

Reflection P5

VRBANISM – Assessing Virtual Reality as an urban design tool

Ruben Hanssen – 4253930

July 6, 2017

1 Challenges and observations during the research process

Virtual Reality is a rapidly evolving technology. Even during the short time span of this research the technological context changed drastically. New VR plugins became available for modelling software, like Mindesk for Rhino¹ and the Marui plugin for Maya². These plugins made 3D modelling possible *in VR* rather than having to switch to a traditional 2D modelling program. Unreal Engine was upgraded as well³ and even offered a native 3D modelling option, plus features like 'smart snapping'⁴ – a function that would have saved a lot of time during the design process. The fact these solutions were only months away from application in this research is quite ironic, but frustrating as well.

The consequence of the rapidly changing technology is that my project has become outdated, even before the final presentation. The challenge of the rapidly evolving context was addressed after the research and design part was finished, since a change to the methodology during the research process would have distracted the focus on the research. It could not be ignored either, since the rapid change of this technology had important repercussions on the conclusions of this research.

Another challenge was my lack of advanced software skills – a lot of skills had to be learned from scratch, using sources on the internet and experimentation. This was both time consuming and distracting from the research process. With a more advanced set of skills, it might have been possible to use VR for a wider set of applications, like data analysis or the creation of interactive building elements. The potential extra functionality for the design system could have helped to get a better view on the full potential of VR as a design tool.

During this research process, I became gradually aware of the various constraints such as skill level and time. Additionally, I became aware of the true focus of my project, which was based on the immersive quality of Virtual Reality. This 'learning curve' resulted in the realization that the initial research questions did not match with the outcomes of the research – partly because of a focus shift, partly because of the development of the technological context. By carefully examining the actual lessons from this research, it was possible to restate the research questions which could be answered.

¹ <http://www.mindeskvr.com/site/> Accessed June 22, 2017

² <https://www.marui-plugin.com/> Accessed June 22, 2017

³ <https://docs.unrealengine.com/latest/INT/Engine/Editor/VR/GDC2017/> Accessed June 22, 2017

⁴ <https://www.unrealengine.com/en-US/blog/unreal-engine-4-16-released> Accessed June 22, 2017

2 Issues regarding answering the research questions

As said, the research questions could not be answered in their initial form. The research was focused on visual and spatial aspects of VR in a design process, while the initial research questions focused on the effectivity of VR as a tool and its functionality. These questions proved to be too ambitious for this research and were not in line with actual focus of this research. The focus shift was partially caused by the definition of the methodology, during which choices were made on which software to use and how to use this software. The choice was made to solve as much as possible within UE4 and not using newly introduced plugins, which prevented a more iterative process. This, together with my lack of advanced Unreal Engine skills and the lack of time, restricted my design approach and the knowledge resulting from the research.

As discussed before, the research questions have been restated to reflect the focus shift of this research. The similarity between the initial and restated research questions is that both are still mainly focused on the application of VR in a design process. Most of the questions have been changed, however. The number of research questions has been reduced, some questions have been integrated into new ones. The emphasis was placed on potential advantages and aspects of VR as used in a design process, mainly of visual and spatial nature. Before, the emphasis had been on VR as a tool itself with research questions that implied benchmarking. While restating the research questions, suggestions of benchmarking, like the measurement of 'effectivity', were avoided.

3 Relationship between the methodical line of approach of the Design of the Urban Fabric studio and the method chosen in this approach

In the Design of the Urban Fabric studio, a key method is the use and study of urban patterns in order to find solutions for urban problems. In this research, the design approach was focused on VR as a tool to experiment with spatial and visual aspects of urban space. Concepts such as grain size of the urban fabric, block alignment and setbacks were researched through this VR tool – concepts that are closely related to urban patterns, as I found out in chapter 4. VR could potentially be used to study, even compare, the subjective experience of various urban patterns. With new plugins and software, urban patterns could be tested in various real time simulations like traffic flow, sunlight exposure or wind.

One aspect of the methodical line of approach of Design of the Urban Fabric is the iterative character of design processes. The designer switches back and forth between analysis, literature research and design, gradually expanding knowledge and understanding of the design problem, creating and evaluating design variants using the

newly discovered insights. The analyses and evaluations of design variants done during this design process are mostly based on a broad array of urban data, like economical data, flows of traffic, zoning, social aspects and environmental data.

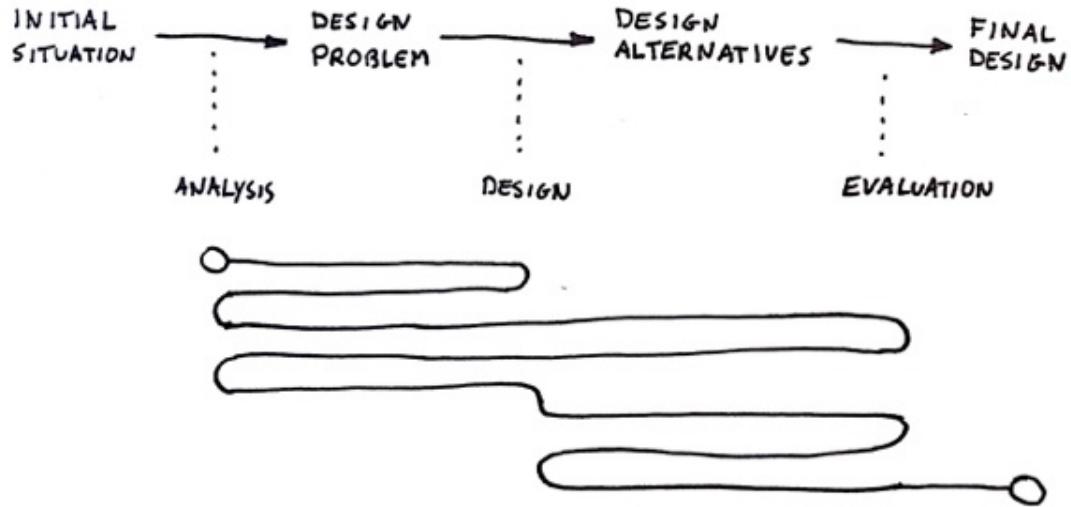


Fig. 1: Conceptual scheme of an iterative design process

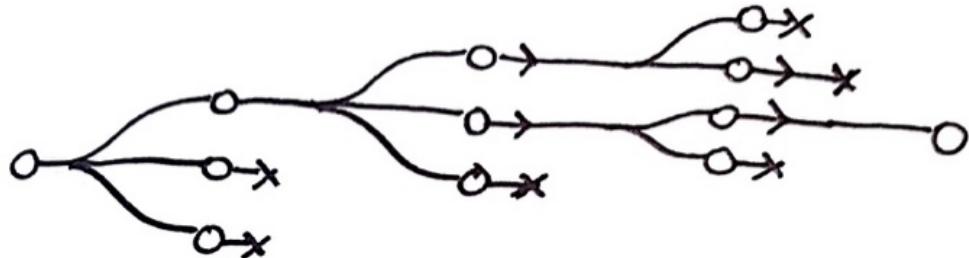


Fig. 2: Conceptual scheme showing creation and selection of design alternatives.

In this project, a set of circumstances restricted the iterative character of the design process.

An absence of 3D modelling plugins or data analysis tools, a lack of programming skill and the limitation of available time led to the rigid adherence to the predetermined methodology, using only one type of software to design and analyse (UE4). This prevented from switching between multiple programmes and possibly analytical tools, which could have made the process more iterative. Without the necessary analysis tools or the skill and time to create these tools right at the start of the project, the iterative character of the design process was limited.

4 Relationship between the project and the wider social and scientific context

Surprisingly little research has been done specifically on the use of VR in an urban design process other than as a visualization tool and a tool for public participation processes

(Kuliga et al., 2015, Nguyen et al., 2016, Portman et al., 2015). A lot of speculative theory has been written on the potential of VR in its broader sense, like by Bowman & McMahan (2007). Portman et al. (2015) emphasize the lack of research on the use of VR for architecture, environmental planning and landscape architecture, a lack that is also eminent in the case of urban planning and urban design. A short search on Google Scholar learns that most of the current research on VR is focused on medical and mental health related subjects⁵, while the potential benefits of immersion as observed in this research would make it an interesting subject for urban design research.

Apart from research focusing directly on the application of VR in urban design processes, which is nearly nonexistent, there are a number of research fields that have been important for this product. Firstly the research on defining levels of detail (Biljecki et al., 2014), secondly research on the use of 3D models (Silvestri, 2010, Yin, 2010), thirdly research on the use of VR for public participation processes (Luigi et al., 2015) and finally research on VR and depth perception (Ng et al., 2016, Peer & Ponto, 2017).

This research fills in the discussed gap in research on the practical application of VR in urban design processes. Although this research was limited to visual and spatial aspects, it is still a unique project that offers a number of important insights on this matter.

This project shows the advantages and disadvantages of a modular VR design system using a game engine, using the latest VR hardware. It has implicated the importance of detail in virtual environments for urban design, of the use of accurate scale and of the need for recognizable context in a virtual environment. It has shown the advantages of immersion related aspects like switching between various perspectives, as well as the outline of a workflow to prepare and execute an urban design process in VR. Finally, this project showed how using VR as only a tool to help with spatial and appearance based choices limits the potential of this technology. It encourages other researchers to continue using VR for urban design and to study if data analysis, zoning and simulation could be integrated into the VR design process.

This project might be an incentive, or inspiration, for future research on the use of VR in urban design processes in our faculty of the Built Environment. This could lead to VR being used more often in design education, increase awareness of this potential application and possibly lead to new design methods in practice as well.

The societal relevance of this project is linked to the possible advantages of Virtual Reality for urban design, as well as the mentioned role of VR in design education. The advantage of VR for actual urban design projects has not been proven in this research, but by offering a first step in the direction of an integrated VR design tool that uses the growing amount of available 3D data (Yin et al., 2010) for a quicker, smarter and more intuitive urban design process, this project might indirectly influence future urban environments.

Another potential aspect of VR that is important for our societal context is its ability to intuitively communicate spatial concepts to the layman, helping in public participation processes (Göttig et al., 2004, Silvestri, 2010).

⁵ https://scholar.google.nl/scholar?start=30&q=virtual+reality&hl=nl&as_sdt=0,5&as_ylo=2017
Accessed June 23, 2017

5 Relationship between 'Design of the Urban Fabric' and the theme of this graduation project

The design of the urban fabric studio, as described in the MSC3 semester book of 2016/2017, aims to understand how urban design can be strengthened as a scientific discipline, by understanding urban patterns and the development of tools for professional practice.

In this graduation project, a strong emphasis is placed on the use of a possible new design tool (Virtual Reality), related to the spatial aspects of urban design. Although the goal of this project was not focused on gaining a better understanding of urban patterns, the VR design tool *was* used to gain a better spatial insight of urban patterns resulting from the use of this tool, through the immersiveness of VR. Also, experimentation with spatial configurations of modular building blocks was one of the strengths of this tool, resulting into new kinds of urban fabric. These elements characterize the relationship between the Design of the Urban Fabric and the theme of this graduation project.

6 Relationship between research and design

In this graduation project, the research and design part were thoroughly interwoven. The main research object was the VR design process itself, instead of the design location or the design outcome. The design process was both research object and research method: in order to study VR as a design tool, it had to be tested as a design method in a design process.