Research Plan

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Introduction

This research plan will reflect on the process and methodology used to conduct research during my graduation at the ExploreLab studio. The graduation will focus on the topic of co-design using a virtual reality (VR) platform, called "Link", under current development by the company "Studio 202122". This platform uses a system of modular building components that can be placed, moved and adjusted in VR by all co-designers, including architects and clients. By using multiplayer technology, participants can see each other in VR and be aware of the changes or comments they are making. The goal of the research during graduation is to test and evaluate the effectiveness of the platform in a co-design workflow, whether the participants feel more empowered and involved in the design process, and whether the participants have a better understanding of architecture and architectural values by the end of the sessions.

Co-design is defined as an umbrella term for a design process focusing on participatory design, co-creation, or open design (Chisholm, 2016). In this paper, co-design will be defined as a process that goes beyond simple consultation. It allows end-users to actively participate as designers by giving both creative and value driven input. Through this method of co-design, architecture can become more inclusive and objective (Kujala, 2003). Since participants have creative control, they are likely to feel more empowered during the design phase and have a greater sense of ownership once the project has been completed (Christiansson et al., 2008). An added benefit is that more inclusive and practical architecture will lead to a higher sustainability of the building (Van Oel & Koolwijk, 2014). However, current popular co-design methods are likely to fail to properly integrate end-users in the process, especially those in the field of architecture and the built environment (Zeng, 2019). Most of the issues can be accredited to a lack of understanding of the architectural language (sketches, plans, sections) (Cruickshank, Coupe, & Hennessy, 2016), a lack of full scale prototyping (Sanders & Stappers, 2014) and a long and complex design process that requires a lot of time from participants (Christiansson et al., 2008). The "Link" platform has been designed specifically to overcome these issues, so using it might result in a better and more efficient co-design process.

This paper will first describe the framework and contents of the research during graduation. Then it will discuss the relationship between the research and the design phase of the graduation projects, which is very integrated in this case. Afterwards, the research methodology used during the experiments will be described and reflected on. Finally, this paper will reflect on the ethics and implication of this project, and the potential of further studies.

Research Framework

When reflecting on the methodology of a research project, it is important to first describe its scope. Since there isn't enough literature available to properly answer the research questions, the research will be centered around a practice based case study, using methodology common to other usability testing studies. The paper will start with a theoretical framework about co-design, studying the definition and consensus of participation and co-design, the shortcomings of common co-design processes and the possible benefits of using VR to overcome these shortcomings. Afterwards, the paper will describe the scenario, approach and methodology used to conduct the experiment and list the findings of the experiments. These findings will be summarized and discussed before concluding the research paper. A possible addendum will reflect on tensions during the design processes, specifically between architectural quality, co-design needs, and technical demands. It is important to note the shortcomings in this process however. Since this experiment is conducted within the scope of a graduation project, the entire process will be simulated with a limited number of participants. Participants will be asked to personate given personas, since the design is limited by the time available and the requirements of the graduation process. These requirements also stipulate that the research and design have to be done by the same person, preventing proper separation of interests.

Design and Research Relationship

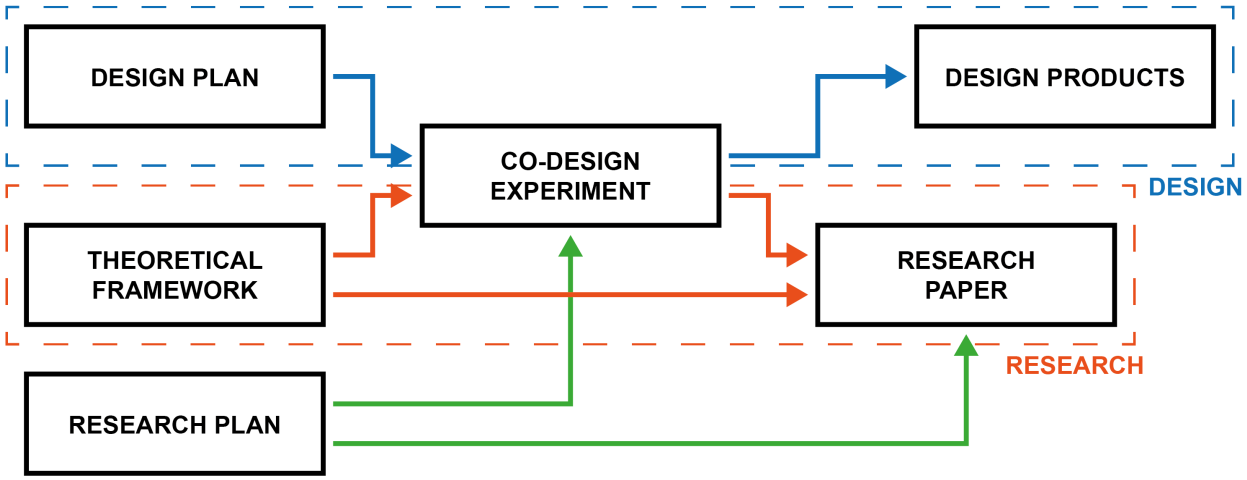

Figure 1: Relationship between design and research during the graduation process

During this graduation project, the design and research phase are fully integrated. The theoretical framework of the research will act as input for the design phase, whilst the (initial) design phase will act as the case study for the research. This relationship between design and research steps is shown in Figure 1. From the design perspective, the goal is to design multiple homes integrated into a single building. Each participant will be given a persona to represent (e.g. A family household with a single child and a moderate budget). The participants are however free to introduce their own design withes and taste. The architect will then design this building together with the participants using the "Link" platform. This process will be spread out over multiple sessions and steps:

- Session 1: A more traditional session where the architect and the participants will brainstorm together to come up with a design brief.
- After session 1, the architect will design 3 proposals for this design brief, meant to inspire a conversation with the participants.
- Session 2: The architect and participants evaluate the 3 given proposals inside of the "Link" platform. Afterwards, everyone comes up with a new design brief together.
- Session 3: Everyone works together on a new proposal for the new design brief inside of the "Link" platform.
- After session 3, the architect elaborates on the codesign proposal and adds detail to it.
- Session 4: Everyone evaluates the elaborated proposal making small adjustments and giving final input inside of the "Link" platform
- The architect finishes the design and technical requirements.
- Session 5: Final design presentation, interviews with participants and process evaluation for the research paper.

The goal of these sessions is to not only involve participants in the design process, but also train their ability to reflect on architectural values. This is why the process starts with the reflection of 3 relevant design proposals. This method has been inspired by the curriculum of first-year architecture students at the faculty of architecture at the Delft University of Technology (TU Delft, n.d.).

Research Methodology

The goal of the research is not to reflect on the quality of the design itself, but rather on the effectiveness of the platform and method used. This will be tested on participants in order to evaluate it. By definition, this research technique is called Usability Testing (Jerz, 2000). There are many different methods of applying usability testing in research, as shown in Figure 2 (HotJar, n.d.). In this scope, remote is used to describe techniques to be used after the sessions, where in person techniques need to be applied during the sessions. Moderated techniques are controlled by the researcher, where unmoderated techniques are passive. Since the researcher is also a design participant, in person research techniques will require multi-tasking and are therefore error prone compared to remote techniques.

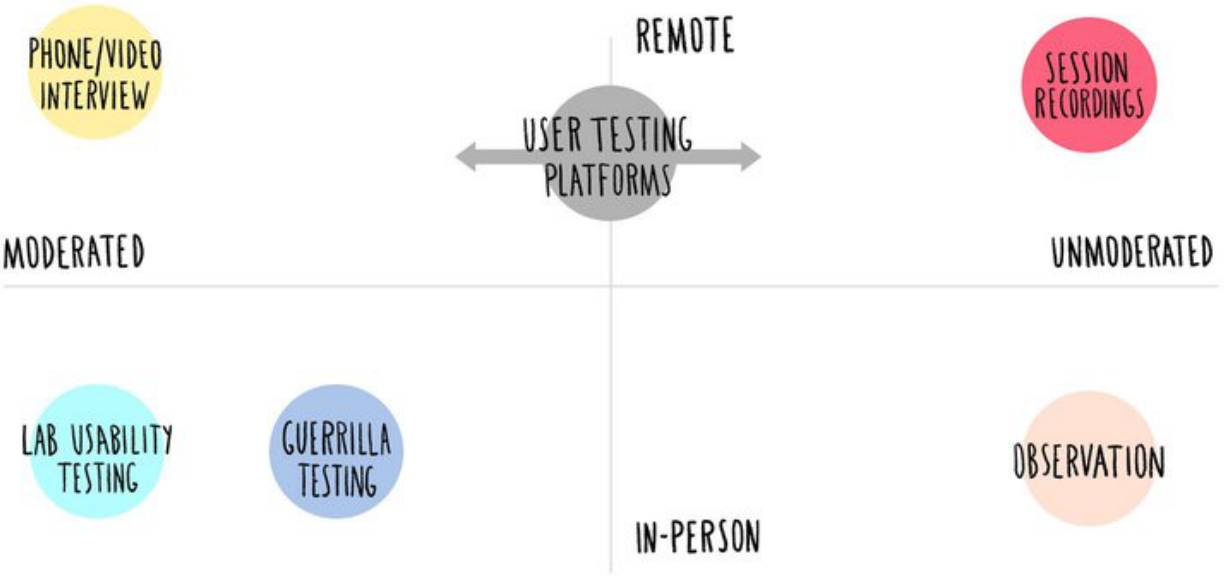

Figure 2: The different types of usability testing methods (HotJar, n.d.)

Researching the participants feeling of involvement and empowerment in the design process requires a reflection after the experiment is done. Since the participants will be asked to give their opinion, this requires moderation and therefore an interview might be the best method to obtain these results. When researching the participants understanding of architecture and architectural values however, an expert assessment is required. This understanding might be most visible in the actions performed or comments made by the participants. Moderation might influence the participant and therefore create bias in the results. Therefore observation or session recordings might prove most beneficial.

Interviews can be conducted in multiple ways, ranging from more to less controlled. A fixed questionnaire with fixed options (multiple choice survey) is the most controlled version of an interview. It allows for good structure in the responses and is easy to scale up. However these benefits are less significant with a smaller number of participants. An open conversation is the least controlled version of an interview. It has a higher chance of discovering new findings, insights or priorities, but can easily go off-topic and is hard to structure. A structured interview might prove to be the best solution for this kind of experiment. The questions and topics are structured, but the interviewer is allowed to adapt the questions to the responses of the participant.

Observations are a bit more difficult to integrate into the process, since it requires the researcher to do two things at once. Therefore, it is important to incorporate observation techniques that allow for session recording as well. One of these techniques is the think-aloud method, combined with audio recordings. With think-aloud, participants describe what they are doing and thinking aloud during the session. This forces participants to think about their actions and why they are doing things, giving insight into possible misconceptions and confusion. However, this method requires active cooperation from the participants, and might therefore be unnatural or distracting. Another method is to use the digital nature of VR to record all of the co-design sessions. Since the digital state of the "Link" platform can be recorded, the entire session can be played back and observed afterwards. This data can give insight into participants actions, movement and focus. However, this method can only replay whatever the platform is able to record. Moreover, it is very intrusive on privacy and therefore requires careful explanation to the participants. A combination of both the think-aloud method and less intrusive VR recordings might be the best solution for observing participants during this experiment.

VR has been used in combination with projects concerning participatory design before. At the Delft University of Technology, at least three of such projects have taken place since 2018 at the faculty of Architecture and the Built Environment. Reflecting on their data gathering methodology might give additional insight into the methods of collecting data. The first project studied is the "IDEAS for a Better City at Eye Level" project (TU Delft, 2019), where participants did a walkthrough of an urban design followed by a review. In this project, participant focus was tracked using VR recordings and compared to answers obtained from an open interview with an anthropologist. Another project is "UDIHIG" (ZonMw, n.d.), where participants did an iterative review of an urban intervention. A multiple choice survey was used to collect data. Both these projects had a larger number of participants (50+), and were focusing on review. In VR-Renovate (NWO, n.d.), a part of the exercise of participants was configuring a new kitchen. During the sessions, observations were made by the researcher. Afterwards, a structured interview was used to gather data about the choices made by participants and to reflect on the process. A next iteration of this project will use VR recordings techniques as a control method. These examples show a similar methodologies as the ones proposed in this paper. However, the first two projects focused on the design only, and did not include a

reflection on the proceses itself. VR-Renovate shows that a similar methodology to the one proposed in this paper can be used to do obtain the goals of this research.

Note: Even though all of these projects are still awaiting publication and therefore lack a proper reference for the methodology used, I have been actively involved in all of these projects through my job at the VR-Zone of the TU Delft.

Ethics, Implications and Potential

When reviewing this research plan from an ethical point of view, there are a couple of important notes to make. Firstly, the "Link" platform is developed by the author of this paper and the person conducting the research, resulting in a conflict of interest. Even though this does allow for a tight integration between the "Link" platform and the research, it is important to realize that this research might have to be repeated by a third party researcher to be fully objective. Furthermore, any research using participants will have an impact on their privacy. It is important to properly inform the participants about the research methodology and its impact on their privacy before starting the sessions. Due to the limited number of participants, even anonymized data might be traced back to the participant, therefore it is important to filter the results in order to prevent this.

This research does have potential however. The approach is scalable, meaning that it can be repeated with a third party researcher after graduation. If the research concludes that this approach to co-design has benefits over traditional approaches, it could attribute to a more inclusive method of doing architecture. The proven benefits of co-design, when applied in other industries, could then translate into architecture and help improve the built environment for all its users.

Conclusion

The design phase and research phase of this project are interlinked, it is therefore important to use a methodology that allows for results to be obtained and analyses after the sessions. A structured interview is the best solution for testing the participants feeling of involvement and empowerment. When testing the participants understanding of architecture, a combination of think-aloud and VR recordings can be used to collect data during the session and analyse it afterwards. It is important however that when showing the results of the experiment, the participants privacy is kept in mind. To properly test this hypothesis, another study with a third party researcher is needed to prevent conflict of interest.

Course Reflection

I thoroughly believe that when graduating on a MSc level, the student should be able to pick their own topic and mentors to assist them during graduation. This is the reason why I applied for ExploreLab and picked mentors that are knowledgeable about my topic. This does however make it harder to reflect on the involvement of the Research Plan course in preparing for my research.

I do believe in preparing research and developing a research plan. I do believe in reflecting critically on this research plan. However, I do not believe that this course improved or benefitted me in this. It is my understanding that being able to reflect on, or towards, a project is a critical part of academic education. Therefore, by the time a student is allowed to start graduation, this still should have been trained, developed and tested multiple times. I believe that this should be taught during the bachelor, or preferably even during high school, and for me I feel like this has been the case. The lectures did not teach me anything new. If the students following the course had not obtained these skills before, I feel like this course is taught too late. If the university believes a course like this should take place during the masters, I would advice integrating it with the thesis preparation course (AR1A066), since there already is a lot of overlap and students without these skills would require them while writing their history or theory thesis as well.

Another issue I found is that graduation tends to be very specific. The research that I'm doing is completely different from other students at ExploreLab or other studio's. We already have studio mentors that are well trained and knowledgeable in the topic researched by the student. Most of my advice on how to approach this research came from these mentors, since they have conducted research like this before and know the intricacies of the topic and relevant research techniques. Separating the research plan and its reflection into a different course seems therefore counterproductive, only adding complexity to an already complex graduation process.

At this point I would strongly suggest reevaluating the course and its necessity. I want to stress that this is nothing personal against any teacher involved in this course, but this course did not feel like an added benefit to me personally.

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