VELOCITY

Reflection Report - May 2019

Fig. 1. Cover is a map of all the bicycle lanes in Amsterdam

PREFACE

This reflection report is part of my deliverables in the graduation project 'velocity' for the graduation studio Dutch housing. During this graduation process, I try to find an answer to the studios' main question namely: 'how do we want to live and what kind of buildings do we need to allow for that?' To formulate well-founded argumentation on answering this question I conducted various types of scientific research. In this report, I reflect on my approach towards research and its scientific value. Is the research scientific and objective or is it based on a subjective opinion?

CONTENT

I. Introduction

II. Scientificity

III. Research & design
       Literature research
       Precedent research
       (3D) model research & drawings
       Field research
       Research through collecting pictures
       empirical research

IV. Retrospect

I. INTRODUCTION

Since the graduation track is part of the education at the Technical University Delft, scientific research is an important aspect of the process. The usage of scientific research in the design process allows the design to become more advanced and form a solid foundation for substantiated reasoning in my design decisions. In this report, I reflect on my research methods and its scientificity.

To reflect on the relation between the different types of research and scientificity I first formulate what is scientific research and which criteria it must meet. In a publication by Theo van der Voordt Methoden en technieken van onderzoek[1], van der Voordt formulates a definition and criteria for scientific research.

The second part describes the different types of research that I used during the graduation period and reflects on these types of research with the criteria of van der Voordt. Each type of research has a different influence on the design. In this section, the relation between research and design is demonstrated by using examples. To relate the different types of research to scientific research I have chosen to write this report based on the different research methods rather than in in the chronical order of implementation

Concluding, the design process is put into retrospect of the full education process. This puts the research into a wider context and allows to answer the question who I am as an architect, or rather what kind of architect I became after studying at the TU Delft.

1. van der Voordt, T. (1998). Methoden en technieken van onderzoek. Delft: publikatiebureau Bouwkunde.

II. Scientificity

The faculty of architecture is part of the Technical University Delft and after graduating you receive the title Master of Science. In the Netherlands, the Msc title is often customary for architecture, while in other countries, such as in France, you receive the title masters of arts. This raises questions about the scientific nature of architecture.

If we, as aspiring architects want our research to be scientific, we have to look at the requirements for our work to be called scientific. To understand what scientific is and what requirements it has we first need to define it. In the publication Methoden en technieken van onderzoek by Theo van der Voordt he defines it as:

'scientific research is the methodical, verifiable, objective, valid and reliable collection, processing and analysis of data in order to better understand and explain reality and thereby make it more manageable.'[2]

In this publication, van der Voordt discusses five criteria of scientific research which are also mentioned in his definition. These criteria are:

1. efficiency and effectiveness/methodology
2. Objectivity
3. Verifiability
4. validity and reliability
5. scientific relevance [3]

The first criterium is a *methodology* which focuses on efficiency and effectiveness of the research. According to van der Voordt a characteristic of scientific research is that the researcher examines in advance how he can answer the research question efficient and

2. van der Voordt, T. (1998). Methoden en technieken van onderzoek. Delft: publikatiebureau Bouwkunde. P. 3

3. Ibid. P. 2-3

effectively. Efficient research means that you do not use more sources than necessary, while effective research means that the method must answer the research question.

The second criterium for scientific research is *objectivity*. The researcher must exclude personal views and judgements as much as possible. When another researcher performs the same research he or she should come to the same conclusions. In the research report, the actual research results and the interpretation should be separated as much as possible. This leaves open the possibility of arriving at different conclusions based on the same material.

The third criterium is *verifiability*. To be able to speak of scientific research, the research method used, the analysis of the material and the interpretation of it must be made transparent to third parties, so that it is clear how the researcher came to his conclusions.

the fourth requirement for scientific research is the *validity* and *reliability* of the measuring instruments. Validity means knowing what is meant to measure. Reliability meaning the degree to which the result of a measurement, calculation, or specification can be depended on to be accurate.

the last criterium is *scientific relevance*. Scientific research must contribute to the development and deepening of the field.

By reflecting on my research with these five criteria I aim to formulate substantiated reasoning on how my research relates to scientific research and its scientificity.

LITERATURE RESEARCH

During the literature research I noticed that writing works performative since it helps to start a thinking process. Although some might experience it as just explaining and writing down your findings I noticed that while writing it helped with new thoughts about the project. Studying books and articles and writing has been an important source of information during my graduation process. The literature studies serve different purposes within the research process. It helped to combine the different studies but during the writing phase it immediately encourages different thoughts.

In the first week, we had to write a passport where we had to motivate why we choose the graduation studio of Dutch housing. In this final sentence, I wrote: 'Within this studio, I would like to do research into the well-being of people and how this combines with the way people dwell'. This formed the starting point for my literature research. In the beginning, literature studies helped in defining a broader research topic namely the relation between the way we dwell and health. I started by scanning news articles that are related to this topic and quickly noticed the current relevance of the topic. Following I started reading literature on 'active design' to understand how to stimulate people to become physically active.
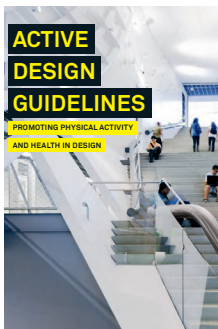

Fig. 2 literature that forms the foundation of the research

The research is based on combining research about stimulating movement and integrating the bicycle into the building. To formulate tools to encourage movement I studied Active design guidelines by the City of New York[4] and active design in buildings by BETA office.[5] For the research into the use of bicycles within the residential building, I used the studies by Steven Flemming in his book Velotopia.[6]

By linking news articles to these studies, it helped to formulate a substantiated and logical narrative. A well-founded narrative can contribute to providing convincing and well-founded argumentation for design decisions.

To reflect on the scientificity of the literature research we first need to define the applied *method*. For my research, I used literature study to formulate domains and design principles. These design principles are placed in a domain which forms a scheme. To simplify these design principles, they are translated into a diagram. This way of organizing results from the theories is a method that has been applied in earlier studies in architecture. In my position paper, I wrote about the 'grid' structure that was introduced during a CIAM-conference by Le Corbusier which served as a tool to systematically organize different approaches.[7] This grid can also be considered as a form of standardization. The toolbox forms a standardized solution for designing active and bike-friendly buildings but can be interpreted differently in a different context.

Since the toolbox is based on studies and theories of others it becomes a collection of findings in other studies. By researching these different studies, it becomes apparent to review the scientific value and *objectivity* of these studies. Another researcher should come to the same results using the same research methods. By refereeing to the sources, the study becomes reproducible which contributes to its objectivity and *verifiability*. When interpreting research data and presenting the conclusions, it is virtually impossible to completely exclude your own prejudices. Because you are always looking for a confirmation of your own hypothesis while conducting research, you will always be favoured. The research is, therefore, something that is verifiable but not completely value-free.

The *validity* and *reliability* of the sources is something that can be checked by examining the sources in the research and review the the research. To add to the validity and reliability off the research I combined two studies about the same subject. Although it should be noted that some of the conclusions in these studies are based on the same research.

By combining these research reports about active design with the book velotopia it adds a new dimension to the way I look at the active design and the design for the use of bicycles in the building. This contributes to the *scientific relevance* of the research because it gives an expanded view in the combination of active design and the use of bicycles in the building.

Reflecting on my literature research I noticed that although it stayed in the same domain my topic changed every time I read a different book or articles. This also reflects in my research report since the first chapters on relevance and history are more focused on the general relation between architecture and health and well-being. While in the end focus shifts towards the relation between architecture and cycling.

I used the literature research to position my design in relation to the findings of others. For me, it shows the relation of the study and design to a wider context and shows that it is part of it rather than stands on its own. I see the project as my interpretation and an expanded view on existing principles.

4. City of New York, Active Design Guidelines: Promoting Physical Activity and Health in Design (New York, 2010)
5. BETA, Active Design in Buildings (Amsterdam: City of Amsterdam, 2016)
6. Steven Flemming, Velotopia: The Introduction of Cyclespae in our mind and our Cities (Rotterdam: NAI10 publishers, 2017
7. Tom Avermaete. 'CIAM, Team X, and the rediscovery of African settlements: between Dogon and Bidonville.' Lejeune Jean-François and Sabatino, M. Modern architecture and the Mediterranean: vernacular dialogues and contested identities. (London: Routledge, 2010)
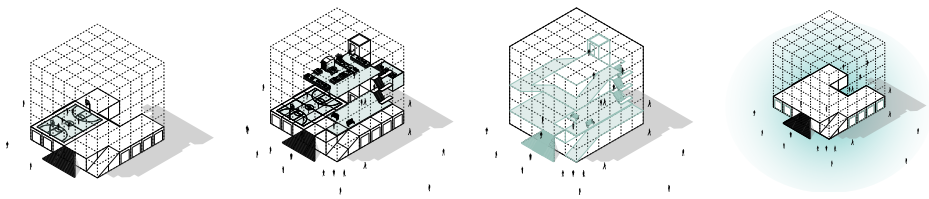
Fig. 3 diagrams of tools for active design

PRECEDENT RESEARCH

I used precedent research as a method to test my results from the literature research. During this process, I used the *method* of reduction drawings. By making a reduction drawing about the five domains of the literature research, it can expose an interpretation of these domains.

By making reduction drawings you highlight one element or principle in the design. This can be considered an *objective* way of researching since you highlight something that is physically there. Although you could argue the objectivity of the reduction drawing considering the one making the drawing is selecting what elements are part of the topic you want to highlight and how to highlight it.

The method of reduction drawings is always *verifiable* but can never be completely value-free since you can't exclude your own prejudices. You could argue if it is possible et al to create something of complete value freedom.

Since a reduction drawing is about highlighting something that is physically there I consider it to be a *valid* and *reliable* instrument. The researcher knows what is meant to be measured and can expose this element in the building.

Finally, if we look at the scientific relevance of the reduction drawing, the added value to *scientific knowledge* can be considered low. Since it is about something that is already there it doesn't add anything directly. However, if you combine the precedent research with literature research, the drawings can contribute to strengthening the conclusions from the literature.

Overall, the precedent research had a significant influence on the design. I consider precedent research to be a scientific way of researching. It can strengthen your theories from the literature research or verify an existing approach.

For example, I studied the clustering and stacking of different dwelling types combined with the bicycle ramp at 8-house. These design principles are clearly visible in my design but with different dwelling types and in a different form. Another example is the way MVRDV accentuate with colour and position their access system in the mirador design. I applied the same principles as the case studies but applied them in a different context.
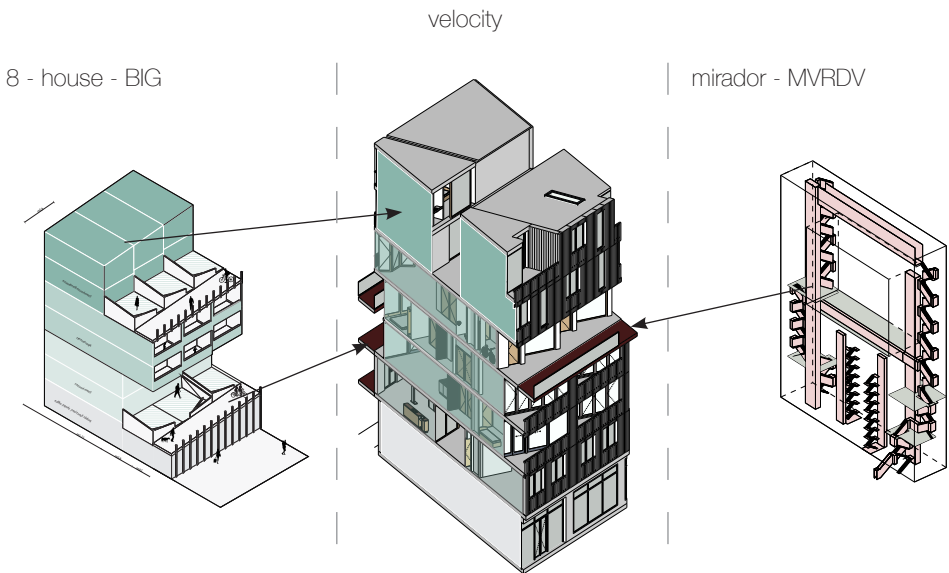
velocity

8 - house - BIG

mirador - MVRDV

Fig. 4 relation between design and precedent studies

(3D) MODEL RESEARCH & DRAWINGS

While writing about model making and drawings I noticed that both methods have many similarities. when a model is used for research, we often speak about a sketch model. With both methods, there is a quick and precise version with different means to an end. In this topic, I elaborate on the different methods and the relation with a 3D model.

I started using a new 3D model program since this program allows me to make 3D and 2D drawings with the same model. The program of Archicad is commonly used by professional architecture firms. During my process, I used physical and 3D models as a tool to research aspects such as the spatial experience, morphology and the relation to the urban context.

For example, I used a 1:50 physical model to research the ratio in the façade and the possible expressions I want my building to have. During this research, there is a strong relationship between the physical and digital model. Where I mainly used the digital version to research different experiences with the material, I used the physical model to test the relation between, size, cladding, windows and tectonics.

On the scale of 1:1000 and 1:500 the relation between physical and digital models worked the other way around. I used the scale of 1:1000 to quickly test different morphologies and relations between the urban context. When I was satisfied with the physical form I changed the 3D model which gives a different perspective (since it also gives you the perspective from within the model) than the physical model. This collaboration between digital model, physical model and sketching works as a way to quickly and roughly test some ideas and afterwards test these ideas in a more accurate drawing or model. I like the speed and creativity of a rough model or drawing and the exactness of the digital drawings.

Fig. 5 comparing different facades

Fig. 6 sketch of the expression of the bicycle lane

I used different *methods* during this study since each study has a different purpose. For each study, the most effective and efficient method is considered and applied.

Sketching (models) are often a representation of what the designer envisions for the design which results in a subjective representation. When working with a 3D or presentation model it becomes an *objective* representation of the design since it accurately represents the building.

Research models and sketches can be a *verifiable* method since the process of making is transparent to third parties but every model or sketch will have a personal touch. When other researchers would reproduce the model or sketch the result will always be slightly different and therefore can be interpreted differently. This may result in different conclusions. Since the researcher knows what is meant to be measured and can expose this element in the building it is a personal subjective view which can make it unreliable. This is different for a technical drawing or floorplan. These drawings are an exact representation of what is envisioned for the design.

The models and sketches are my interpretation of what the design can look like which make it subjective. Although the methods are reproducible they are not *verifiable* since the models and sketches are based on interpretation and what I, as a designer want to highlight or expose. However, they can contribute as a communication method and help to formulate and communicate well-founded reasoning. It helps to quickly test different scenarios and to make considered comparisons.

The presentation model and digital drawings are more objective and accurate which makes them more reliable and verifiable. I consider these methods to have higher scientific value and to be scientificly relevant.

FIELD RESEARCH

During my graduation period, field trips were a tool to see how architectural approaches and solutions can be applied and how certain spatial experiences are designed. It provides a very different perspective compared to text, drawings and models.

During this period, I made three field trips with each a different purpose. The first trip was to the 'havenstad' in Hamburg which gave an insight into the development of the harbour district and their different urban and architectural approaches. It was an inspiring excursing which shows how the relationship between the buildings and the water can work and what spatial experiences this yields. During this field trip, we walked with a guide through different neighbourhoods in Hamburg which shows the different approaches over time and how a neighbourhood can develop top down or bottom up. It helped to experience different approaches to architecture and urbanism.

After the P2 presentation, we started with the building technology tutoring. During this period the tutor suggested field trips to see how other architects approach elements such as (bike) parking and installations in buildings. This gave the opportunity to look at more practical solutions and approaches.

During the phase between P3 and P4, I started to finalize my design and knew which direction it was going. To see how others approached the same design problems that I was encountering I planned a field trip to Amsterdam and Utrecht. During this trip, I started at an exhibition about the relation between Amsterdam and the bicycle. This exhibition gave me information that forms a link that I missed during my literature research between the history of health and architecture with the popularity of the bicycle. After visiting this exhibition, I cycled through Amsterdam and to the project location to understand how the current situation is related to cycling. During this trip, I planned a route so that I would cycle through the new developing districts in Amsterdam houthavens and Funen. While visiting these districts I

noticed that during the graduation period I developed another way of looking at architecture and especially to dwellings. The dimensions of spaces and different facades seemed more logical and related to different interpretations of architecture and urbanism.

After my bicycle trip through Amsterdam, I went to Utrecht where the biggest bicycle parking has just been completed. Since I am integrating a bicycle path into the building this multi-story bicycle parking gives a feeling about the different dimensions of the bicycle paths, storage and the radius for a turn. I used this trip to test if the dimensions I got from literature and empirical research are realistic.

The *method* of the field research has certain effectiveness to it since it is a way to research how others solved similar problems and experience it on a 1:1 scale. It provides the researcher with different perspectives than literature, models or diagrams. The way the field research is documented has an impact on the *objectivity* of the research method. When documenting what is physically there it is an objective method. When you document or sketch your interpretation it becomes a subjective method.

The way of documenting has an effect on *verifiability* and *reliability*. For example, I documented the width and radius of the bicycle parking garage in Utrecht which reflects directly in my design. These dimensions can be verified which makes it reliable.

Fig. 7 Field trip to utrechts bicycle parking garage

RESEARCH THROUGH COLLECTING PICTURES

During my process of designing and writing, I collected pictures for inspiration and references. I used the website Pinterest to make pin-up boards of different themes in my project. I made boars of:

- Graduation studio inspiration
- Cycling
- Wooden Facades
- Diagrams
- Models

Wooden facade
🔒 13 pins

Graduation inspiratie
🔒 34 pins

fietsen
🔒 12 pins

Fig. 8 different pinterest boards

Pinterest runs on software that links images that have a common theme. It works like an AI (artificial intelligence). It learns from the pictures you collect and gives you options of related or similar pictures. Pinterest helps to show different or related approaches to a similar problem.

When I am too focused on one aspect of the design and get stuck I scroll through the collected pictures and look for references on how others approach the same problems. It provides different perspectives and inspiration on a different approach towards to problem. Pinterest can also be resourceful for a different way of presenting your information with diagrams or models.

The *method* of letting AI define references can be effective but is completely dependent on the software. You, as a researcher, have minimum influence sins you only define the reference picture and the software selects alternatives. This makes the researcher dependent on the input and the software.

Since the software is about collecting pictures it can be considered an *objective*. Although the software selects the reference material it shows pictures which are a representation of the reality.

It may be an objective method but it is not *reliable* and *verifiable*. Since the software learns from what the researcher is searching it adapts to each individual. This means that every researcher gets different results.

The method of collecting pictures through an AI isn't *scientificly relevant* but can be very influential for your design. It helps by selecting different perspectives which can be applied in other, more scientific, research methods.
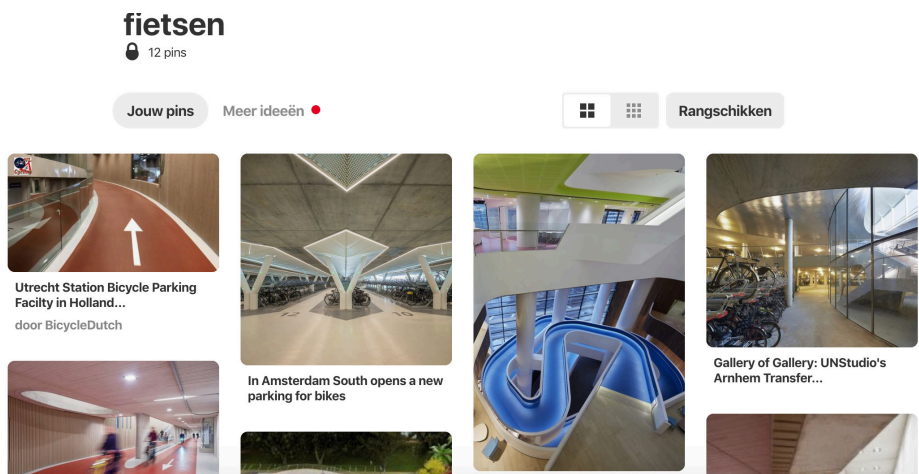

Fig. 9 Letting AI suggest references

IMPERICAL RESEARCH

Most of the dimensions on cycling in relation to architecture came from scientific research on bicycle lanes in the Netherlands. For my building, I need to implement (sharp) turns for (cargo) bikes. For these dimensions, I used empirical research to come up with a minimum radius. To make sure that the figures are correct is used three different bikes driven by two different people and took the average of all the results. I consider this method to be scientific since it is measurable and reproducible. By making sure other bikes and people come up with a similar result it is not only based on one result but a combination of multiple tests.

Empirical research can be an effective *method* to test and experiment with scenarios. Since it creates a physical environment that is envisioned in the design it provides different perspectives and creates new possibilities. For example, the testing of the radius of a U-turn tells you something about the experience of that scenario. In my case, I helped me to conclude that the radius of a bicycle turn should have a minimum dimension of 4m.

To come to an *objective* conclusion, I used different material and let others do the same experiment. Now, it became a mixture of perspectives resulting in a well-founded conclusion. Since the experiment is documented and the material is something that is accessible by other researchers the experiment becomes reproducible making it verifiable.

During the empirical research, the hypothesis and the measurement instruments were clearly defined. This creates a *reliable* experiment.

The empirical research was done since the literature studies did not define a clear answer to the question I don't consider the empirical research to be *scientifically relevant*. It adds to the knowledge of the research but I consider the knowledge to be of low scientific value.
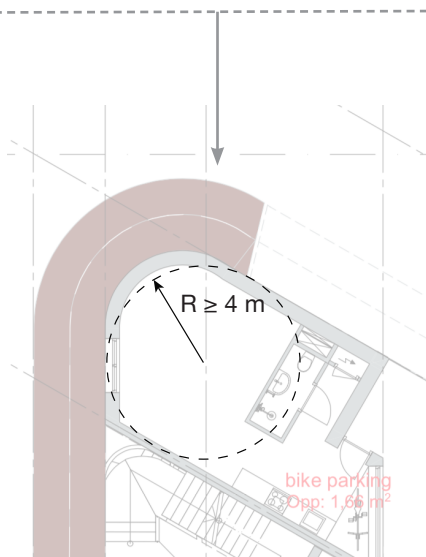
R ≥ 4 m

bike parking
Opp: 1,6 m²

Fig. 10 Testing the radius of a U-turn on a bicycle

IV. RETROSPECT

the relationship between research and design
This report forms a broad description of the relation between different research methods and design. In general, I applied different research methods to help advance my work. I learned that there is not one solution for every design problem, but it is about the combination of these different methods. The way I do research, asked questions and what methods I have used are very different. Every method influenced my design but each in its own way. Reflecting on the relation of research and design I can not see these to aspects separate from each other. For me, designing is doing research and the design is a combination of all the conclusions made during the research and design period. The research helps to formulate substantiate design decisions and can create a convincing and complete narrative about the design approach.

the relationship between the graduation topic and the studio topic, the master track Architecture and the MSc AUBS programme
My graduation topic is a combination of the studio and my personal approach. The main studio question about the way we want to live and what kind of buildings we need to allow for that, motivated me to look at the way we want to live in cities in the future. When you design a dwelling you design the living environment which strongly relates to the view of the chair of Dwelling where a dwelling is never seen as an individual but rather as a part of a building, cluster, neighbourhood or city fabric. For my topic, I choose something that is innovative and that can be seen as a challenge for our cities in the future. Graduating on a topic with a possible solution for mobility, health and sustainability relate to this faculty and the TU Delft, since they are always searching for innovative ideas.

the research method and approach chosen in relation to the studio methodical line of inquiry, reflecting hereby upon the scientific relevance of the work,

The studio has a clear line of inquiry which makes the program very structured. For every presentation, there is a clear list of inquiries that the student needs to meet. It still leaves freedom in choosing a topic and bring your own ideas. For me, this system with a clear structure and deadlines helped me to finish my work in time. Since we were the first group to do this project I feel like some of the time could be better distributed. This also had some advantages since it gives you more freedom and you are not influenced by previous research. For some of the deliverables, it is clear which method is the most efficient. Each method has its own scientific relevance which is elaborately discussed in the reflection report.

the relationship between the graduation project and the wider social, professional and scientific framework and the transferability of project results

I see the project as something that is an interpretation of the research I studied and combined. The toolbox that came from the research is part of a wider context and does not stand on its own. It is clearly visible that the literature and precedent studies have had a big influence on the design. It is part of a wider framework but it is unique in its combination because in every context the tools can be applied differently. Since the project will be part of the repository others can learn and expand from the gained knowledge and design principles.

on the ethical issues and dilemma's encountered in doing the research, elaborating the design and potential applications of the results in practice,

I can see the potential application of the research in practice. The design shows that something which first seems experimental and daring can actually be realistic and have great added value. The architecture may seem provocative but is already applied in other scenarios such as BIG's 8-house. I see a clear potential application in the future to create healthier cities.