Serious gaming as a participatory tool in complex transformation of religious heritage:

The case of the Kruispuntkerk in Voorschoten

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Abstract

This paper utilizes a modular generative design framework, as proposed by Azadi & Nourian (2021b), to create a serious game that includes a novel phase - the development phase - in addition to the three phases proposed in the original framework: planning, configuration, and shaping. The serious game incorporates both digital and physical elements and is tested through a case study involving the transformation of the Kruispunt church in Voorschoten. The game deals with the different stakeholders, their goals and relation towards the church, but also with the values related to attributes that come with religious architectural heritage. In a role game five students play the role of the participants. The reached consensus within the serious game can directly be applied on the case study but the idea is they will be also interpreted by an architect in the last phase, the shaping or as this paper proposes the implementation phase. This paper recommends future research can be done on the further development of a serious game using scoring mechanism, AI and stakeholder participation instead of roleplay.

Key words serious gaming, generative design, participatory design, religious heritage

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 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). PD 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(2019) states that city administrations and businesses have adopted smart city technologies in order to 'drive efficiencies and resource optimisations'. These technologies are often top-down and techno centric approaches in risk of overlooking varies 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.'

There are various methods and tools available for Participatory Design (PD), one of which is serious gaming. To understand the concept of serious gaming, its implications for the design process, and its benefits, we must view it in the context of Generative Design (GD). In essence, GD is a design methodology that uses algorithms, artificial intelligence, and machine learning to explore a range of design options and identify the best solution based on a given set of objectives. In GD, designers input their design goals, parameters, and constraints into a software program that generates numerous design options meeting those criteria. These options are then evaluated and refined by the designer to arrive at the final design solution. The key difference between GD and traditional design practices is the "feed-forward" characteristic of GD. In traditional design practices, the designer proposes a limited number of ideas that are evaluated, and feedback is used to refine the design. In contrast, GD uses constraints and objectives as a starting point rather than an evaluation tool, resulting in a debate about the performance of a design rather than a debate about a specific design. To take advantage of the benefits of GD while also making case studies more feasible, this paper employs serious gaming, which does not require advanced programming skills.

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.

This paper will add one more layer of complexity 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 intensives 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 serious gaming 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 and thereby serious gaming to the transformation of religious heritage.

Serious gaming for development of religious heritage

This paper looks at the use of a serious game 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 serious gaming 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 serious gaming contribute to a more participatory transformation of religious heritage?

- How can a design problem be methodically addressed within a serious game?

- 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 a serious game?

Theoretical Framework

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

Modular framework for generative design
Shervin Azadi and Pirouz Nourian come up with a modular framework for generative design(2021b). In their framework they propose an GD process divided into three phases: Planning, configuring and shaping. An example of this can be seen in the project by equicity in which they use serious gaming(Azadi & Nourian, 2021b). In the Planning phase a consensus must be reached by the stakeholders. In order to do is the participant play a digital 'serious' game. During the second phase an algorithm combines the consensus on programme, spatial qualities, etc into a configuration (figure 1).

This configuration consist of voxels, in order to provide in a discrete design proposal which is capable of encompassing the reached consensus. In the last phase the voxels are shaped towards a surface building geometry as a surface mesh.
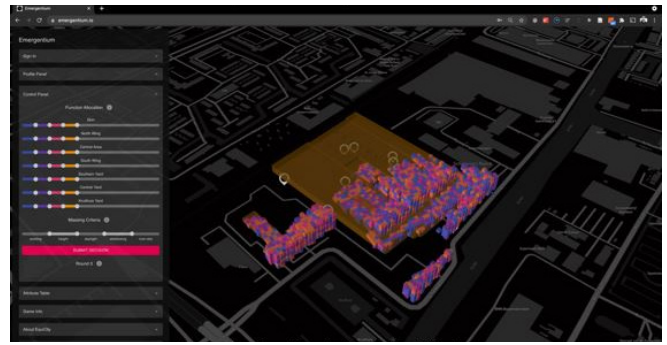*Values and attributes*

Figure 1. Configuration within Emergentium (platform used by equicity) (Emergentium, n.d.)

To address the values related to religious heritage, a combination of the work of Veldpaus(2015) Roders (2007) is 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. The serious game is capable of dealing with the values by providing a debate about the attributes. 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.

Sustainability in the context of PD
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.

Methodology of the serious game

In this paper a serious game is developed making use of a modular framework for generative design(Azadi & Nourian, 2012b). The different phases(planning, configuring and shaping) are used in order to come to a particular set up for a serious game(schema). An extra development phase has been proposed in order to ensure the methodology can be used in other cases of participatory design related to religious heritage (Figure 2).

For the development phase of the game three main object elements have to be addressed: scale of intervention(1), design principles/constraints(2) and the goals of the stakeholders(3). These three elements will change per case and are therefore
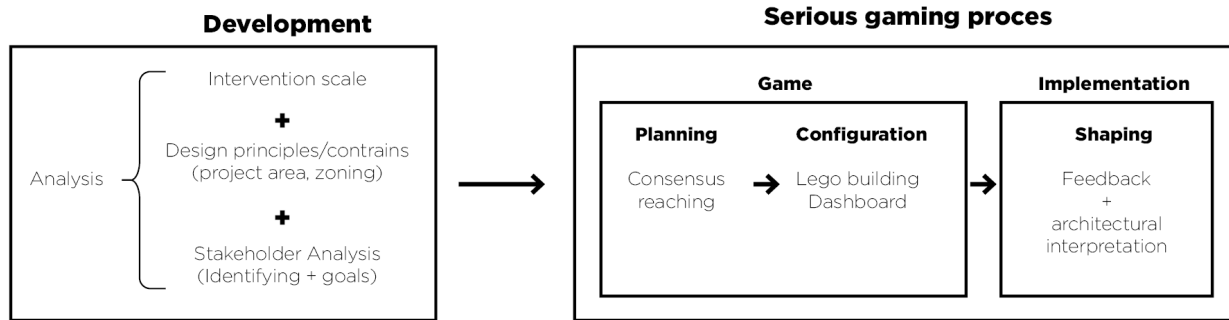
Figure 2. Schematic methodology

the main elements to define. Through a thorough analysis of the Kruispuntkerk, literature research and interviews, the needed information was gathered.

The analysis showed that the debate about the Kruispuntkerk is mainly focussed on an urban intervention. So the main topics of the debate are the new function and whether adding new extensions or buildings is appropriate and feasible. Based on this the most obvious scale of intervention should be an urbanistic scale. The outcome of the game should be able to display the reached consensus on the volume and program.

The second element was needed to give the game boundaries to provide clear design task for the game, but also to be able to implement boundaries towards the values given to church. In the game this is done for example by providing 4 zones of development. At the north-east however it wasn't wishful to build in order to preserve the value this facade has as a characteristic element of Voorschoten. Therefor no zone of development was created in front of this facade. Another example is the maximum building height in order to stay within the characteristics of Voorschoten.

The last element that was researched for the development of the game are the stakeholders and their goals. Through news articles, city council report and conversations with the project developer, neighbours, passers-by and the municipality the stakeholders were identified. Their goals were mapped using the same methods. These goals then were translated into role descriptions and goal cards for the different participants. The goals are also used as scoring criteria in the game.

Gameplay
These three elements together with the knowledge of the literature research resulted in a proposal for the game. The game consist of 2 stages which can be linked to the stages planning and configuration(Azadi & Nourian, 2021b). The game uses a physical model, a dashboard, role description and goals cards. The main principle the game is based on is that more power means more listening and less power means more speaking.

The planning phase is divided into 5 rounds in which one of the stakeholders is allowed to be in the lead of the negotiation with the other participants. The first round the stakeholder with the lowest amount of say in the design is allowed to negotiate with

Figure 3. Form for stakeholder to define the program

others about the program. A round is ended with every participant filling out their program card. On the card they can assign functions to different zones of the project. To every zone they also assign a certain amount of interest. This and also their overall power and the proposed program will be taken into account during the calculation of the weighted average. After every round the outcome of the round is shown on a dashboard which than provides useful information for the next round. Every round the participants proceed based on the outcome of the previous round (Figure 3), so only after the last round every participant has proposed his total program. After the last round the planning phase is finished and the program is determined and hopefully a consensus is reached.

During the configuration phase the participants are asked to develop the program into a design proposal (Figure 4). As a tool the participants get a Lego model of the site. The advantage of the Lego model is that it is a representation of the real world but it uses voxels(3d pixels). This focusses the debate on the program and rough volume of the proposal and prevents it from being about small details.

Different approaches could be chosen towards the interaction with the model. For this phase some 3 dimensional calculation (Figure 5) are added to the dashboard to ensure the debate would also encompass the values related to the heritage sight of the church . During the test of the game the students were completely free to design together to come to a design.
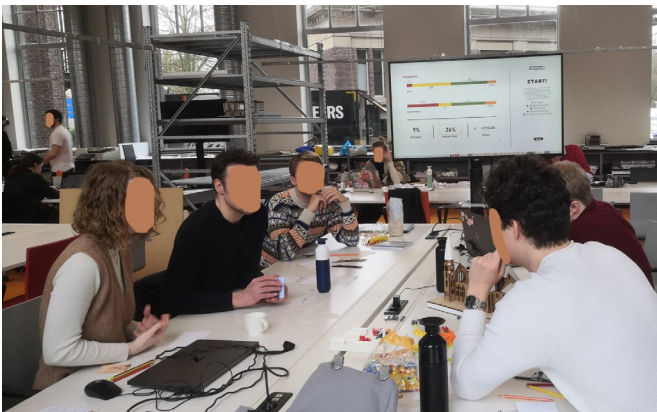

Figure 4. Serious game with participants, the lego model and the dashboard.
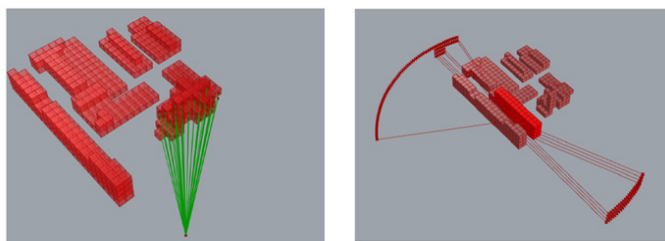

Figure 5. Calculation on how the view on the church and view of the neighbours is affected by a proposed program

After the serious game the last phase starts in this implementation phase the architect analyses the negotiation and the outcome of the game. He then can interpret this and incorporate the knowledge into his proposed design. This phase is important for the game because the outcome isn't necessarily the best solution. Due to for example a very good player in comparison to the other participants or that the given constrains are unintentionally limiting the participants to reach a better design option. In the case of the Kruispuntkerk this means that I as a student use the debate and the outcome to further develop the design.

Results of the case study
The goal of the game was to reach a consensus on a certain design proposal. The participants came up with the following proposal:
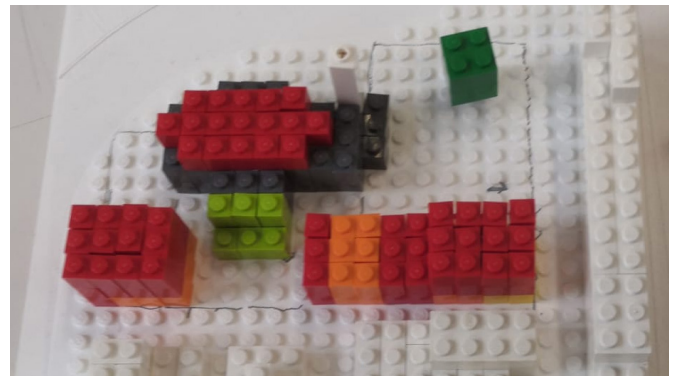

Figure 6. Lego model which ecompasses the reached consensus

Results of the serious game
The proposal provides clear conclusions and input for last phase the implementation/ shaping phase in which the design is further elaborated. Examples of these clear proposals are the preservation of the square, an additional square at the sight of the church and the amount of new housing.
It would have been very helpful to map the positions of the stakeholder towards the design proposal per round in relation to the negotiation but due to the setup of the game this was not possible. This is due to the fact that only after the last round a proposal is done for the whole program by all the participants.

Observations regarding the gameplay and the serious game.
The goal of the game is to reach a consensus amongst the stakeholders. So in a way the physical results of the game are of less importance than the state of the stakeholders. Therefor in a discussion after the game the participants were asked if they were content with the outcome of the game. All 5 participants stated that they were more or less content and that a consensus was reached. Two main reasons were that they felt that every voice

was heard and that the process was transparent. The participants clarified that the transparency and the feeling of being taken seriously was supported by a couple of elements in the game. Mainly the dashboard was referred to as providing an overview of the whole process and therefor providing transparency. It also made the game less between the participants and more between the participants as a group and the dashboard. In which the scores on the dashboard were actively used as arguments in the conversations. Secondly the negotiation debates were perceived as useful because the participant with the least amount of influence started and had 5 minutes as everybody else afterwards to plea for his own case. This gave the participant the feeling he was taken seriously and everybody could if it was possible with small changes take into account his goals for the project.

The result of the game can be defined as positive because a consensus was reached amongst the stakeholders. The consensus could be defined as a state in which the stakeholders are satisfied with a certain design solutions which they possibly would have declined at an earlier stage.

Discussion
As already stated is this paper an attempt at designing a serious game. To learn from this particular approach and to come to a better understanding of the role of serious gaming within participatory processes it is essential to evaluate and understand the limitations of the proposed methodology.

The five students who participated in the game had individual roles to play. They were provided with a role description on an A4 sheet and given a brief presentation about the situation surrounding the Kruispuntkerk. The selection of student participants was intentional, taking into account their familiarity with spatial design tasks but also the feasibility of the project. However, it is worth questioning whether their involvement in the game was justified. They clearly were all capable of playing the role of the architect but is a legitimate concern whether the role description and presentation were sufficient to immerse them in the role of another stakeholder, such as a citizen. In future research real stakeholders could be asked to together with students play the game. This would also result in a better representation of the goals of the stakeholders and their power and would make the outcome more sustainable because due to the fact that more engagement would create more the feeling of ownership and care for the design.

The game was intended to played using a scoring mechanism. It was developed but not capable of really reflecting the situation within the game. Beside the fact that a scoring mechanism makes the game more fun to play it also results is a consensus which is more justice. Because what people agree upon may not always be really what can be seen as

justice towards every participant. By knowing that one of the participants has won a round or lost a round in the next round this will be taken into consideration leading towards a .

The game was designed in a way that only after the fifth round everyone proposed their total program. If the game would be slightly modified so that after each negation round a whole program was proposed the development of the ideas would have been more clear. This added with a transcription of the negotiations would give valuable input for the implementation phase. The architect could analysis these and interpret the outcome of the game even better.

As already discussed was the game played by students. A setup of the game in which stakeholders join the game has been proposed. But even better would be if students could be left out and the game could be played by stakeholders on their own. During development of the methodology, a look has been taken into the use of AI in combination with a physical model. This could result in an app in which the proposed Lego model can be configured or scanned. The AI could than blend pictures of the building with the Lego model. Proposed new building mass could be rendered based upon preferences of the users. The AI this paper tried couldn't give sufficient results (Figure 7).

Figure 7. Test of AI generated images by DALL-E-2 based on an image and a proposed design.

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

options are the possibility to set design principles and constrains but also the possibility to define goals for the participants.

Conclusion
The paper suggests a specific approach of a participatory design proces. As a case study the Kruispuntkerk in Voorschoten is used. A serious game is proposed using 4 phases. Phase 1 is about the development of the game, considering the intervention scale, design principles/constraints and goals of the stakeholders. Phase 2, 3 and 4 are based upon a generative design framework. Phase 2 being the planning phase in which the participants reach a consensus on the program through negotiation rounds after which a weighted average is taken based on the proposed program, their interests and power. In the configuration phase the participants propose a design by building a physical model using a discrete model in this paper being a Lego model. In the last phase (shaping and implementation) the proposal and the proces of the serious game are used to further elaborate the design in detail. In the case of this paper this is done being part of a graduation studio.

The goal of the serious game was to reach a consensus amongst the stakeholders. The definition for consensus being a state in which amongst stakeholders are satisfied with a certain design solutions which they possibly would have declined at an earlier stage. This emphasizes the importance of the proces and also transparency and openness within the game, in order to reach this consensus. This is also reflected in a principle which is used in the game that more power means more listening and less power means more speaking.

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