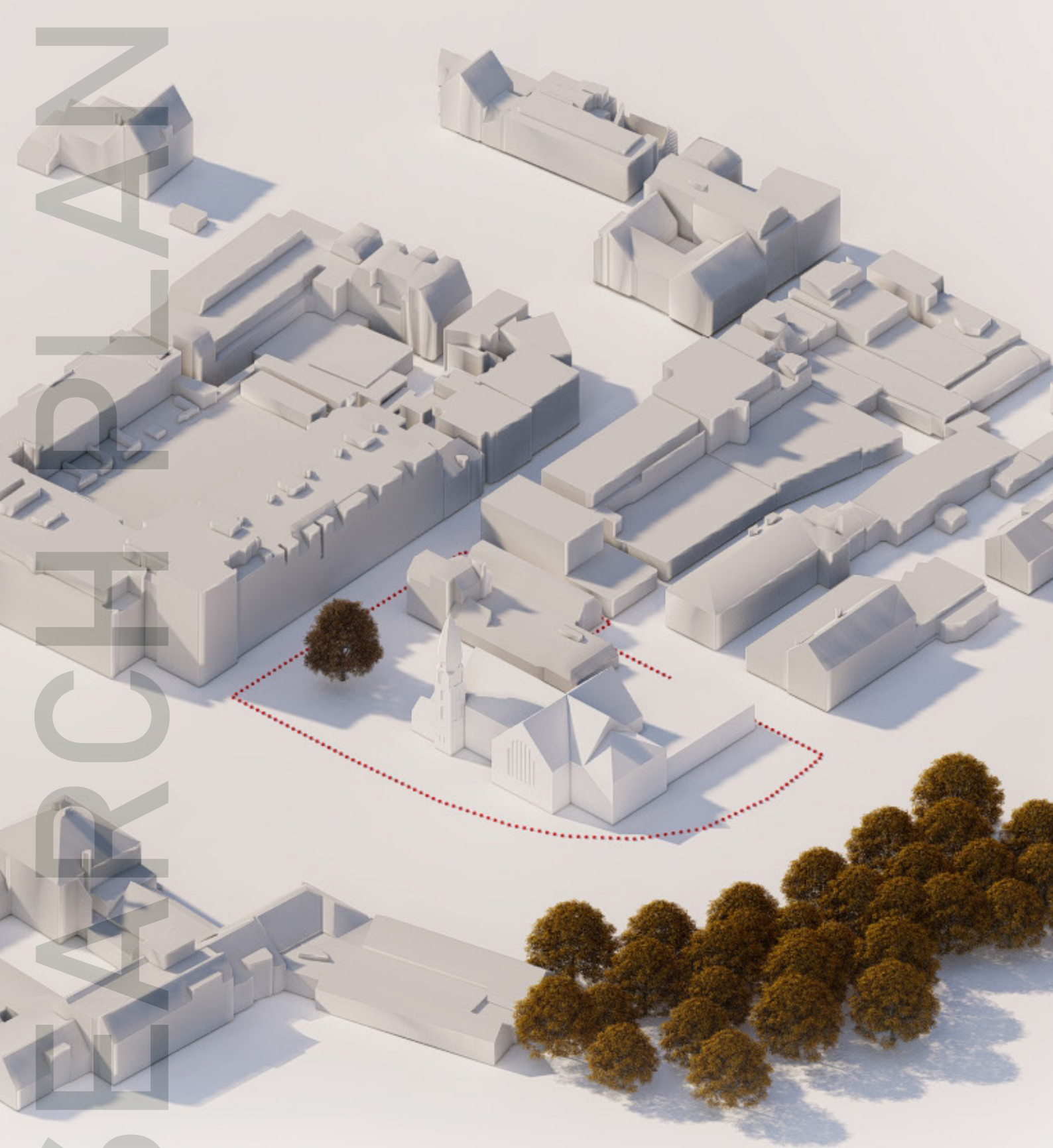




Generative design as a participatory tool in complex transformation of religious heritage

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Zero waste church
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Introduction

'It will take some arguing before something can be realized here' is what the project developer said during a visit to the vacant kruispuntkerk in Voorschoten. The look on his face gave away he would enjoy every bit of it. As a project developer he is used to slow and difficult processes especially regarding transformations, but he knows his patience will pay off.

The role of the project developer is complex. He has to deal with a lot of different stakeholders and satisfy them more or less in order to reach his own goals. Actually for every actor in a project this is truth. They all are looking at their own goals and consider their possibilities to reach them. Since the mid 1960 participatory design(PD) became a way to create solutions that were not based upon the insights of one profession but also based upon the insights of users(Luck, 2018). Participatory design considers people as 'experts of their own lives'(Kopackova & Komarkova, 2020). Luck states that since the mid 2000's a renewed interest in PD can be observed after the

2008 global economic crisis. One of the new reasons for PD being the desire for sustainable design developments. This desire was turned into goals by the UN(2015) by defining their sustainable development goals(SDG). The 17 SDGs are created to achieve social, economic and environmental sustainability. To achieve those goals it is crucial that users, communities and minorities are seen. Yigitcanlar et al states that city administrations and businesses have adopted smart city technologies in order to 'drive efficiencies and resource optimisations' (2019). These technologies are often top-down and techno centric approaches in risk of overlooking various social, civic, economic and environmental factors(Mattern, 2017). PD is able to provide in developments that are inclusive and are capable of addressing the factors that are often overseen. In the latest developments of PD Luck concludes that: 'There is a sense of ongoing mutual learning, living in the midst of change, where 'becoming' may be an apt characterisation for architectural participatory design that is always incomplete.'



Fig. 1: Kruispuntkerk, Voorschoten

Many different methods and tools exist for PD, one of the tools that can be used is generative design(GD). GD is a form of computational design. The term computational design is used when a the computing power is used as a design tool. CAD programmes for example aren't necessarily a form of computational design because their main use lies in the translation from ideas sketched on paper into a digital model. In the last 10 years the development of computational design has experienced a strong growth. GD is a form of computational design in which an algorithm generates potentially uncountable design solutions. These design solution can be filtered based upon their performance. During participatory design GD can be used as a tool to discuss not certain designs, but discuss how a design should perform. Based on these discussions multiple solutions can be selected which are in accordance with the asked performance. The main strength of GD lies in the broad scope of solutions that is investigated. Where designers often use their intuition based on their experience to come up with a couple of design solutions GD has far bigger reach because it tests all the possible design solutions within the parameters given. This immediately implies that GD is also about the design of the GD process. Or in other words if an algorithm is poorly designed it will never generate a good solution.

The ambition to identify and formulate design problems and design methodologies within an algorithm is not new(Azadi & Nourian, 2021b). An early example from 1977 is the book Pattern language by Christopher Alexander(2018) in which he describes a system in which a set of rules is applicable to various scales of architectural design. The challenge of a pattern or algorithm that tries to formalize a design problem is that it has to deal with design problems. Design problems are known as ill-defined (Dorst,2003) and wicked-problems (Rittel & Webber, 1973) meaning they deal with human/physical complexities. Azadi & Nourian(2021b) state it is not an easy task to 'devise a course of actions' that could be

guaranteed to reach a single design objective, let alone multiple ones.' The problem is even more complex when the involved actors aren't on the same page regarding the goals and priorities of a project.

In this research one more layer of complexity is added by looking at the possibilities for GD in a participatory way in the transformation of religious Heritage. Within the studio zero waste church organised by the chair of Heritage & Architecture at the TU Delft the question is raised how to deal with vacant churches, are they heritage or waste? (HA revitalising Heritage, 2022). Therefore this research will be conducted within the field of built religious heritage. The democratic element of PD is crucial for the way we treat heritage. As the Faro convention (2005)states knowledge and use of heritage is part of the human rights. Article 7b of the Faro conventions states:

The Parties undertake, through the public authorities and other competent bodies, to:
b. establish processes for conciliation to deal equitably with situations where contradictory values are placed on the same cultural heritage by different communities;

(Council of Europe, 2005)

PD is able to provide in a process of transformation in which justice is done to the certain co-ownership of heritage that exists among the different communities. This means that the GD process also needs to address these conflicting values given to religious heritage. The contradicting values is one part of the complexity, the other part is that certain values can be vague to measure. Pereira Roders (2007) defines possible values related to heritage. As an example one of the values defined in her research is the social, emotional individual value. This value relates to memories and personal life experiences, which are of course not easy to incorporate in an algorithm. To sum up the complexity for GD lies in the 'translation' of the more or less vague and sometimes contradicting values into measurable values.

As a case study the Kruispuntkerk in Voorschoten has been chosen. This protestant church was built in 1924. In 2020 the last service was held but already some years prior an intensive debate was started about the future of the church. Being a protestant church symbolism and related artefacts are scarce. The main discussions ongoing in the community (Leidsch Dagblad, 2018) and in the city council (D66, GL, SP, z.d.) are about the future function and appearance of the church. The community advocates a demolition of the church in order to make place for a new to build community centre. Due to the fact the church is listed as a municipal monument this hasn't been done already. This case seemed as a good object of research as an introduction of GD in the transformation of religious heritage. Two main reasons make this case appropriate. The first being the willingness amongst the stakeholders for transformation or at least change of the current situation. Secondly without doubt the questions related to religious heritage will be addressed due to the fact the protestant church is listed as a municipal monument. But in comparison with a national or international listed catholic church the case of Voorschoten is less complex and therefore more optimal for an introduction of GD to the transformation of religious heritage.

Problem statement

This research looks at the use of generative design as a tool for participatory design in order to come to a more economic and social sustainable development of religious heritage. The aim is to test whether generative design in complex cases of development of religious heritage is possible. This encompasses how design problems being wicked and ill-defined should be methodically addressed; how the complexity of multiple actors with contradicting views can be addressed; how through participatory design a social and economic sustainable outcome can be realized; how the values related to religious heritage can be considered within the generative design process.

Therefore the main research and sub questions are:

In what way can generative design contribute to a more participatory transformation of religious heritage?

- How can a design problem be methodically addressed within an algorithm?
- In which way can the actors and their views be incorporated in the project?
- How is the chance of a social and economic sustainable outcome maximized?
- In which way can values given to religious heritage be addressed within an algorithm?

Methodology

The case study of the Kruispuntkerk will be the main object of research. An algorithm will be designed which will act as a tool for participatory design. The algorithm will be made within grasshopper, a plugin for Rhino.

Four different direct inputs for the algorithm can be defined. First of all design principles will be formulated based upon an analysis of the Kruispuntkerk and his context. GD is about designing an algorithm therefore the input should be similar as in normal design studies in which designers also starts with an analysis. Secondly the scale of intervention should be chosen based upon the analysis and goals of the stakeholders. Taking into consideration the discussions about the Kruispuntkerk are mainly focussed on the function and building mass the most obvious scale of intervention should be an urbanistic scale. The third input are the constraints. This is where the physical constraints of the site are implemented but this is also where at least partially values of sub question 4 should be incorporated into the model. The fourth and last input into the parametric model are the goals of the stakeholders. In this phase of the design the goals of the stakeholders shouldn't be mapped in detail the main focus should be to get an overview of the different goals in order to build an algorithm that is capable of achieving these goals. After the model is finished the generating of the different solutions will start.

Through literature research a suiting way of participation will be chosen or formulated. Also taken into consideration the possibilities within the studio and the case. The research should be conducted within the remaining 7 months of the graduation and the project developer has also his wishes in relation to the approach of local actors. A simulation of the actors by students might be a solution. Based upon the chosen form of participation the generated options need to be assessed. This assessment is done also within grasshopper, on certain specifications formulated by the actors the solutions will be assessed. For this part of the process a consensus among the stakeholders is important. Through literature research but also insights given by the case study a good method has to be chosen to create this consensus. The role of GD within PD is it being a tool to give possible solutions that match the goals of the stakeholders. But it is not the main tool to create consensus among the stakeholders. It is important for the research to understand this difference.

Last but not least the outcome will be a set of solutions that fit the given criteria. This outcome needs to be assessed whether it is satisfactory. If not the algorithm should be changed in order to get an outcome which is in accordance with the criteria set by the stakeholders. If the solutions are satisfactory they act as input for

a next stage in the transformation and design of the Kruispuntkerk.

The results and experiences of this case study will provide an answer to the question whether generative design is a useful tool for the participatory development of religious heritage. And maybe will provide in a versatile tool for other churches and religious heritage.

As already mentioned the research has to be conducted within the span of 7 months. The main part of the research is going through a constant feedback loop(fig. 3) in order to design an algorithm that is capable of producing design solutions that take in consideration all the topics described. The goal is the algorithm works satisfactory around P3 in order to get input from stakeholders to create building masses with functions. When more time was given for the project a new intervention scale would be chosen and the stakeholders involved would be addressed in order to get a new PD process. Because this isn't feasible between P3 and P5 the focus will be locating those possibilities for GD and PD and whenever possible study them as smaller cases studies in order to research the possibilities. Such a study could be related to a building element for example the design of a roof.

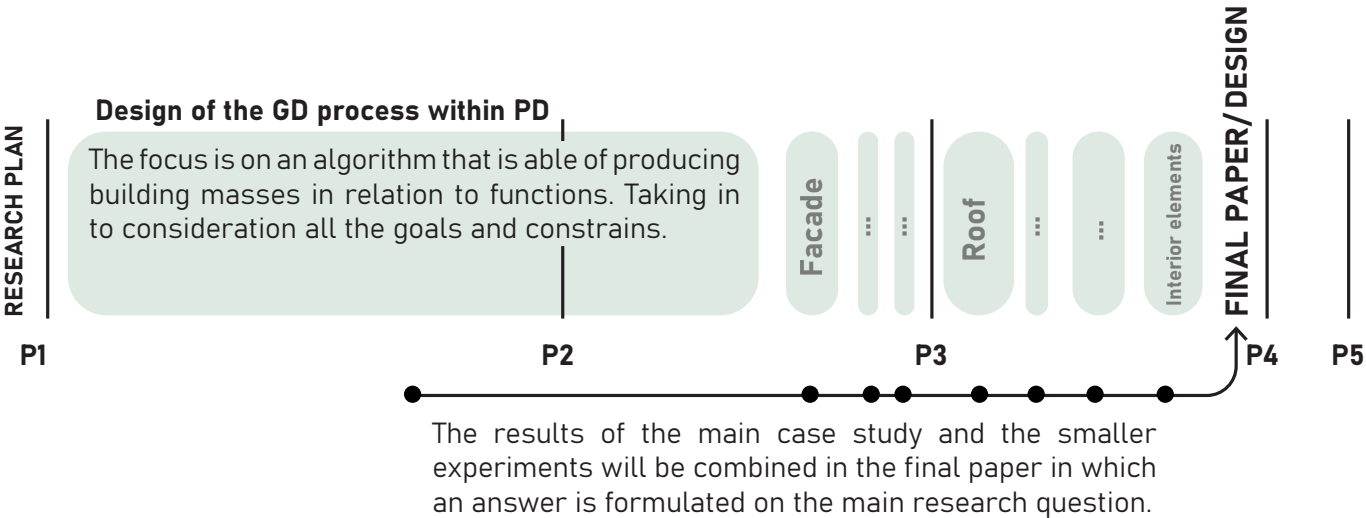


Fig. 2: Year schedule

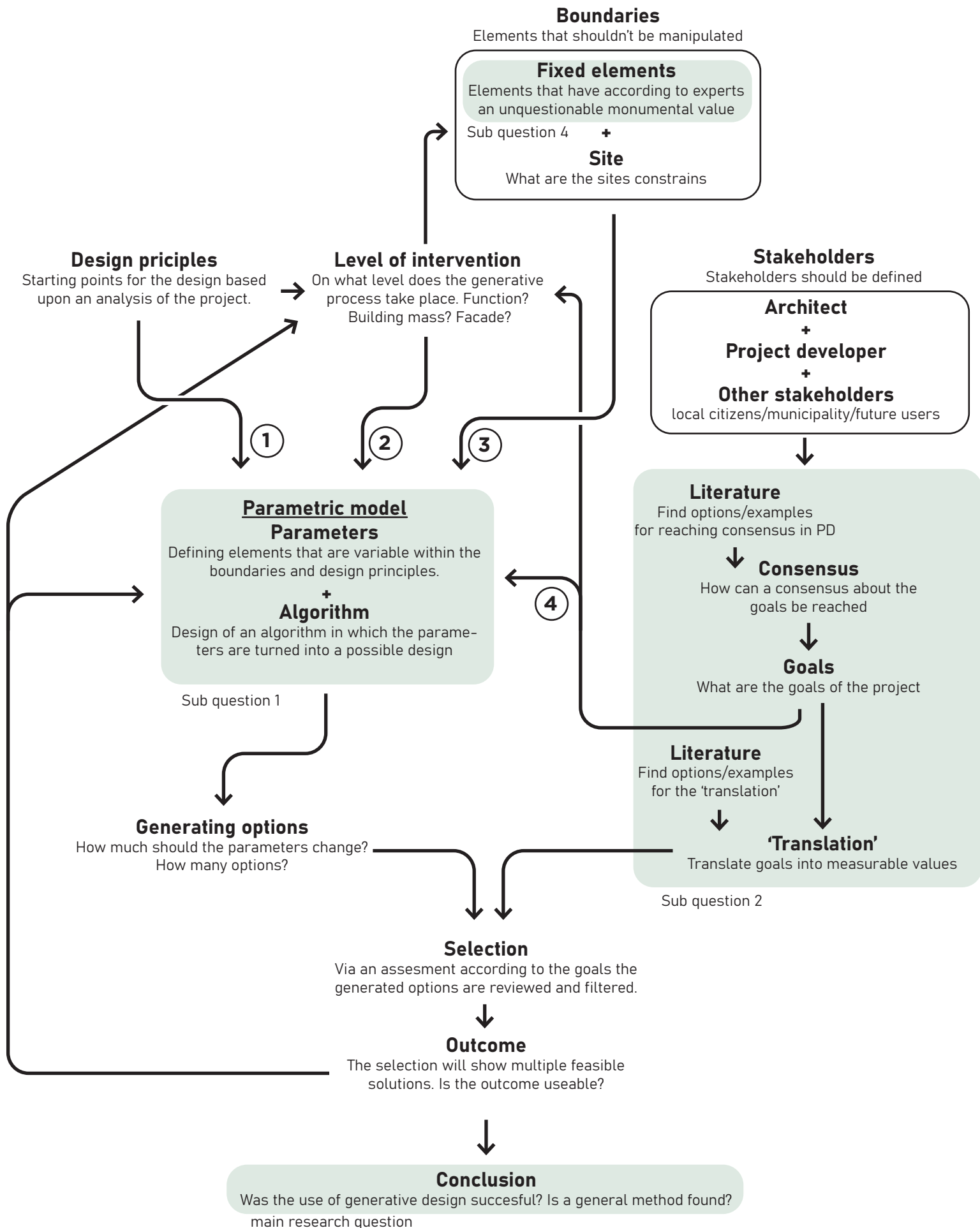


Fig. 3: Diagram research plan

Theoretical Framework

The research touches upon couple of fields, namely religious heritage, social and economic sustainability, participatory design and generative design. In order to come to a well-founded and comprehensive research the theoretical framework is based upon research from all these fields.

To address the values related to religious heritage, a combination do the work of Veldpaus(2015) Roders (2007) will be used. Roders defined and described in detail the different values related to heritage. Veldpaus addresses the attributes to which these values can be assigned, both tangible and intangible. The combination of the two makes it possible to link values to attributes. For this research this is crucial because the attributes can be manipulated in the algorithm. This is easier for tangible attributes (building mass, urban element, etc.) than intangible attributes(function, relations, etc.) but it is a way to address the values related to them.

Within the field of participatory design (PD) research is done after the sustainability of PD. In their literature review Poderi and Dittrich (2018) conclude that there are three relations between sustainability and PD: PD for Sustainability, Sustainability of PD Practice and Sustainability of PD Results. PD for Sustainability focusses on a process in which the main goal is sustainability. Sustainability of PD Practice focusses on the length and commitment of the participation and the participant in order to ensure valuable results. Sustainability of PD Results refers to the aim to obtain long lasting and durable outcomes. Because this research focusses on sustainability of the process and outcome the main interest lies in the last two.

Shervin Azadi and Pirouz Nourian came up with a generic framework for generative design(2021b). In their framework they propose an GD process divide into three procedures: Planning, configuring and shaping. Planning is the procedure in which a consensus must be reached in a certain way by the stakeholders. An example of this can be seen in the project by equicity in which they use serious gaming(Azadi & Nourian, 2021b). The participant play a 'serious'

game in which in a playful manner a consensus is reached, the outcome of the game then has real influence on the proposed solution for the design problem. There are of course more ways to reach a consensus but which fits best within the case of the Kruispuntkerk needs to be investigated.

Relevance

The research has a three-fold relevance. The main relevance lies in hopefully social and economic sustainable solutions found for the transformation of the Kruispuntkerk. The secondary relevance may lay in an addition to the existing tools within the framework formulated by Azadi and Nourian(2021). The research could provide an innovative way to support participation which then could be tested on other cases related to heritage. And last but not least the research might also provide a methodology to address the values given to religious heritage in order to smoothen the processes related to transformation of religious heritage.

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