Reflection Paper

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The relationship between research and design

Within the graduation, multiple topics of research have taken place. The three main topics are:

- The urban context and the existing buildings;
- The program;
- Circularity in architecture (theoretical research paper).

The relationship between the research and the design for the first two topics is straightforward, as the research has directly influenced the design. The third topic is more generic and has influenced the design less directly.

The urban context and the existing buildings:

I did research on the urban organisation of the Marineterrein by analysing maps and visiting the site a number of times. This has resulted in a series of analytical drawings that indicate some important spatial aspects such as routing (for various means of transport); visual lines; the building stock; and qualitative public spaces. This research also revealed ways of improvement of the urban structure. This targeted a specific plot, which is currently occupied by a building that, in my view, disrupts the quality of the area. Therefore I chose this plot as my site for the project. As such, this research has had a straightforward relationship with my design, as it led directly to useful design input.

I decided that the existing building should be transformed to enhance the qualities of the area. I did additional research on this building, internally known as 'building 027', as well as the two adjacent buildings: 'building 027E' and 'building 027W'. As a starting point for the design, I have drawn out building 027 completely, based on a small amount of documentation, some historical photos and my own photos from one of my site visits. This has provided me with knowledge about the structural components of the building, as well as the building materials used. The amount of use I had for the existing building and its components and materials has evolved over the course of the project. In the end, just the structure is reused. Therefore, this relationship between research and design was less direct: first I investigated what was there and later I reviewed what was useful in my design.

The program:

As in this project I was free to choose the required program to my own liking, I had to do research on what would be a good fit. I studied municipal documents about the vision for the Marineterrein, as well as the whole city of Amsterdam. This only partially provided me with clues to what would be a useful program. The main thing I took away from this is that the program should play part in accomplishing the municipality's main ambitions for the Marineterrein: to enhance the area's unique waterfront park characteristics within the city of Amsterdam; to create an innovative hub for businesses and institutions; and to become a frontrunner in the Circular Economy (CE). In the end, this

resulted in two ideas for the program: a common facilities building for the innovative businesses and institutions on site and a venue for the 2021 Amsterdam Biennial. During the course of the project, the focus shifted from the latter to the first.

Circularity in architecture (theoretical research paper):
This topic of research was chosen because of its topicality and broad relevance in the field of architecture, as well as the municipal ambitions for the site. The theoretical research I conducted is about design strategies that aim to help architects, during the design process, to make their designs more circular. This research was based on literature and exemplary case studies, and led to a graphic framework containing various 'circular' design strategies, ordered by hierarchical level (scale) and lifecycle phase. This framework and the trajectory were presented in a research paper. Even though this research was very theoretical and non-specific to my or any design project, the framework was meant to be used as a guide in my own design project. Additionally, the knowledge about circularity and circular design gained in the research process were relevant for my own design project.

As an additional study, I made a series of 'pavilion' designs, each representing one of the main strategic directions derived in the research. This helped me to get a bit of a feel for concrete design solutions in line with these strategies. The pavilion designs provided me with a set of design solutions that I could try on my actual design project.

RESEARCH > Guidance Tool for Circular Design (Framework) > Design strategies > DESIGN

RESEARCH > Knowledge about circular design > Design solutions > DESIGN

The relationship between research and design was tricky at times. Beforehand, I expected the framework to be a leading guideline throughout the design. However, in practice, it turned out not to provide the decisive directional guidance in many design problems.

The relationship between my graduation (project) topic, the studio topic, my master track, and my master programme
The broader field of research in my graduation is the topic of the CE and circularity. These concepts are gaining traction across different industries, including the building sector. As such, the *TU Delft* has shown a particular interest in the CE, working towards a CE transition across its faculties, in collaboration with businesses.[1] This attention is also apparent in a number of projects across the campus, including the façade leasing at the EWI building.[2] The faculty of architecture in particular has had a focus on sustainable development for a while already. The master *programme MSc Architecture, Urbanism and Building Sciences* puts an emphasis on innovative sustainable design.[3] The circular trend fits nicely with this, which is evident given the amount of attention this topic receives in lectures and seminars.

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[1] https://www.ellenmacarthurfoundation.org/ce100/directory/delft-university-of-technology
[2] https://www.tudelft.nl/en/architecture-and-the-built-environment/research/research-themes/circular-built-environment/projects/
[3] https://www.tudelft.nl/onderwijs/opleidingen/masters/aubs/msc-architecture-urbanism-and-building-sciences/

Architectural Engineering (AE) – my chair within the *Architecture* master track – combines spatial, functional, social and technical developments in integrated design projects.[4] In this chair, 'make' and 'flow' are the two main approaches. The CE is a hot topic for both of these concepts, as it combines 'thinking in systems' (flow) with 'designing for disassembly' (make). For this reason, it is a popular topic within the studio.

Elaboration on research method and approach chosen, in relation to the graduation studio methodical line of inquiry, reflecting thereby upon the scientific relevance of the work
The theoretical research was conducted to answer the question: "*How can architects, non-expert to the CE, be stimulated and systematically guided towards circular design?*" Providing systematic guidance required the framing of the key principles of circularity, using a 'logical argumentation' method.[5] The research sought to give logical order to the concept of circular building design, through the development of a framework for a usable guidance tool for architects, non-expert to the CE, who wish to develop a circular building design. This was done in four steps:
- Step 1: Identification of key principles of the CE and circularity. This was done through (academic and non-academic) literature on the fundamentals of the CE and circularity and on assessment methods for circular performance;
- Step 2: Exploration of existing design and material usage strategies of the CE and circularity. This was done through (academic and non-academic) literature on design methods for the CE and circularity and through architectural and non-architectural case studies of circular design;
- Step 3: Development of a framework. This was done using the knowledge gained in the literature and case study research into a usable guidance tool for the targeted users, by combining theoretical principles with practical strategies and reference projects;
- Step 4: Conclusions were drawn and recommendations for future research were made.

In order for me to create the categorisations, my research has adopted a combined method of *logical argumentation*, supported by *case studies* and *research by design*. According to Groat and Wang, such an integrative approach has increased in popularity amongst researchers in many fields, including that of architecture. The motivation for the use of a combined research strategy is the utilisation of 'triangulation', meaning that it can provide checks against weak points in each of the individual research methods, while the benefits of the respectable research methods can complement each other. In my case, the effect of triangulation was used as a means to increase relevance and applicability through the inclusion of precedents, and to address research validity.

The 'logical argumentation' research method, I think, is quite typical for the chair of *Architectural Engineering* (AE). Often times, like in my case, this leads to a conceptual framework or set of guidelines for a particular design question. These models tend to be more 'formal/mathematical' for the *Building Technology* (BT) oriented students and more 'cultural/discursive' for *Architecture* oriented students.[6] My research was conducted in a 'cultural/discursive' approach, as the target users (architects) are typically more susceptive to this. In general, I think these kind of models have great scientific value, as they are usually quite generically applicable and contain verifiable information.

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[4] https://www.tudelft.nl/onderwijs/opleidingen/masters/aubs/msc-architecture-urbanism-and-building-sciences/master-tracks/architecture/programme/studios/architectural-engineering/
[5] Groat, L. & Wang, D. (2013), *Architectural Research Methods – Second Edition*, Wiley, New Jersey, p.379
[6] Groat, L. & Wang, D. (2013), *Architectural Research Methods – Second Edition*, Wiley, New Jersey, p.379-411

Elaboration on the relationship between the graduation project and the wider social, professional and scientific framework, touching upon the transferability of the project results

The research project is supposed to be widely applicable to building (component) design, as it is a theoretical framework of circular building design. In my graduation project I have had the chance to experience the working of the guidance tool as a user and I have found it to be helpful, but not a decisive factor in much of the decision making. This is because the guide contains a wide variety of strategic design philosophies, but lacks a proper indicator of choosing between them.

At times, it has provided me with an overview of strategic design approaches to choose from or to combine. Usually, some kind of logical thinking could help me select one or several strategies for a specific part of the design. However, as some of the strategies contradict each other, it could be hard to prioritise them.

In practice, circular design is only relevant in the context of the CE. Circular business models require specific circular design strategies, as to make them technically possible and, most importantly, economically feasible. In my research, I have not studied such business models extensively, therefore the choosing of circular strategies has been a bit of a struggle at times. I think that the model would be even more useful to architects (or students) when it was combined with a research on circular business models in the building sector.

The ethical issues and dilemmas I have encountered in doing the research, elaborating the design and potential applications of the results in practice

In my research and design project, I have not experienced any noteworthy ethical dilemmas to speak of, apart from the essence of circular development: to what extent does your building / design justify its required resources? In my design project, I started of with the intention of designing a 'circular' pavilion for the 2021 Amsterdam Biennial. However, as this event had such a short time span, I felt obliged to make sure that the resources were spent responsibly. This has resulted in a shift of focus from the pavilion to the function it would get afterwards, which in the end dominated the project.