be used to further future research.

The following thesis period has provided a development of knowledge in domains outside of architecture, as well as niches within it. It has been a learning curve in getting acquainted with the topic of AI, which is a subject I had no prior knowledge of before this thesis. I wanted to challenge myself by taking on such a topic, especially since its presence and uses have been growing in many industries, including architecture. Being unfamiliar with computer programming terminology and design processes, to then having to adapt them to an architectural brief, required me to reach towards innovation and to think freely and creatively, whilst pushing me in uncomfortable directions, where the territory of design was unfamiliar, and where architectural knowledge was not enough. These types of situations were prominent within the research phase, when deciphering how 2D generated AI images were going to be translated into 3D forms. I had to develop my own process, entering a foreign direction of design, with uncertain expectations and desired results. The approach I decided on included the creation of a grasshopper script, as it seemed the most promising from an architectural perspective. Having decided to go in that direction, it was also entering into the unknown, especially since it was uncertain if such a script could even be created, and if generated, would it be successful in executing the desired actions and results for the project. Whilst attempting to generate a solution and conclusion in this section, it taught me that that there is always more than one approach to do something, but to develop new strategies and ways of thinking requires a multitude of iterations, questioning your design, and rethinking your approaches. The number of iterations is truly never fully exhausted in design. It is a process that is continuously improved based off new information that comes to life and is limited to the knowledge, skills, and technical abilities as a designer you possess. Lastly, dealing with ornamentation in relation to places of worship, also required me to become more acquainted with the design and construction of varying religious buildings and analyze how they relate as well as differ in design, spatial distribution, and experience. Merging programming and typologies on the same site let alone the same building is not an approach taken when designing and constructing such buildings, thus the challenge at

hand was to try and adapt them to a modern and more innovative approach, that is also sensitive to the design of these spaces.

Looking ahead, the last quarter of the graduation period will continuously look at and adapt the contemporary ornament within the architectural design scope generated for my thesis. With new findings coming to light about AI on a daily basis, such information is analyzed and used to tweak the definition and use of ornamentation within this project. Its design will evolve, and its definition will be refined for its contemporary use, integrating it into the final design and the dialogue of if ornaments should again be implemented in architecture. The useful information in literature and case studies enabled the finalization of defining 'the contemporary ornament' and building up the characteristics that it must entail. With such success, this was what was focused and worked on to be translated into the grasshopper script, generating a process that emulates these characteristics. Varying aesthetics, structure, imagery, and functionality that the observer can interact with, are all conclusions and output results of the generated grasshopper script. The coming weeks will continuously define its current possibilities and drawbacks, embracing the technological and cultural improvements of the time and fallbacks and continuously question its presence, implementation, uses and future within the project and discipline. Based off such observations, it demonstrates the unlimited capacities that the script embodies, enabling the creation of whatever form of imagery to be translated into a 3d form, that is not only sculptural but also structural. In terms of acting on the drawbacks, the project had to work around the limitations of the script. The post-processing of the script requires more refinement and having to manipulate and manually adjust the output results for it to translate the ideas, explorations and theoretical assumptions about AI and ornamentation to the design project. The project falls short in the delivery aspect of being able to fully use the script to generate all the ornamentation results for the building. Such actions only theorize the possibilities and require the manual fine tuning and adjustments on the project by the architect. However, as mentioned previously, this system and process is intended for the initialization process of designing and generating ideas and visuals, thus it is inherent that the architect must still intervene to take further action and generate the aspired results.

To conclude, the developed research and design outcomes for the following thesis generate a singular approach of the potential uses of AI in architecture and specifically ornamentation. Reflecting on the current process used and outcomes developed, it evokes further reflective questions that relate to the content of the work. If given more time, or if the research were to be developed further, what new findings and conclusions would alter the outcome of the way AI could be used to design ornamentation? The topics of this thesis remain a constant conversation, as styles and design of architecture change and evolve with time. And with the advancement of technological innovations at an exponential rate, what new findings and technological capabilities, will come to light in the next few years, that will once again require to reassess the presence and design of contemporary ornamentation and architecture?