Graduation Plan

Master of Science Architecture, Urbanism & Building Sciences

Graduation Plan: All tracks

Submit your Graduation Plan to the Board of Examiners (Examencommissie-BK@tudelft.nl), Mentors and Delegate of the Board of Examiners one week before P2 at the latest.

The graduation plan consists of at least the following data/segments:

Personal information	
Name	Paulina Panus
Student number	5551390

Studio		
Name / Theme	Graduation Studio Cross Domain - City of the Future	
Main mentor	Ir. JA (Joran) Kuijper	Architecture
Second mentor	Seyran Khademi	Theory of Architecture and Digital Culture and the Co-director of AiDAPT
Argumentation of choice of the studio	I value the freedom that this studio gives in the exploration of our own fascinations within the realm of architecture. It also has an interdisciplinary approach which enables varying and unique perspectives from tutors, professionals, and students of different academic fields, which provide unique conversations, collaborations and learning approaches when it comes to our thesis topics.	

Graduation project	
Title of the graduation project	Digital Ornaments: The Crossover of Digital Technology and Contemporary Ornamentation
Goal	
Location:	New York City, United States
The posed problem,	Digital tools and fabrication technology can change the way architecture is being designed and thought about. A variety of digital tools is powering contemporary architectural design, some of which include AI, parametric modeling, digital fabrication, and robotics. Such tools enable architects to produce complex designs, creating advanced forms, new textures, optimizing functions and generating new processes of construction. These tools, however, are being under-utilized. Their focus mainly lies on the methods of

	mass production, standardization, and efficiency, as from the second industrial revolution, generating an architecture that has become un-ornamental. Contemporary ornamentation used is restricted to façade design, where the designs contain ideas like patterns and repetition. Although these sorts of designs can be successful, they lack the craft and "the sense of depth that classical ornamentation once had". Current social, cultural, and technological design mindsets and influences means that present ornamentation no longer encapsulates the significance it once had. This research questions this reality and investigates the use of contemporary computational design and fabrication techniques to understand how such tools can revitalize ornamentation and re-imagine it in today's architecture.
research questions and	Main Research Question: How can artificial intelligence (AI) and digital technology change the way we design and think about ornamentation? Sub-questions: What should contemporary ornament aim to contribute/communicate to current, as well as future architecture and audiences? What are the potentials of AI/digital technology and how will they change the fabrication process of ornaments? Why should ornaments be reintroduced into architecture, if they are deemed as time-consuming, non-functional, and purely decorative?
design assignment in which these result.	This research will explore the potential in revitalizing ornament, within the realm of artificial intelligence and digital technology. It will highlight how such technologies can be beneficial and are unforeseeably interwoven in their creation, having the potential to

	generate a multitude of outcomes. By using a process of digital software and modeling, visual scripting, algorithms, fabrication tools and robotics, these techniques will find ways to explore and optimize its new forms. The design assignment will focus on implementing the researched and newly defined 'Contemporary Ornament' into a design brief and a building scale, with its new definition and set of rules for the current time period. Being that the contemporary ornament can be applied to various typologies and design briefs, I have decided to implement my thesis research into the urban fabric of New York. This city is considered a playground for architects, where already technological advancements within architecture have reached unforeseen limits and boundaries. New York also contains different types of ornamentation from varying time periods, allowing to situate the 'Contemporary Ornament' within its collection. The design will reimagine the ornament within a religious tower, which houses varying religions found within New York. As urban land is scarce, and the attendance of religious services have declined over the years, the clustering of these spaces within a tower will free up land and provide new spaces of community and a home for the 'Contemporary Ornament'. Places of worship from various religions have always contained an abundance of ornamentation and are some of the most studied examples. I think it would be an interesting exploration to study the contrast of what the modern-day ornament would look within these typologies.

Process

Method description

The method of this thesis is subdivided into four parts, beginning with a theoretical background obtaining historical and contemporary definitions and perspectives on ornament, AI, and digital technology. The second part includes conducting case study

analysis on projects from various time periods and locations, to study their significance, craft, and type of technology used for design and fabrication. In the third section, ornamentation will be studied through the digital realm and AI, looking at the capabilities of current innovations, software, materials, as well as the progression of the digital and its effects on architecture design and production. The fourth part is the testing and realization of these design proposals, where the fabrication method and theory are tested and demonstrated in different architectural situations.

Literature
Primary sources of literature will be used to gain knowledge about the varying perspectives on ornamentation, artificial intelligence, and digital technology, as well as their definition throughout different architectural time periods. The literary research methodology provides the base for a holistic understanding of the topic due to its roots in architecture, history, and theory. The sources will give insight into the design and construction process, social and political influence, the position of the ornament and artificial intelligence in the different contexts, and the connection between architecture, technology, people, and culture. Next to the academic literature, more current and modern literature on architecture and ornament, as well as digital technologies, AI, software, scripting, design, and manufacturing texts will provide contemporary approaches for understanding the connection between architecture, ornamentation, and digital technology.

Case Studies
As the architectural ornament has been introduced in numerous buildings and locations in the world, case studies will be used to show how various cultures have adapted such elements. A contemporary example that will be explored is the Digital Grotesque II by Michael Hansmeyer and Benjamin Dillenburger. Studying such project will explore the evolution of ornamentation and its relationship with digital technology. It is the first 3D printed wall which contains unseen levels of resolution and topological complexity in architecture design, using compositional strategies based on purely geometric processes. The tools used to examine such projects will consist of studying architectural drawings, sketches, re-drawing, and re-modeling, to better understand the relationship and reasoning of ornament within the studied projects, and how the information can be extracted and adapted to redefine ornament.

Computational Design and Artificial Intelligence
Computational design will be used to understand how such tools can revitalize ornamentation and re-imagine it in contemporary architecture. Digital design has created a new way of designing in architecture. Its evolution approaches AI, parametric and generative techniques, which provide a more flexible design process, where it no longer has a definitive form, but rather a form based on mathematical function and rule-based reasoning. The architect no longer generates the form using traditional methods of pen and paper or a mouse. Instead forms are created with a complexity that would be impossible to create otherwise or requiring hours of work. Every component of the images produced are generated through these customized algorithms with minimal human intervention. The influence of such technique unveils

captivating opportunities to pursue an exploration of ornament through such mediums.

Qualitative Research & Simulation
This following method begins by taking the knowledge learned from previous steps and applying it to software to create small-scale digital explorations and tests which then translate into small-scale prototypes using manufacturing. After an evaluation and critical reflection of these algorithms and prototypes, they will be refined and iterated to create designs that reflect the information learned and concluded.

Literature and general practical preference

The following literature will be used as a framework for my thesis:

Aiello, C. (2014). *Digital & and parametric architecture: Evolo*. EVolo.

As, I., Basu, P., & Talwar, P. (2022). *Artificial Intelligence in urban planning and Design: Technologies, implementation, and impacts*. Elsevier.

Bernstein, P. (2022). *Machine learning: Architecture in the age of Artificial Intelligence*. RIBA Publishing.

Bohnacker, H., Gross, B., Laub, J., Lazzeroni, C., & Frohling, M. (2018). *Generative design: Visualize, program, and create with JavaScript in p5.js*. Princeton Architectural Press.

Campo, M. del. (2022). *Neural architecture: Design and artificial intelligence*. Applied Research and Design Publishing, an imprint of ORO Editions.

Campo, M. del, Carlson, A., & Manninger, S. (2020). Towards hallucinating machines - designing with Computational Vision. *International Journal of Architectural Computing*, *19*(1), 88–103. https://doi.org/10.1177/1478077120963366

Campo, M. del, Leach, N., Prix, W. D., Schmidbaur, K., Crespo, S., Manovich, L., Farahi, B., Menges, A., Wortmann, T., Andrasek, A., Steinfeld, K., & Spiller, N. (2022). *Machine hallucinations: Architecture and artificial intelligence*. John Wiley & Sons.

Chaillou, S. (2022). *Artificial Intelligence and Architecture: From research to practice*. Birkhäuser.

Garcia, M. (2014). *Future details of Architecture*. Wiley.

Jabi, W. (2013). *Parametric design for architecture*. Laurence King.

Kapsali, V. (2021). *Biomimetics for designers: Applying nature's processes and materials in the real world*. Thames & Hudson.

Kolarevic, B. (2005). *Architecture in the digital age: Design and Manufacturing.* Taylor & Francis.

Leach, N. (2022). *Architecture in the age of artificial intelligence: An introduction to Ai for architects*. Bloomsbury Visual Arts.

Levin, G., & Brain, T. (2021). *Code as creative medium: A handbook for computational art and design*. The MIT Press.

Loos, Adolf. (1998) *Ornament and Crime*. Penguin Books Ltd. Kindle Edition.

Moussavi, F., Kubo, M. (2007). *The Function of Ornament.* Cambridge: Actar, Harvard School of Design.

Pearson, M., & Watz, M. (2011). *Generative art: A practical guide using processing.* Manning Publications Co.

Pell, B., Hild, A., Jacob, S., & Zaera-Polo, A. (2012). *The articulate surface: Ornament and technology in Contemporary Architecture.* Birkhäuser.

Picon, A. (2013). *Ornament: The politics of architecture and subjectivity.* Wiley.

Pimlott, M. (2004). *Ornament and Picture-Making. Ornament. Decorative Traditions in Architecture.* OASE, (65), 6–25. Retrieved from https://www.oasejournal.nl/en/Issues/65/OrnamentAndPicture-Making.

Reas, C., & Fry, B. (2014). *Processing: A Programming Handbook for Visual Designers and Artists*. MIT Press.

Reas, C., & McWilliams, C. (2010). *Form+code: In design, art, and architecture.* Princeton Architecturel Press.

Retsin, G., Jimenez, M., Claypool, M., & Soler, V. (2019). *Robotic Building: Architecture in the Age of Au-tomation.* Detail Business Information GmbH, The.

Sullivan, L. H., & Weingarden, L. S. (1990). *A system of architectural ornament.* Rizzoli.

Tedeschi, A., & Wirz, F. (2014). *Aad algorithms-aided design: Parametric strategies using grasshopper*. Le Penseur.

Vitruvius. (1960). *The ten books on architecture.* (M.H. Morgan, tr.) New York: Dover Publications (Original publishing date 1914.)

Xiaoyao, L. (2020). *Ascend Ai processor architecture and programming: Principles and applications of Cann*. Elsevier.

Reflection

1. What is the relation between your graduation (project) topic, the studio topic (if applicable), your master track (A,U,BT,LA,MBE), and your master programme (MSc AUBS)?

Throughout history, ornament was 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.

2. What is the relevance of your graduation work in the larger social, professional and scientific framework.

Contemporary ornament lacks a clear definition, and its renewed interest emerged due to the advancement of digital design and fabrication. The relevance 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 its 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 to 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.