EMERGING NEIGHBOURHOODS
OR WHY PIECE-BY-PIECE URBANISM LEADS TO FLEXIBLE AND DIVERSE CITY DEVELOPMENT
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Master Thesis Report
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Preface

This is the final report for my thesis project as part of the Urbanism Master of Science program at the faculty of Architecture at the Technical University of Delft.

My thesis deals with the development of more flexible piece-by-piece constructed neighbourhoods as city extensions. Due to the problems developed by a substantial amount of post-war comprehensively developed areas, a new way of city development is needed. This thesis explores the current problems of post-war neighbourhoods and puts them in a new perspective using input from complexity theories. Furthermore, a first step in the development of a new process to create more fundamentally flexible neighbourhoods has been made and illustrated with a case design.

This thesis focusses most of its attention on the city of Utrecht in the Netherlands. It has been used to study the current problems of the post-war neighbourhoods and has served as the location for the final case design.

This thesis project has been realised with the aid of my three mentors:

Roberto Rocco, chair of Spatial Planning and Strategy, TU Delft (main mentor)

Egbert Stolk, chair of Environmental Planning and Ecology, TU Delft

Juval Portugali, department of Geography and the Human Environment, Tel Aviv University

I would like to thank them for their always useful insights and support throughout my project.

Thijs Jansen

Delft, 6 November 2009
Introduction

This chapter will introduce the thesis problem statement, aim and research questions. In the methodology section, we will elaborate on how the research has been conducted and what methods have been used to answer each research question.

1.1 Problem statement

In the last decades, urban planning has been mostly characterized by top down planning processes (Pinilla, 2008). In Western Europe, neighbourhoods have often been developed on a large scale and according to a comprehensive urban vision (Portugali, 1999). In the Netherlands, the post-war modernistic developments and the current VINEX\textsuperscript{1} program are clear examples of this approach (NICIS, 2008). In Utrecht, the 4\textsuperscript{th} largest city of the country with approximately 300.000 inhabitants, around 35\% of the population lives in comprehensively planned large scale post-war areas. (Municipality of Utrecht, 2008) This means that a considerable part of the urban population in the Netherlands is now living in this type of neighbourhood.

However, evidence suggests that in the last twenty years a lot of post-war modernistic neighbourhoods have slide down to become the least attractive areas in today’s cities. (NICIS, 2008). The ‘krachtwijken\textsuperscript{2}’ program, targeted at the ‘worst’ neighbourhoods of the country, contains 37,5 \% comprehensively planned mod-

\textsuperscript{1} Vierde Nota Extra. A national policy document to develop approximately 650.000 new houses around existing cities. VROM, 1993.

\textsuperscript{2} The ‘krachtwijken’ program is developed by the department of VROM in 2007 to allocate funds for the 40 ‘worst’ neighbourhoods in the Netherlands. There are 18 indicators spread over 4 themes: economical arrears, housing arrears, social problems and physical problems (VROM, 2009).
ernistic post-war neighbourhoods, which is substantial for a 20-year period in building history.

Even though a lot of research has been conducted into the problems of the post-war modernistic neighbour- 
hoods (NICIS, 2008) and various government programs (e.g. the ‘krachtwijken’ program) and munici-
pal redevelopment projects have tried to tackle the decline, these neighbourhoods remain at the bottom  
of the scale (Municipality of Utrecht, 2008). There is even research that doubts the effectiveness of the past  
restructuring efforts (Bergeijk, 2008).

Therefore, this thesis puts forward a new hypothesis: that the particular vision behind the large scale post-
war modernistic neighbourhoods makes them (spatially) coherent, but in the context of the problems of  
decline and lack of vitality, it also makes them spatially inflexible and impervious to change. They cannot  
easily adapt to societal changes, which were not foreseen at the time of their design. Since they were  
often developed on a large scale, the problems that manifest themselves today in these neighbourhoods  
usually have a large scale as well. This poses problems for cities as a whole since spatially concentrated  
problems can lead to unwanted segregation and deterioration.

1.2 Aims of this research

The main aim of this thesis is threefold:

1. The first goal is to critically study the decline of the large-scale post-war modernistic neighbourhoods of the Netherlands as described in the problem statement above. What are the problems these neighbourhoods are facing nowadays? Why are older neighbourhoods not affected by the same problems? What are the intrinsic differences between the large-scale post-war neighbourhoods and older neighbourhoods that could cause this divergence? Our goal in this part is to gain insight into the relation between the ways neighbourhoods were developed (post-war modern rational comprehensive planning (Portugali, 1999) versus more traditional piece-by-piece development) and the problems they exhibit today. This, of course, in the light of the hypothesis of inflexible neighbourhoods described in the problem statement. This is specifically not a research into the advantages and disadvantages of particular movements in urbanism or an attempt to criticize the post-war modernist extensions of cities especially.
2. The second objective of this work is to research the potential that complexity theories can have for understanding the problems of declining post-war neighbourhoods and whether these theories offer support for the hypothesis that modernistic neighbourhoods are doing bad because they are inflexible and cannot easily adapt to changes in the city and society. The reason that complexity theory is used here, is that it deals with the way complex systems organize and re-organize themselves in constantly changing environments over time and space. Cities are a clear example of a complex system (Portugali, 1999) and the focus on change and time is essential if one wants to look at the development of neighbourhoods. Complexity theories can give insight into why post-war large-scale top down planned areas do not function as they were intended to and exhibit a range of problems today. It can also help us understand why older neighbourhoods constructed in a less comprehensive or piece-by-piece way developed differently and avoided some of the problems that now characterize post-war areas.

3. The third goal is to explore processes and tools for designing more flexible neighbourhoods, which have a better capacity to adapt than their post-war counterparts (see problem statement above). We are looking for guidelines to design neighbourhoods that are better suited to deal with unforeseen changes in the city and society in general. The objective is to find ways to prevent city extensions from deteriorating entirely, thus avoiding that significant parts of a city get socially detached from the rest of the city and that socio-spatial segregation arises. This is related to the belief that if problems are less concentrated, they are more manageable and less harming for the city structure as a whole. In order to create equal life chances and acceptable living environments for everyone, large problematic and/or segregated areas are highly undesirable.

To summarize, the general aim of this study is to find guidelines to design neighbourhoods able to deal with the constant change and movement of urban structure and of the people living within them. In other words, more flexible and adaptative neighbourhoods will help create an equal city without large malfunctioning parts and where decaying neighbourhoods have the ability to adapt and regenerate themselves more easily.
1.3 Research questions

In line with the problem statement and aim described above, the main research question of this thesis is:

How can we develop and design more flexible neighbourhoods in order to prevent future decline such as currently exhibited in large-scale post-war modernistic neighbourhoods?

From this main research question, we have derived operational research questions. These deal with specific parts of the research and will return throughout the thesis to explain their links and relations. The operational research questions are:

a) **Specific spatial problems**: What are the specific problems of comprehensively planned large-scale post-war neighbourhoods today?

b) **Differences in development**: How have neighbourhoods been developed in the post-war era (since 1945)? What are the differences with how they developed before?

c) **Problems in relation to development**: How does the way post-war neighbourhoods have been developed relate to the problems they exhibit today?

d) **Complexity theory**: What new insights on the problems currently existing in large-scale post-war neighbourhoods can be gained by looking at them in the light of complexity theories? Do these theories offer a way forward?

e) **Piece-by-piece pre-war neighbourhood structure**: How does the physical spatial structure of pre-war neighbourhoods enable them to grow in a piece-by-piece way?

f) **Process for flexibility**: What kind of process can be devised to design and develop new, more flexible, neighbourhoods nowadays and to regenerate decaying post-war neighbourhoods?

g) **Guidelines for design**: What general guidelines and parameters can we define to guide the development and design of more flexible neighbourhoods?
1.4 Methodology

This chapter is accompanied by a work scheme (figure 8), which provides a basic planning and framework for the research. This scheme elaborates on the different (main) actions that need to be taken, their relations and to which research question the task or product is mainly related. Below we will describe the different elements showed in the scheme.

In the first phase of this research, the problem statement and aim have been developed. They have originated through observations and small literature studies in order to establish a basic starting point and have later been elaborated and improved with insight gained from other stages. From this problem statement and aim we have extracted a main research question, which is accompanied by some operational research question in order to answer the main question.

In this phase it has also been decided to limit most of the research to one case city. This has been done to make a more detailed analysis of one situation possible, and to prevent that the research becomes a comparative analysis between cities. As a case city Utrecht, located in the centre of the Netherlands, has been chosen. This choice will be elaborated on in following chapters.

The aim, objectives and research questions combined provide us with four main research themes. First, a research into the main problems related to large scale post-war neighbourhoods. The direct goal of this study will be to answer research question a), but (as can be seen in the scheme) it is also needed in order to answer question c). The main tool for this research is a statistical comparison between the different neighbourhoods in the case city Utrecht. In this research different characteristics of the neighbourhoods will be reviewed in relation to their relative success, so as to determine which factors are the main reasons post-war neighbourhoods are decaying.

The second theme deals with the way neighbourhoods have (been) developed. We are mainly interested here in the difference between the large scale post-war areas and the piece-by-piece grown areas. This theme is directly related to research question b), but is also needed in order to answer research questions c) and e). There are three main tools used for this theme. The historical development of Utrecht and its neighbourhoods is researched by means of a morphological analysis and a literature study. This will give insight into the differences of neighbourhood development over time and will provide some knowledge on which neighbourhoods (or parts of the city) were developed in which way. To answer research question e), a more detailed study of individual neighbourhoods is conducted. This study combines map and
statistical analysis to research the key elements of piece-by-piece grown neighbourhoods.

The third theme is a research on complexity theories in relation to urban development in order to provide a direct answer to research question d), but mainly to provide input in other themes and parts of the process. The tool used in this research is a literature review, which has three main goals. The first is to provide a basic understanding of complexity theories. The second is to gain insight in the complex self-organizing processes in cities, in order to better understand the problems dealt with in this thesis. The third is to find out how planning systems function as a self-organizing system. This is necessary in order to later develop a process and guidelines for flexible neighbourhood development and for the final case design.

Finally, the input from the various analyses and literature reviews has be combined to develop a process and guidelines to create new, more flexible, neighbourhoods and to answer research questions f) and g). This will be done by means of a case design, in which the developed process and guidelines will be tested and exemplified.
Figure 1. Schematic view of the thesis structure concerning the relations between research questions
The problem of post-war neighbourhoods

What is the problem of post-war neighbourhoods? Various theories have been put forward: bad connection to the city structure, faulty separation of functions, too much dull ‘undefined’ public space, monotonous construction, etc. It could well be a combination of all of these factors, but clearly there is no consensus here.

In this thesis, we start by questioning whether large-scale post-war neighbourhoods have a problem at all, and to determine the reasons why they are perceived as problematic. After that, a statistical comparison at neighbourhood level is made to determine which characteristics of neighbourhoods (both physical as well as social) bear any relation to the success of a neighbourhood. Finally, the post-war areas have been compared, also by means of statistical data, to older neighbourhoods built in a piece-by-piece way, in order to determine what makes them different and how this relates to the characteristics filtered out in the previous step.

Because this research took place at a quite low scale level (neighbourhood), a case city has been chosen to keep the research manageable. Analyzing this kind of data for multiple cities would have left too little time to conduct the subsequent steps of this research.

Since every city is unique, the use of just one case city can be contested. However, the specific conclusions drawn from this research are universal enough to be transferable to other cities in North-western Europe, or at least in the Netherlands. The general concepts introduced throughout this thesis are relevant everywhere large scale comprehensively developed neighbourhoods have developed problems.

In the following part, the case city will be introduced, after which the conducted research will be presented.
2.1  Utrecht

To research the current problems of the large-scale post-war developments, the city of Utrecht has been chosen. The reason why Utrecht makes a good case to research the problem described in the problem statement, is that it has both an old historical structure, as well as a large amount of post-war neighbourhoods. It features areas that have developed in small steps over longer periods of time and large-scale areas built within years. The city is also home to the largest VINEX extension of the country (Leidsche Rijn; with 80,000 expected inhabitants at completion in 2015). These structures are a good basis to gain insight on the influence of large scale planning on flexibility and neighbourhood vitality.

Furthermore, there is sufficient data available from the municipality of Utrecht on neighbourhood characteristics. This information is necessary to be able to answer research question a). Also, historical maps are available about a large part of the historical development of Utrecht. These maps can explain how neighbourhoods developed in the city, which will be vital information to answer research question b) and c).

Figure 2.  Location of Utrecht in the Netherlands

Figure 3.  City region of Utrecht
Finally, it should be noted that is also a choice by reduction. Amsterdam has not been chosen intentionally, because the capital of a country is always an exceptional case. Rotterdam and Den Haag are both not really representative, since the first one has been largely destroyed in the second world war (and rebuilt after) and the second one is the institutional capitol, which also has extensive consequences. Utrecht is the first good candidate on the list of large Dutch cities. Below, I shall first give a short introduction to the city of Utrecht, after which the problem statement will be introduced in the context of the city.

The city of Utrecht is located in the centre of the Netherlands (figure 1). It is the fourth largest city of the country with around 300,000 inhabitants. As can be seen in figure 2, the city is a highly connected area. Both the main north-south and east-west highways (A2 & A12) pass Utrecht and the main train station (Utrecht Centraal) is one of the busiest in the country, processing over 55 million passengers per year and directing trains to every part of the Netherlands. The city region (figure 2) has around 610,000 inhabitants.

Figure 4. The city of Utrecht with its main infrastructure
The city itself dates back to Roman times when the old river Rhine was the final border of the empire. In the middle ages, the city became important as the home of the archbishop and it used its location to develop the trading industry. The city grew from around 30,000 people in 1500 AD to around 100,000 people in the beginning of the 20th century. Like most Dutch cities, the 20th century was one of explosive growth. In this period Utrecht tripled in size, which was mostly due the development of the large scale post-war neighbourhoods. In the nineties, the city was appointed for the largest VINEX extension of the country. Leidsche Rijn is supposed to house around 80,000 people at completion in 2015.

1. Abstede, Gansstraat
2. Amazonedreef
3. Binnenstad winkelgebied
4. Binnenstad woongebied
5. De Meern, Rijnenburg
6. Kanaleneiland
7. Leidsche Rijn
8. Lombok, Leidseweg
9. Lunetten
10. Nw Engeland, Schepenbrt
11. Nw-Hoograven, Bokkenbuurt
12. Ondiep, 2e Daalsebuurt
13. Oog in Al, Welgelegen
14. Oud-Hoograven, Tolsteeg
15. Oudwijk, Buiten Wittevrouwen
16. Pijlsweerd
17. Rivierenwijk, Dichterswijk
18. Taagdreef, Zamenhofdreef
19. Transwijk
20. Tuindorp, Voordorp
21. Veldhuizen, Vleuterweide
22. Vleuten, Haarzuilens
23. Votulast
24. Wilhelminapark, Rijnsweerd
25. Wittevrouwen, Zeeheldenbuurt
26. Wolgadreef, Neckardreef
27. Zambesidreef, Tigrisdreef
28. Zuilen-Noord/Oost
29. Zuilen-West

Figure 5. The municipality of Utrecht and its neighbourhoods
2.2 The post-war neighbourhoods of Utrecht

As we have seen in the problem statement, there is some evidence, and especially an image, that post-war modernistic neighbourhoods are in decline. To verify this image however, this research starts with an investigation into the post-war neighbourhoods of Utrecht. Are they in fact doing bad? What are the problems that typify these areas? To study these questions, the neighbourhoods of Utrecht have been compared to each other, using statistical data provided by the municipality.

The administrative structure of the municipality of Utrecht includes 10 districts, which are subdivided into 29 neighbourhoods (figure 5). Below this there is still the level of the sub-neighbourhood (98 in total), but since most data is available at the level of the neighbourhood, we will mostly use this as the scale level for our research.

Utrecht has 10 neighbourhoods that qualify as a comprehensively planned post-war neighbourhood. This means that they were developed after 1945 according to a comprehensive predetermined plan and nowadays span at least one administrative neighbourhood. In total, these areas are part of five extension plans that have been realized over the years. This is due to the fact that some administrative neighbourhoods are smaller than the size of the complete extension plan that was realized at some point. The actual extension plans are called: Hoograven (1954, no. 11), Kanaleneiland (1957, no. 6 & 19), Overvecht (1959, no. 2,18,26 & 27), Lunetten (1974, no. 9) and Leidsche Rijn (1997, no. 7 & 21). Together these neighbourhoods house 106.212 people (municipality of Utrecht, 2008), which is around 36% of the total population of Utrecht.

To find out if these 10 post-war neighbourhoods are indeed functioning badly, a comparison of all the neighbourhoods of Utrecht has been made. The first thing that really stands out is the grade that residents give to their own neighbourhood (Table 1). All of the comprehensively planned post-war neighbourhoods except Lunetten (that means 9/10 appointed areas) receive a grade below the city’s average. Six of them even fail to receive an adequate grade (at least a 6) at all (Municipality of Utrecht, 2008). This is an image that is visible in more cities. In Amsterdam the comprehensively planned post-war neighbourhoods are also at the bottom of the scale in terms of neighbourhood appreciation (Municipality of Amsterdam, 2009). It is therefore valid to assume that, according to this pattern, there is at least some kind of problem with these types of neighbourhoods.
With this in mind, a large comparison between all kinds of characteristics of the neighbourhoods of Utrecht (or the people within it) has been made. These characteristics have then been related to the residents’ neighbourhood grade, to find out which features are strongly correlated to people liking their neighbourhood. The highly correlated features can then form the basis for a new approach to the problematic of the declining post-war neighbourhoods.

The reason why the residents’ neighbourhood grade is used to relate the other characteristics to is that since the rise of post-war modernism, the neighbourhood is the unit and scale level of most city extensions. If this unit is actively used as a design tool, it should do its job well. One of the main jobs a neighbourhood is designed for is to form a direct environment, between that of the house and the city as a whole, for the people living in it. People should like their environment, or otherwise the neighbourhood would not do a good job, and the grade residents give to their own neighbourhood is a direct way to measure this. The fact that a neighbourhood is very important to people is reflected in the statistic that for people buying a house, the neighbourhood is the most important factor for their choice (van den Broek & de Jong, 2007).

When we look at the correlations\(^3\) of the different researched features and the residents’ neighbourhood grade, the following table shows the residents’ grade for their neighbourhood. The city’s average is a 7. The comprehensive post-war neighbourhoods are indicated in green.

<table>
<thead>
<tr>
<th>Neighbourhood</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oudwijk, Buiten Wittevrouwen</td>
<td>8,3</td>
</tr>
<tr>
<td>Wittevrouwen, Zeeheldenbuurt</td>
<td>8,3</td>
</tr>
<tr>
<td>Binnenstad woongebied</td>
<td>8,0</td>
</tr>
<tr>
<td>Oog in Al, Welgelegen</td>
<td>7,8</td>
</tr>
<tr>
<td>Votulast</td>
<td>7,8</td>
</tr>
<tr>
<td>Binnenstad winkelgebied</td>
<td>7,7</td>
</tr>
<tr>
<td>Tuindorp, Voorord</td>
<td>7,7</td>
</tr>
<tr>
<td>Wilhelminapark, Rijnsweerd</td>
<td>7,6</td>
</tr>
<tr>
<td>De Meern, Rijnenburg</td>
<td>7,5</td>
</tr>
<tr>
<td>Vleuten, Haarzuilens</td>
<td>7,5</td>
</tr>
<tr>
<td>Lombok, Leidseweg</td>
<td>7,4</td>
</tr>
<tr>
<td>Lunetten</td>
<td>7,1</td>
</tr>
<tr>
<td>Rivierenwijk, Dichterswijk</td>
<td>7,1</td>
</tr>
<tr>
<td>Nw Engeland, Schepenbrt</td>
<td>7,0</td>
</tr>
<tr>
<td>Oud-Hoograven, Tolsteeg</td>
<td>7,0</td>
</tr>
<tr>
<td>Leidsche Rijn</td>
<td>6,9</td>
</tr>
<tr>
<td>Abstede, Gansstraat</td>
<td>6,8</td>
</tr>
<tr>
<td>Veldhuizen, Vleuterweide</td>
<td>6,8</td>
</tr>
<tr>
<td>Zuiten-West</td>
<td>6,5</td>
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<tr>
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<td>6,4</td>
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<td>Ondiep, 2e Daalsebuurt</td>
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<tr>
<td>Transwijk</td>
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<tr>
<td>Amazonedreef</td>
<td>5,9</td>
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<tr>
<td>Nw-Hoograven, Bokkenbuurt</td>
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<tr>
<td>Zuiten-Noord/Oost</td>
<td>5,8</td>
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<td>Taagdreef, Zamenhofdree</td>
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<td>Wolgadreef, Neckardree</td>
<td>5,2</td>
</tr>
<tr>
<td>Zambesidreef, Tigrisdree</td>
<td>5,1</td>
</tr>
<tr>
<td>Kanaleneiland</td>
<td>4,7</td>
</tr>
</tbody>
</table>

\(^3\) Correlation here is calculated as the difference in the rank of a neighbourhood between a certain feature and the residents’ neighbourhood grade, averaged over all neighbourhoods.
Figure 6. Neighbourhood characteristics’ correlation to residents’ grade (lower result is better).

Figure 7. Neighbourhoods physical characteristics’ correlation to residents’ grade (lower result is better)
grade we see that the most correlated features are almost all social indicators (figure 6). Education level, income level, percentage of immigrants and percentage of social rent tell more about the people living within the neighbourhood, than the neighbourhood itself. The only physical characteristic that is highly correlated is the amount of companies. The fact that the value of a house/m² correlates with the neighbourhood grade is merely a confirmation that the neighbourhood plays an important role in where people want to live.

Is it strange that mostly social factors are highly correlated to the residents’ neighbourhood grade? If we consider that indicators such as education level, income, whether or not you are an immigrant and if you live in a social rent controlled apartment mainly mark the difference between people with choice and people without, this becomes quite logical. People with choice choose to live in their neighbourhood, and so they will (or should) be happy with it, whereas people without choice are limited in their options and can therefore get stuck somewhere they would rather not be. Again, this is nicely reflected in the correlation with the average house value/m². People in popular neighbourhoods want to be where they are, and you always have to pay more for something that you want.

The question remains though, as of why some neighbourhoods are highly appreciated and why the post-war areas attract mainly people without choice. For this we will have to look into the physical characteristics of the neighbourhoods, because we believe that the primary reason for these differences resides in the built environment. This is of course a highly contested statement and it always debatable whether the physical structure of a neighbourhood causes social problems or if social problems make a physical structure less appreciated. There is a large middle grey area however, and the built environment can definitely provide some answers.

When we only take the physical characteristics of a neighbourhood into consideration we can see that the amount of companies and the percentage of very large houses are highly correlated, and that neighbourhoods with a lot of post-war housing are indeed less appreciated (figure 7.). What is interesting to see though is that the highest correlation exists with the amount of housing constructed before 1905. If we look at the other time periods in the list, we can see the correlation decreasing when the houses get less old until finally a negative correlation (more leads to less appreciation) remains for construction from 1960 to 1980. It seems that the age of neighbourhoods is a very important factor in its success. This effect can be further illustrated by showing some of the characteristics researched before, but with the neighbourhoods in order of construction. For every feature the trend line is moving in a negative direction (fig. 8-11).

This is unexpected. Intuitively it is expected that new things should work better than their older counter-
Figure 8. Residents’ neighbourhood grade (from the oldest neighbourhood to new)

Figure 9. Average family income per neighbourhood (arranged from the oldest neighbourhood to new)

Figure 10. Education level per neighbourhood (arranged from the oldest neighbourhood to new)

Figure 11. Median time to sell a house per neighbourhood (arranged from the oldest neighbourhood to new)
parts, since they have been developed with more knowledge and can be adapted to the current society better. As the matter of fact, we can find some of this effect back in the data. If we look at the most recent neighbourhoods, we can see that some characteristics (neighbourhood grade, education level) are just a bit better than their slightly older neighbours. This is also visible in the correlation diagram of the physical characteristics. The correlation for building period gets worse and worse the more recent the period is, until the last one when it gets a bit better again. The line goes down, down, down and finally a little bit up again.

The all time low of most researched features here corresponds to the post-war modernistic neighbourhoods, so the obvious conclusion would be to say that these areas were a mistake in our urban history. They were created with good intentions, but the idea just did not work. But if we look in the same chronological order at some of the physical features of the neighbourhoods of Utrecht, we can start to see something of a more fundamental problem (fig. 12-15).

When we analyse the development of neighbourhood construction that is shown in these graphs, we can define quite a large discontinuity after the Second World War. Before 1945 neighbourhoods were built up out of different housing typologies, different types of ownership mixed in with companies and constructed in different time periods. After 1945 this seems to change quite dramatically. The diversity that typified neighbourhoods before the war changes to uniformity. During the post-war modernistic era we can see that this uniformity is mostly apartment buildings in combination with social rent, but after that, when we enter the age of the VINEX neighbourhoods, this changes to owned single-family housing. Both of these two developments lack the diversity of pre-war development, however. Another issue here is the speed and scale of neighbourhood development that change. In the figure x we can see that after 1945 neighbourhoods are constructed almost at once, without any preceding or later added development.

These features are, at a fundamental level, the same for the post-war modernistic neighbourhoods, as for the later developed VINEX extensions, and so it might be wrong to write off the demise of the post-war development as a bad idea and leave it at that. If we keep developing neighbourhoods the way that has been introduced by the modernistic post-war movement, every extension might run the risk of developing the same problems.
Figure 12. Division of housing typologies per neighbourhood (from the oldest neighbourhood to new)

Figure 13. Division of construction periods per neighbourhood (arranged from the oldest neighbourhood to new)

Figure 14. Division of ownership per neighbourhood (arranged from the oldest neighbourhood to new)

Figure 15. Companies/1000 inhabitants per neighbourhood (arranged from the oldest neighbourhood to new)
2.3 Conclusion

The post-war neighbourhoods’ of Utrecht main problem is that they are not well valued by their own inhabitants, or by other residents of the city. Therefore, these neighbourhoods attract mainly people without choice, who exhibit the typical problems of this group: low income level, low education level, high unemployment, etc. This is not a specific problem of the post-war modernistic neighbourhoods however. Any neighbourhood functioning badly or which is unvalued by the inhabitants of a city will exhibit exactly this same phenomenon.

When we look at the physical characteristics of the post-war modernistic neighbourhoods we can see that the main difference with neighbourhoods that were realized before is the uniformity of development. Both in functional characteristics, such as the type of housing or the mix of functions, as well as in the time of development the differences are big. The post-war modernistic neighbourhoods were the start of a culture of developing neighbourhoods comprehensively, which is to say, as a complete entity at once, but we can now question if this was really such a good idea.

The hypothesis of this thesis is that this uniformity in functional characteristics and in time of development renders this type of neighbourhoods inflexible. Because they were so specifically designed in and for a certain time they have great difficulty to adapt if the city and society for which they were created change. When this leads to a decline in the appreciation for the neighbourhood it starts to become more and more the place for people without choice, and social problems enter the area. Since they were developed in such a uniform way and according to such a strict urban vision, there are no alternatives within the neighbourhood and so whole areas suffer from the same problems and start to deteriorate entirely.

The post-war neighbourhoods were the first to be developed according to the comprehensive or modernist planning tradition, but by no means the last. As we have seen in the chronological analysis of the physical characteristics of the neighbourhoods of Utrecht, the VINEX extensions show exactly the same uniformity. Although their exact form is different, the underlying pattern is the same. They were comprehensively developed, entirely at once, with uniform results. Currently, the VINEX neighbourhoods in Utrecht are rated just below average by their inhabitants, but these areas have the qualifications to go the same way as the post-war modernist extensions.

To gain more insight into the nature of this process of uniform comprehensive development and decline we will review some theoretical knowledge in the next chapter. We look at complexity and planning theory
in relation to the development of neighbourhoods, and we will research what these theories can say about why the comprehensively developed areas start to deteriorate at some point.
Complexity, planning and time in relation to the development of neighbourhoods

In this chapter we will try to gain more insight into the decline of comprehensively developed neighbourhoods. For this end, some literature research has been undertaken, mainly in the field of complexity theories. As is described in the aim section of this report, complexity theories can make a valuable contribution to this report since they deal with the way systems develop and change over time. First an introduction to complexity theories in relation to urban planning will be made, after which the influence on the problem of comprehensively developed neighbourhoods will be concluded.

3.1 An introduction to complexity theories in relation to urban planning and development

Complexity theory has had a long start as a discipline. For years scientists in various disciplines such as physics, biology and cybernetics wrote about subjects related to complexity and self-organization within their own fields without really acknowledging it as a separate field of research (Johnson, 2001). Already in 1948, Warren Weaver referred, in a seminal speech for the Rockefeller foundation, to the emergence of a new field in science: the study of ‘organized complexity’. In his opinion this was a field that was missed between the studies of problems of simplicity (few, clearly related, variable problems) and that of disorganised complexity (huge amount of variables for which statistical relations can be determined) (Weaver, 1948).

It took however until the mid sixties, before the field really kicked off. Especially Haken’s theory of synergetics, Prigogine’s dissipative structures and Eigen’s catalytic networks played a large role in the maturisation of the theory (Portugali, 1999).
In the early days, researchers studying the complex self-organizing systems were mainly interested in the property of non-causality in the systems. “That is to say, by the finding that in certain situations external forces acting on the system do not determine/cause its behaviour, but instead trigger an internal and independent process by which the system spontaneously self-organizes itself” (Portugali, 1999, p. 50). After that people started to get interested in the more fundamental properties of complex self-organizing systems and came up with three main features.

First is that they are open systems, part of their environment and thus able to exchange matter, energy and information (Portugali, 1999 & 2008). Because of this feature they “can attain a spatio-temporal structure and maintain it in far from equilibrium conditions; not in spite of, but as a consequence of, a sufficient flow of energy and matter” (Portugali, 1999, p. 51). The second feature is that these systems are not only capable of (through this flow of energy) self-organizing themselves in a certain structure in far from equilibrium conditions, but are also able to “create or invent novel structures and new and novel modes of behaviour” (Portugali, 1999, p. 51). This leads to some attribution of creativity to self-organizing systems. The last feature is that the system is complex. This complexity shows in two ways: the parts of the system are so numerous that there is no technical way to establish causal relations among them and “their parts form a complex network of interaction, with feed-forward and feedback loops, that makes the determination of causal relations in essence impossible” (Portugali, 2008, p. 256). Systems with these forms of complexity are typically characterized by features of non-linearity and phase transition. If all these features are summarized we can say that we are dealing here with self-organizing, open, complex systems.

Cities are a clear example of such type of systems. They are open systems exchanging information and goods with their environment. They are capable of generating new structures and behaviour (through their residents) and their parts are most definitely numerous and complex.

Complexity theories can give insight into the dynamics that play in open, complex, self-organizing systems such as cities, but, in the light of planning, they also present a problem. “Predictability, control and ‘social engineering’ are the pillars of modern town and regional planning” (Portugali, 1999, p. 230), but complexity theories provide the central insight that cities and other open complex systems are fundamentally unpredictable. Portugali (2008) states that there are four essential problems with prediction in complex self-organizing systems.

The first is that because of non-linear effects occurring in complex systems such as cities, it is impossible to “establish predictive cause-effect relationships between some of the variables” (Portugali, 2008, p. 256). Second is the problem that “many of the triggers for change in complex systems have the nature of
mutations. As such, they are unpredictable, not because of lack of data, but because of their very nature (Portugali, 2008, p. 256). The third is that in these types of systems the predictor is part of the system. This is a problem because it can lead to self-fulfilling and self-falsifying predictions. Self-fulfilling predictions are quite known, they are predictions based on false assessments leading to new behaviour which makes the predictions come true (Portugali, 2008), but self-falsifying predictions are less famous. An example of a self-falsifying prediction is the Osborne case. In this case, computer manufacturer Adam Osbourne announced in 1983 the arrival of a next generation computer, which drove potential buyers to postpone their purchase and caused the company to go bankrupt before the new arrival. The last problem is that cities are actually dual complex self-organizing systems. Because their inhabitants are in themselves open and complex systems too, the city becomes a dual layered system of a self-organizing environment with self-organizing agents on top.

If predictability is so essential for modern planning, but open complex systems, such as cities, are fundamentally unpredictable, what does this mean for plans developed according to such a planning system? And what is exactly this relation between planning and predictability of the system? To answer these questions we will have to look at some fundaments of planning.

### 3.2 A few words on planning theory

According to Peter Hall, “planning as a general activity is the making of an orderly sequence of action that will lead to the achievement of a stated goal or goals” (Hall, 2002. p.3). However, to reach a desired goal by means of an orderly sequence of action implies that a kind of estimation or prediction on how the system will respond to an action has to be made. As we have seen that open complex systems are fundamentally unpredictable, this immediately poses an immediate problem for planning in these types of systems. It does not stop there however. There is a second problem hidden in Hall’s statement if we are talking about city planning. It has to do with goal or desired state part.

Stephen Marshall writes in his book ‘cities, design and evolution’ that there are three degrees of planning intention or “the envisioning and precipitating a desired future state”. “The first degree of planning is simply that of maintaining an existing desired state into the future…. The second degree of planning would be to create and provide for a desired future state that is in some way better than the present…. A third degree of planning would attempt to create a future desired state for an ‘improved’ society. This could
be equated with ‘Utopian’ planning and social engineering” (Marshall, 2009. p. 27). Post-war modernistic planning was above all utopian and therefore falls into the third, and most ambitious, category (NICIS, 2008). It is not that easy to reach utopia however.

The problems of planning cities to reach a desired state have been described by Rittel in his paper ‘Dilemmas in a general theory of planning’. Already in 1973 he wrote: “By now we are all beginning to realize that one of the most intractable problems is that of defining problems (of knowing what distinguishes an observed condition from a desired condition) and of locating problems (finding where in the complex causal networks the trouble really lies)” (Rittel, 1973. p.159). The issue of locating problems in complex networks we have seen before in complexity theory: this is mainly due to the non linear effects and the sheer complexity of the network. The issue with defining problems is that, according to Rittel, planning problems (and other societal problems) are ‘wicked problems’.

Rittel describes wicked problems like this: “As distinguished from problems in the natural sciences, which are definable and separable and may have solutions that are findable, the problems of governmental planning – and especially those of social or policy planning – are ill-defined; and they rely upon elusive political judgement for resolution” (Rittel, 1973. p.160). He defined ten distinguishing properties of wicked problems of which these three are the most relevant here:

1. **There is no definitive formulation of a wicked problem.** “The information needed to understand the problem depends upon one’s idea for solving it. In order to describe a wicked problem in sufficient detail, one has to develop an exhaustive inventory of all conceivable solutions ahead of time”. This is simply not possible.

2. **The solution to a wicked problem cannot be tested.** Solutions to wicked problems cannot be tested in isolated experiments and they cannot be tested in practice to learn by trial-and-error for “any solution, after being implemented, will generate waves of consequences over an extended – virtually an unbounded period of time…. Every implemented solution is consequential. It leaves ‘traces’ that cannot be undone”.

3. **Solutions to wicked problems are not true or false, but good or bad.** This is actually the most important feature of wicked problems. “Normally, many parties are equally equipped, interested, and/or entitled to judge the solutions, although none has the power to set formal decision rules to determine correctness. Their judgements are likely to differ widely to accord with their group or personal inter-
ests, their special value-sets, and their ideological predilections”.


The essence of wicked problems then, is that there is no best solution. There is never a definite answer, because the problem cannot even be definitely described. Every action therefore depends upon the actors, the context and the interpretation of the problem. This is the final problem for modernistic comprehensive planning.

### 3.3 Modernistic comprehensive planning in complex cities

To summarize, there are two fundamental problems with modernist comprehensive planning, as was applied in the post-war neighbourhoods:

1. We have seen that every form of planning requires some kind of prediction about the responses of the system to a certain action, and we have seen that the post-war neighbourhoods with their utopian goals were the most ambitious form of planning. Complexity theories however, tell us that prediction in open and complex systems such as cities is fundamentally impossible. This means that any plan made in a complex system runs a fundamental risk of failing, since there is always a chance that the reality turns out differently than predicted. It also means that modernistic comprehensive planning runs an increased risk, since it is such an ambitious form of planning and therefore makes more predictions about future states.

If we combine this with the fact that during the post-war modernistic era entire neighbourhoods were developed on a very large scale according to one single utopian vision, we can start to see why so many of these neighbourhoods are in decline now. The predictions that were made about how the system, the city and society, would respond to the plans and designs of the post-war neighbourhoods just turned out to be false, and since the entire neighbourhood was developed around the same vision, there is no alternative and the whole neighbourhood starts to deteriorate.

2. The second fundamental problem has to do with the desired state. Utopian planning, as the third degree of planning, has the largest distance between the current state and the desired state of the
system. Rittel defines this distance as the problem (“what distinguishes an observed condition from a desired one”). The post-war modernists tried to grasp this very wide problem space by trying to approach it scientifically, with lots of statistical data analyses and quantitative methods (Rittel, 1973. NICIS, 2008). For the modernists this was a kind of insurance for ‘objective’ quality. Rittel however, would describe this as fooling yourself. Planning problems are wicked problems and there are no ‘objectively’ best solutions to wicked problems. It always subjectively depends on the actors and the context.

Since every city or country has a specific (planning) culture this should not have to be a problem. Designers and planners are usually raised in the culture where they practise their profession so they should understand it, and it is their job to understand the context, so they should be able create a plan or design that fits most people’s interpretation of the problem. However, there is an aspect of the context that is often overlooked, and that is the timeframe or era. The context and culture do not only differ per person or geographical location, but they also change over time. This means that the interpretation and thus the preferred solution of a wicked problem changes over time as well.

What we now have is that a plan, which is the result of an interpretation of a wicked problem, can be made to reach a desired state by predicting the response of a complex system to the actions in the plan. Although prediction in a complex system is fundamentally impossible, somehow the predictions made for this plan turn out to be correct, but by the time this becomes clear and the plan has achieved its desired state, the desired state is not the desired state anymore, because the whole interpretation of the problem has changed. The post-war modernists thought they were creating utopia, but in fact they created quite the opposite for their ancestors.

Again, this problem is worsened by the scale in which the post-war neighbourhoods were constructed. Because the entire neighbourhood is constructed according to the same vision of a desired state, there is no alternative if this desired state changes over time. The whole neighbourhood goes ‘out of style’ which leads to people without choice entering the neighbourhood along with a range of social problems.
3.4 Conclusion: The importance of time in neighbourhood development

“Time, in cities, is the substitute for self-containment. Time, in cities, is indispensable.”

(Jacobs, 1961. p.133)

When we look at the two problems described above here, we can see that both of them originate from the way the post-war neighbourhoods were developed. The fact that they were developed on a very large scale and at a single point in time renders them much more vulnerable to develop problems because of these two very common effects. Every plan for the built environment in history has been subjected to the two effects outlined above and yet there are countless examples of successful plans that have stood the test of time. As we have seen in the previous chapter, it is the speed and scale of development that makes the post-war neighbourhoods different.

Let us look at the first problem, which is that prediction about the response of the city to a plan is fundamentally impossible. This does not mean that all plans for a city are bound to fail. It just means that you can never be certain of the result and that it will probably turn out a bit differently than imagined. But a different result does not automatically lead to problems; maybe different is fine as well.

The problem with developing neighbourhoods comprehensively and completely at once is that you never have time to find out. There is always a fundamental risk that any implemented plan fails, and if you develop an entire neighbourhood at the same time according to one plan, you put all your money on one horse. If a part of a neighbourhood is constructed first, and it turns out that it is not doing well, it is always possible to adapt future plans and try to avoid the same mistakes. Over time, more information becomes available. If a neighbourhood consists out of multiple plans, there is already a much lower risk that all plans will fail, and there will always be alternatives available if one part of the neighbourhood is functioning badly at some point.

Almost the exact same story goes for the problem of changing interpretations of a problem and changing desired states. A plan in a city is put into action to achieve a desired state. When over time, due to a changing culture and context, the desired state and the interpretation of the problem the plan was supposed to tackle change, the results of the plan become unwanted. Regardless of the fact that the plan was able to achieve its original desired state. Once again, this effect is much more consequential if an entire
neighbourhood is developed at once, according to a single vision (and thus interpretation of the problem). And again, multiple plans and visions are necessary to create alternatives and lower the risk that the entire neighbourhood is unfit for a certain time period.

There is an issue here however. It is a fact that the culture and context of a society always change over time, but it is also very difficult to anticipate these changes. People are naturally inclined to think within their context and spirit of the age. This makes it even more important that neighbourhoods are developed over a longer period of time instead of at once, because this is the only way to incorporate truly different visions and interpretations into one neighbourhood.

Time then, is indeed a very important factor in neighbourhood design. When a neighbourhood is developed in parts over a longer period of time, it is much less likely to run into problems caused by impossible predictions or changing cultures, simply because it has a multitude of plans from different time periods within it. All these plans respond differently to the current situation because they were designed according to a different interpretation of the problem, and most of them have the added advantage that they were created with the knowledge of what happened to the previous ones, so mistakes in predictions can be responded to.

This diversity in plans is what enables neighbourhoods to adapt to cultural changes and changes in the city structure over time. Because each plan responds differently to the changes over time, there will always be many alternatives within one neighbourhood, and it will not matter very much if one part is not suited to deal with the current age. Because this diversity in plans is so structurally built into to neighbourhood, we will call it structural diversity. Structural diversity is what creates truly flexible neighbourhoods, able to deal with changes in society and the city over time, and it is this kind of flexibility that is referred to in the introduction of this thesis.

Before the rise of post-war modernism, neighbourhoods were indeed developed over a longer period of time and not according to a comprehensive plan. Do they possess the structural diversity that is necessary to adapt to new times? And what can we learn from their characteristics and development? In the next chapter we will look at the piece-by-piece grown neighbourhoods.
Piece-by-piece grown neighbourhoods

Before the post-war modernistic comprehensive planning model was adopted in full scale after the Second World War, neighbourhoods used to be developed in a different way. They were developed over a longer period of time and they ‘grew’ more, by adding one part after another, than that they were comprehensively planned in advance of any construction. Because of this characteristic, we call these neighbourhoods piece-by-piece grown neighbourhoods, and if time is such an important factor in neighbourhood development, we must be able to learn something from them.

How were these neighbourhoods developed? What are their most important characteristics? How do these characteristics enable them to grow in such a way? These are the questions that we are going to answer in this chapter. We are going to start with a short history of the development of Utrecht and some of its piece-by-piece grown neighbourhoods in particular.

4.1 A short history of the development of Utrecht

In this chapter we will shortly discuss the development of Utrecht from 1850 to give an overview and put other things in perspective. We start in 1850, because at this point, the city was still highly similar to a few centuries before. Most buildings were still contained within the area surrounded by the former city walls and with 45,000 inhabitants, the city was barely bigger than the 30,000 it had in the centuries before.

The population growth really started off in the second half of the 19th century. In 1900 the city already counted a 100,000 inhabitants, more than twice that of 50 years earlier. On the map of utrecht in 1900, it is clear that most construction took part in the the east part of town. Neighbourhoods such as Oudwijk and Wittevrouwen are mostly from this period. These first extensions of the old city core were mainly de-
Figure 16. The development of Utrecht from 1850
veloped by private parties, often without any predefined plan for a neighbourhood at all. Land speculation and small working class houses were the words of those days. The most the municipal government did was to sometimes construct a small street pattern to guide construction a bit (Blijstra, 1969).

After the introduction of the national housing bill of 1901 the extension of the city became more structured according to predefined plans. The new extensions of the early 20th century were often developed as a unity, although still on a pretty small scale, which led to a more structurized image of the city plan. This can be seen in a neighbourhood like Lombok. From around 1915-20, the garden city ideal of Howard was often used as a guideline for new neighbourhoods. Neighbourhoods like Tuinwijk, Oog in Al and Tuindorp are clear examples of this. In 1920, the Berlage/Holsboer plan is made, which is a design to grow the city to 450,000 people (figure 17). This plan is revised in 1924, but in the end, almost nothing in it will actually be realised. First of all, the scale of the plan was just too large to be accepted as a detail plan for politicians in those days. Secondly, at that point the municipality had barely any space left within its borders to construct anything and the border alteration would take a long time (Blijstra, 1969. Bruin, 2000).

When in 1954 the border alteration is finally a fact, the city expands rapidly. The newly available space in combination with the comprehensive and large scale style of post-war modernism creates a growth of 100,000 inhabitants in 20 years. In 1970, Utrecht has 270,000 inhabitants which is almost the same as

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The ‘woningwet’ of 1901 was a historic piece of legislation for urban development in the Netherlands. It improved the quality of housing, it led to the institutionalization of housing corporations and it was the start of real urban planning in the Netherlands.
today. As can be seen on the map, the growth of this period was mainly directed to the north and west. This contrast between the ‘old’ growth towards the east and the ‘new’ growth to the west and north is still clearly visible in the city. Especially since the new modernistic neighbourhoods, such as Overvecht and Kanaleneiland, looked radically different from what was built before the war. The post-war modernistic neighbourhoods were developed comprehensively on a much larger scale and according to very different urban and architectural rules (Blijstra, 1969. Bruin, 2000).

In the period after 1970, the large scale city extension has come somewhat to a halt. Some neighbourhoods such as lunetten were still added, but the scale became much smaller than in the 50’s and 60’s. This period focussed its attention more on urban renewal and renovation projects. Especially neighbourhoods built in the late 19th and early 20th century were targeted, because of their often poor technical quality. In the end of the 80’s a start was made with, what became later known as, the VINEX policy, which would have large consequences for Utrecht. The city was selected for the largest VINEX location of the country and in 1997 the development of Leidsche Rijn started. When completed in 2015, Leidsche Rijn will house 80.000 people, which is indeed enormous compared to the 280.000 inhabitants Utrecht had before this latest addition. Although the VINEX policy tried to decentralize decision making and create more diversification in the neighbourhoods, the results are somewhat disappointing. Neighbourhoods are still constructed according to enormous master plans and the diversification is mostly a different façade. The modernistic comprehensive planning system is still used, with uniformity on a structural level as a consequence. How it will turn out for the VINEX neighbourhoods is therefore still uncertain (Bruin, 2000. Boeijenga, 2008).

4.2 How does a piece-by-piece neighbourhood develop?

To gain more insight into the exact (spatial) development of piece-by-piece neighbourhoods, a detailed historical study of three of these neighbourhoods in Utrecht has been made. Oudwijk/Wittevrouwen (actually two neighbourhoods), Votulast and Lombok have all been developed during the end of the 19th and beginning of the 20th century, but not quite in the same way.

Oudwijk/Wittevrouwen, in the east of Utrecht, has developed piece-by-piece along various existing roads, some of which already knew some construction before 1850. The first steps were concentrated directly on the existing roads, afterwards the remaining in-between areas were filled in. The interesting thing is
Figure 18. The development of three piece-by-piece grown neighbourhoods in Utrecht
that the roads along which the neighbourhood ones started its development are still the main streets of the area.

Votulast, in the north of the centre, has developed more or less in the same way as Oudwijk/Wittevrouwen along some existing infrastructure. The main difference however is that in this case, the main streets of the area today do not correspond to the existing historical streets of the neighbourhood. They still exist, but streets that have been planned later on in the development process have become more important at some point.

Finally, Lombok, located to the west of the centre. This neighbourhood has developed very linearly along a central street that was developed along with the neighbourhood. Every time a piece was added, the street was extended as well. This street is still the main street of the area.

To say why these neighbourhoods developed the way they did involves some speculation, but is nevertheless useful. First of all, it is clear from looking at the maps, that all of these neighbourhoods used existing structures to guide their development, although they responded differently to them. Oudwijk/Wittevrouwen incorporated the structure completely and it remains the most important to this day. Lombok just used the existing infrastructure to border the neighbourhood and created its own additional structure. This makes Lombok already a more planned neighbourhood than the other two, since it not only responded to the existing environment, but actively modified its structure.

What these neighbourhoods all have in common though is that the fact that they have been created in a piece-by-piece fashion has led to, both visually as well as functionally, very diverse areas. The functionality we will come to in a later chapter, but the visual diversity is clear the moment you set foot in one of these neighbourhoods. The 50-90 year period it took to construct the main body of these areas is a long time, in which a variety of urban visions and architectural styles have been incorporated, and the development has not stopped afterwards. Various later additions and renovation projects have diversified the image of these neighbourhoods even more.

But how have these neighbourhoods maintained a kind of cohesion between all these different parts? In the following chapters we will start to examine the spatial structure of these neighbourhoods more closely to provide an answer to this question.
4.3 **Spatial characteristics of neighbourhoods developed over time**

To develop a neighbourhood piece-by-piece requires a different way of thinking than developing a neighbourhood in a comprehensive way. You are adding a part to an existing entity, instead of creating a completed whole that is able to function almost as a stand-alone unit. Because piece-by-piece neighbourhood development works by addition, the existing structure becomes very important. Every new part has to connect to what is already there. This is exactly what we saw in the previous chapter on the actual development of some neighbourhoods in Utrecht. The existing structure was very significant in the development of the new neighbourhoods. Since this was mostly a street structure, this is where we will start our research on the spatial characteristics of piece-by-piece developed neighbourhoods. Do all of these neighbourhoods have something in common in their structure that enabled them to develop by addition instead of comprehensive design? We start with a small research on the spatial structure of the entire city of Utrecht.

*Figure 19. Municipal interpretation of the most important roads of Utrecht*
To gain a better understanding of the structure of Utrecht, some different analyses of its street and spatial structure have been made. Figure 19 is a map of what a municipal map lists as the most important car roads in the city. Figure 20 is a space syntax segment analysis of the streets of Utrecht (figure 21 shows only the most integrated streets). Together these give a complete overview of what have been defined as the most important streets, and what streets are the most integrated in the network.

After that, an analysis which shows the locations of shop clusters in the city has been made (figure 22). What stands out in this analysis is the division in point-like shopping malls and linear shopping streets. When we overlay the space syntax and shopping cluster analyses we can see that all of these shopping streets are also highly integrated streets (figure 23). What also seems to be though is that all of these highly integrated shopping streets are in piece-by-piece grown neighbourhoods. To research this further, a detailed analysis of both some piece-by-piece, as well as some comprehensive post-war neighbourhoods has been made.

Figure 20. Space syntax segment analysis of the streets of Utrecht

Figure 21. The most integrated streets from the space syntax analysis

Figure 22. Commercial agglomerations in Utrecht

Figure 23. Commercial agglomerations and space syntax analysis overlayed
For each neighbourhood, the same things have been analysed as for the entire city, which are the most important roads defined by the municipality, a space syntax segment analysis and the location of the most important shopping clusters. The fourth map shows only highly integrated streets bordering somewhere on a shopping cluster, with their adjoining buildings. Arguably, these are the main streets of a neighbourhood. Finally, the sections and some images of these main streets have been added to give an impression on what type of streets they are (fig. 24-30).

What stands out immediately is the large difference between main streets in piece-by-piece grown neighbourhoods, and those in comprehensively developed post-war neighbourhoods. There are three main differences:

1. All piece-by-piece grown neighbourhoods have main streets with shops *along* the street. In post-war neighbourhoods this is only in the form of an occasional shopping centre. This means that in piece-by-piece grown neighbourhoods, the main street is functionally differentiated from other streets, whereas in the post-war neighbourhoods this is only true for the shopping centre itself (which usually only has pedestrian ‘streets’).

2. Piece-by-piece grown neighbourhoods only have one main street, which can at most split itself at some point (the only exception is the centre, which is an exception anyway). This street is usually also the most integrated street of the area. Comprehensive post-war neighbourhoods usually have a network of main streets with some kind of hierarchy in it. This makes piece-by-piece grown neighbourhoods much easier to read, since most roads lead to the main street (highest integration) of which there is only one. Especially if the hierarchy is not clear, it is a lot more difficult in post-war areas.

3. The sections of the two types of main street are completely different. Piece-by-piece grown neighbourhoods have relatively small streets with continuous lower buildings focussed towards the street. The distance between two opposing buildings is not much more than the width of the actual street. Post-war neighbourhoods have relatively wider streets (or more lanes) with separated higher buildings next to it, which are not necessarily targeted at the main street. The space between opposing buildings is usually much larger than the width of the actual road.

When we analyse these differences it becomes clear that in piece-by-piece neighbourhoods the main street is the actual centre of the neighbourhood, with everything else directed towards it, whereas in comprehensive post-war neighbourhoods, the main streets are just the main streets for traffic.
Figure 24. Analysis of the historical centre of Utrecht
Figure 25. Analysis of the east of Utrecht (four neighbourhoods: Oudwijk, Wittevrouwen, Wilhelminapark and Abstede)
Figure 26. Analysis of Votulast
Figure 27: Analysis of Pijlsweerd/Zuilen-South
Figure 28. Analysis of Lombok
Figure 29. Analysis of Overvecht (post-war neighbourhood)
Figure 30. Analysis of Kanaleneiland (post-war neighbourhood)
Since every piece-by-piece developed neighbourhood has a spatial structure with a main street at the centre, this is clearly also an imported element for their development, but how exactly? When we look at the historical development analysis of the neighbourhoods described in the previous chapter, this becomes clearer. These neighbourhoods were developed piece-by-piece along an existing structure, often roads which are still the main streets today. When this is the case one can imagine that the neighbourhood grew around these streets, letting them naturally become the focal point of the area, but this is not always the case. As we can remember, there were also some neighbourhoods which developed their own main street along with the neighbourhood. This is understandable as well, however. If a neighbourhood wants to function as a whole, a coherent network and cohesion between the different parts is necessary. A real main street is ideal for this. It runs as a central axis through the whole neighbourhood, being its functional centre as well. Every newly added part can connect to it when it is added, like beads put onto a string. A main street has the ability to ‘glue’ different parts of the neighbourhood together into one coherent network. Because this central element is so fundamental to the layout of these neighbourhoods, we will call it the structural axis. The next chapter will deal with the characteristics of these structural axes.

### 4.4 Main characteristics of a structural axis

As we have seen in the last chapter, the structural axis is a fundamental part of every piece-by-piece grown neighbourhood. The main characteristics of these axes turn out to be remarkably alike. Of course there are countless similar features to mention here, but in the context of this research there are five main characteristics that are apparently essential to the functioning of a structural axis:

1. **Commercial activities on the ground floor.** The most ‘eye catching’ difference between a structural axis and normal streets is the appearance of commercial activities, usually in the form of shops, on ground floor level. These shops differentiate the structural axis functionally from other streets and attract people enhancing its centre function. The fact that commerciality appears at all though, is not a planned or permanent feature. It is due to other physical characteristics, such as a high integration in the spatial network (more people), a well defined urban space and the diversity of buildings along the axis.

2. **Continuous buildings alongside, and directed at, the axis.** This may seem like a trivial design issue, but when compared to the post-war neighbourhoods it becomes clear that this is an important fea-
Continuous buildings directed at the axis define its urban space clearly and guide or focus all people on one space. They enhance the axis’ centrality.

3. **Short blocks (or frequent side streets).** Jane Jacobs has written an entire chapter on this subject in her ‘Death and life of great American cities’ (1961), in which she describes it as a condition for diversity (in functions). This is the indirect effect though. The direct effect of short blocks on the structural axis is that the axis becomes more integrated into the network, since it is now connected to more streets. This we have already seen is highly important for a structural axis as it makes a range of other things possible, one of which is more functional diversity. Short blocks (and continuity of the street) is the way to achieve this high integration.

4. **A road profile that allows for interaction between different street sides.** As the structural axis is the central entity of the neighbourhood, it is highly important that its two sides are well connected to each other. This requires a road profile fitted to the human scale to allow for interaction between the different sides. If we look at a main street in a post-war neighbourhood, the street does not connect its two sides, it is so wide that it actively separates them.

5. **Diversity of buildings along the axis.** This is perhaps the most important feature of all structural axes. Whereas smaller streets within an old piece-by-piece grown neighbourhood can have only identical or similar buildings along it, this is never the case for a structural axis. The reason that diversity of buildings, both in appearance as in typology, is so important is that it renders the total axis more flexible (we might recall a similar argument from chapter 3 on the increased flexibility of piece-by-piece grown neighbourhoods). It does this because diversity of buildings leads to diversity of functions (different functions require different buildings), different people (different people like different buildings), a mixture of uses (due to the previous two) and thus a more balanced public life and finally a better legibility of the axis and the places connected to it (up to a certain level, see Haken & Portugali, 2003). All these effects create a more balanced, diverse and thus flexible street, therefore enabling the axis to function as the neighbourhoods central entity for a long time.

Because diversity is such an important issue and to gain more information for subsequent design steps, an extra study into the exact level of diversity in some existing structural axes has been conducted. This study analyzes the amount of companies and the exact diversity of buildings on three levels: Basic building shape and height, material used for the facade and the exact building facade (fig. 31-37).
Figure 31. Analysis of the Biltstraat, structural axis of the neighbourhood Wittevrouwen

Figure 32. Analysis of the Amsterdamse straatweg, structural axis of the neighbourhoods Pijlsweerd & Zuilen
Figure 33. Analysis of the Kanaalstraat, structural axis of the neighbourhood Lombok

Figure 34. Analysis of the Rijnlaan, structural axis of the neighbourhood Rivierenwijk
This analysis provides some clear numbers on what typifies an existing structural axis in terms of diversity of buildings and block length, but it also gives an interesting example of the importance of diversity and short block for commercial development. The last example of this analysis, the Rijnlaan, is clearly on another level in terms of diversity of buildings and block length, and this shows in low amount of companies on this axis. This is also clearly visible on the maps above. Whether it is exactly due to this effect, we cannot be entire sure, but it is telling that this neighbourhood is scoring significantly lower on residents’ appreciation than the other three.

Now that we know the structural axis is the main element of any piece-by-piece grown neighbourhood, and we know the axis’ main physical characteristics we might try to find out how we could create new, more flexible, neighbourhoods with this information. This is what the next chapter deals with.
How to develop flexible neighbourhoods

A summary so far: By analyzing the problems of the post-war neighbourhoods of Utrecht and input from complexity and planning theory it has become clear that the use of the modernist comprehensive planning system to create neighbourhoods is not a sustainable way to develop the city. The areas created like this tend to deteriorate along the way and complexity and planning theory can teach us why. First of all, because prediction in complex systems is fundamentally impossible, which means that comprehensive planning becomes extremely risky. Secondly, because the problems you want to solve with comprehensive planning only have context sensitive solutions which change over time. This means that a good plan today can be a bad one tomorrow. From this follows that developing neighbourhoods in a piece-by-piece way can be a much better take on planning. The structural diversity, in the form of different plans and visions, creates a neighbourhood where it matters much less if one part is not functioning well, because there are always alternatives close by. This keeps problems manageable and therefore gives problematic city parts time to adapt to changes in the city and society, without spiralling into ghetto formation. This is what makes piece-by-piece developed neighbourhoods structurally more flexible.

In the last chapter we have concluded that the main and most important element of a piece-by-piece developed neighbourhood is the structural axis. This axis is found in all well functioning piece-by-piece neighbourhoods and not in comprehensively planned post-war areas. The structural axes are essential to the development of a piece-by-piece neighbourhood since they have the ability to ‘glue’ different parts together. Every part connects to the axis, and they axis joins them spatially and functionally. The structural axis has five main physical characteristics: commercial activity on the ground floor, continuous buildings alongside, short blocks, a road profile suited for interaction between the two sides and diversity of buildings.

Since to this day the modernistic comprehensive planning system is used to develop neighbourhoods in
the Netherlands, it is time we start to look at how we can create new structurally flexible piece-by-piece developed neighbourhoods, instead of working with a system that creates fundamentally flawed areas.

5.1 Objectives

The most important aspect of creating structurally flexible neighbourhoods is to include various visions and structures in one single area. This can only be done by developing the area piece-by-piece, including multiple actors spread out over a longer span of time. But what is a longer span of time? Based on the analysed piece-by-piece neighbourhoods in chapter 4, somewhere around 50 years. Considering the fact that truly different plans can only be made in different contexts (which changes over time) we could also say that it would have to be around 10 years per ‘piece’. Since this is not the way neighbourhoods have been developed over the last fifty years, the main objective here is to develop a process to design neighbourhoods piece-by-piece. This process should be adapted to the current planning culture, but the main objective for this process is that it creates good results, in line with what has been concluded before. Specific planning regulation, existing institutions and the current construction process should therefore be taken into consideration, but are not leading criteria for the developed process. The process will be demonstrated by means of a case design, to provide an example and to demonstrate practical applicability.

When we develop a neighbourhood piece-by-piece, the main goal is the inclusion of different plans in one area, which should lead to the fore mentioned structural flexibility. It is therefore highly important that the process is a framework for development and that any actual design of physical structures beforehand is limited to the first ‘piece’ of development. If we make a comprehensive design and then phase the construction over a longer period of time, there is no fundamental difference with the way neighbourhoods are developed now, only that it takes longer. For real piece-by-piece development the actual design for a part should only be made right before it is built. This way the plan-making is spread out over time, and this is the only way to include truly different plans and visions into one neighbourhood (see also chapter 3 on planning). Designs for a piece should therefore also leave as much room for future designers as possible. Restricting them too much has the same effect as making the whole plan at once.
5.2  A step by step plan for piece-by-piece development

When we schematize the historical development of the researched piece-by-piece neighbourhoods in chapter 4, we can derive three alternatives for development. To these we can add one more theoretical alternative. The result is visible in figure 38.

Three out of the four alternatives start their development along an existing axis and, considering the importance we have given to the structural axis, it makes sense to use the selection of a structural axis as the first step in the development process of a new piece-by-piece neighbourhood. A step by step plan of the process could then look like this:

1. Define a location where either a well integrated axis exists, or a new one can be created. The axis should have an actual structural function in the city network.

2. Envision the growth pattern of the new neighbourhood (one of the four described before or any combination), depending on local conditions.

3. Define the goal for the first phase (usually the first development of the structural axis) and the design rules for development.

*Figure 38. Conceptual possibilities for piece-by-piece neighbourhood development*
4. Envision the relation with, and the influence of, the next phases for development. Which created parts will change due to new additions?

5. Create a plan for the first phase.

In the first step a location for the new neighbourhood is selected. This location should either include a road that is suitable to become a structural axis or have the option to create a new one. The only hard criterion for a to-be structural axis is that it should have an actual structural function in the city network. This could be tested for instance with the space syntax method, where a higher integration signifies a more structural function.

In the second step it should be analysed and envisioned which of the growth patterns for piece-by-piece neighbourhood development (or any combination) would be feasible and expectable on the selected location. This helps to understand which (design) choices may lead to a certain type of development at some point.

The third step is very important, for in this step the main framework for development is established. First a clear goal for the first phase of development should be defined. This will (should) usually be the first development of and along the structural axis. Only if this structure is already present or if a development model in which the structural axis is developed in parts is chosen can this step be different. Then some design rules for development should be set up. Because there are some criteria for quality, especially for the structural axis (see chapter 4), this is necessary since we are dealing with a neighbourhood developed in different parts by different people. To maintain quality in such a system and to guarantee that the neighbourhood is developed according to the piece-by-piece principle, some design rules and guidelines are welcome.

The fourth step is a kind of repetition of the second step but then in more detail. It is about envisioning how future changes might influence the current design and design rules and whether they should be adapted to that. Finally, a plan for the first phase of development can be made.
5.3 Case design: Development of a piece-by-piece neighbourhood in Utrecht

In this chapter a case design is presented, intended to clarify how the process outlined above can be applied. Because it is primarily for clarification, this case design ignores a lot of factors that would otherwise play a large role in the design process. The adaptation of the design and process to all these external factors however, would fall outside the primary objective for this thesis and is therefore left for future research.

The location of this case design is an area in the southeast of Utrecht (fig. 39-41). This area is a now mostly empty area on the edge of the city. There is however an opportunity here to develop a link between a neighbourhood (Lunetten) to the south and the university to the north (fig. 42). Currently, this direct link does not exist, even though a lot of students live in Lunetten. By creating a structural axis here, the link would be forged, and the area around it can be developed (fig. 43-44). When we compare, with a space syntax segment analysis, the situation before and after the creation of the new structural axis, it becomes clear that we are not only creating a well integrated link, but also improve the situation in Lunetten, extending the axis all the way into this neighbourhood and connecting to its centre (fig. 45). Hereby we have completed step 1 of the proposed process, selecting a location where a new structural axis has an actual structural function in the city network.

Figure 39. Location of case design in Utrecht

Figure 40. Location overview (source: Google Earth)
Figure 41. The area of the case design

Figure 42. A possibility for a structural axis

Figure 43. Area to be developed

Figure 44. Proposal for the location of a new axis structural axis
Assuming that the first phase of development is the construction of the structural axis and some buildings along it (fig. 46), we can envision some scenarios on how this area might develop later on. In the southern part of the area is a railway station. This is always an attractive location, so a first scenario is development starts here and then spreads north (fig. 47). Another possibility is that at some point a shortcut from the structural axis to the road towards the centre in the north of the area. This would make the area in between interesting to develop, since this is now a well connected place (fig. 48). Imagine however, that some of the current owners of the land do not want to sell it at that point. Then this part could simply be left for that moment, to give negotiations more time and prevent expensive expropriations, and another part could be chosen (fig. 49). This is the intention of step 2; to envision some scenarios in order to gain insight into what the options are.

*Figure 45. Space syntax analysis of the proposed situation. This suggests a continuation of the axis into Lunetten*
Figure 46. Conceptual result of step 1

Figure 47. Scenario 1: Development at the station

Figure 48. Scenario 2: Development of a new road and construction in between

Figure 49. Development of a new road and construction next to the axis
Step 3 is to define the goal for the first phase and the design rules for development. The goal of the first phase is the development (or start of development) of the structural axis. This structural axis will have to ‘glue’ future additions to the neighbourhood together. It must therefore be able to incorporate and adapt itself to changes in its immediate surroundings. Furthermore, the structural axis must comply to the list of qualities of structural axes concluded in chapter 4. To achieve this, a list of criteria for the structural axis has been composed:

**Criteria for the quality of a successful structural axis**

1. Commercial development must be possible along axis
2. Buildings all along the axis
3. Short blocks
4. Suitable road profile
5. Diversity of buildings

**Criteria to ensure the axis’ adaptability**

6. Space must be left for future infrastructure connecting new additions to the axis
7. Space must be left to incorporate buildings from new additions on the axis
8. Buildings on the axis must be able to deal with an incorporation in a future block

To ensure these criteria will be met, a design rule has been developed for each of them. We will look at them all briefly.
Commercial development must be possible along axis

This criterion is related to three main issues:

*Physical characteristics of buildings must support commercial use*

The physical characteristics of the buildings along the structural axis must support or allow for commercial use. This is necessary since the functions along the structural axis will change as the neighbourhood around it changes. What is residential in the beginning of development, might turn into commercial use later on. Therefore a functional flexibility should be built into all structures along the axis. Large minimum floor heights and the possibility for a display window are examples of possible rules here.

*The land use codes must allow the use of property for commercial use*

The land use codes and the zoning plan of the city must allow for commercial use all along the axis, and as much functions as possible should be allowed. This is necessary since it will not be clear what type of axis will develop itself at the beginning of the project.

*A certain amount of diversity is needed for commerciality to prosper*

As has been concluded in the analyses of older piece-by-piece neighbourhoods in Utrecht and older structural axes, diversity is needed for commerciality to prosper. Jane Jacobs also argumented this view in ‘The death and life of great American cities’ (1961). Since diversity is already a separate criterion on the list, it will be dealt with in more detail later on.

*Figure 50. A structural axis with commercial activity along it (Burgemeester Reigerstraat, Utrecht)*
Buildings all along the axis

If we combine this goal with the facts that there will different buildings by different developers within one block and that not all buildings along the axis will be constructed at the same time it becomes clear that some regulation is needed here. The simple constraint that all buildings should be able to deal with neighbouring buildings on both sides, now and in the future will be sufficient to ensure the possibility of continuous buildings on both sides. An extra rule concerning the alignment of facades of buildings within the same block could also be added here.

Short blocks

To achieve the desired outcome of small blocks, rules will have to be set to define what the length of blocks should be. The analysis of some structural axis in older neighbourhoods has produced some indications for this. The length of blocks in the studied areas moves around between 30m and 100m with an average of around 50-60m. The lengths of 30m and 100m can be used as minimum and maximum lengths of blocks. 50-60m can be used as a guideline number to strive for as an average.

During the development of the axis imaginary blocks of 30-100m can be set after which space will be kept for a street to connect future development. The blocks could be changed as long as its allowed for by the already constructed structures. These imaginary blocks would consist out of a number (depending on the length of the block) of plots of 6 metres wide, which is the average width of buildings along the researched structural axes. The width of the actual plots could also be varied according to demand, as long as the average remains somewhere around 6 metres.

Figure 51. Buildings must be ablt to deal with future neighbours on both sides

Figure 52. Imagined blocks with some construction within and space for future infrastructure in between
Suitable road profile

The road profile of a structural axis has to allow for interaction between both sides of the street. This requires a human scale for the profile of the axis. The functions of traffic axis and place of commerce require both space allocated for cars, as well as generous pedestrian facilities.

Research into historical neighbourhoods has shown that all structural axis have a similar road profile. The distance between opposing buildings is roughly 15-25 m. Streets usually have parallel parking on both sides and the sidewalks are generally wide. These numbers and conclusions can directly be used as guidelines for design.

Diversity of buildings

Diversity of buildings is essential for the success of the axis. It is linked to the axis’ main goal of binding different parts of the neighbourhood together, as well as to its ability to sustain commercial activity. Since too much diversity of buildings compromises the axis’ recognisability and coherence it is essential we strive for an appropriate amount (Haken & Portugali, 2003). The different forms of diversity (linked to the research in chapter 4) we will look at are:

1. Basic building shape and height
2. Material used for facade
3. Exact building plan and facade
1. **Basic building shape and height**

The axes of researched historical neighbourhoods usually incorporates three different types of buildings: 3-storey sloped roof, 3-storey at roof, 4-storey sloped roof. One can imagine that these sustain the human scale of the axis. Since there are always exceptions, this should be regarded mostly as a guideline.

2. **Material used for facade**

Researched axes show a use of around three different materials for the facade of buildings. More would probably reduce coherence and recognisability.

3. **Exact building plan and facade**

The research on other structural axes has shown that the amount of exact similar adjacent buildings varies between 1 and 20, with an average around 7. The numbers of 1 and 20 can be used as hard limits, whilst the average of 7 can be a guideline.

![Figure 54. Different building shapes found along studied axes](image1)

![Figure 55. Diversity along an existing structural axis](image2)
Space for future infrastructure

The construction of the structural axis is only the First phase in the development of a piece-by-piece neighbourhood. Different parts will be added over time. In order to link these future additions to the axis, it is necessary to reserve some space for future infrastructure in the development of the axis. This means that not the entire length of the axis can be used for the construction of buildings even though the space is available at that point.

The rule for this criterion is effectively the same as the one for short blocks. Because the length of blocks is already limited, afterwards there will automatically be space for future infrastructure. Only the exact amount of free space to be kept has to be established here. Considering some flexibility, since it is never sure what type of future additions will be constructed, around 3 imagined plots or 18 metres seems wide enough.

Space to incorporate future buildings

To achieve a true diversity of buildings along the axis, the structural axis itself has to be built up from additions from different times as well. Therefore, space has to be reserved on the axis for buildings to be constructed in following phases. Something that has to be considered though is the fact that the axis functions best with continuous buildings on both sides (see ‘Buildings all along the axis’). Allocating to much free space in the beginning will compromise the axis’ functionality. This can be solved by incorporating some semi-temporary structures on the axis that can be demolished at set points. Striving for an equal distribution in the end and counting on five construction phases the construction process could look like figure 52.

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<th>Constructed in phase 1</th>
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Figure 56. Keeping space for future buildings. A different color indicates a different construction period
Incorporation in a future block

When the structural axis is created, it is not yet clear what type of additions will be made in future phases. This may be the creation of urban blocks, as is not uncommon in studied historical neighbourhoods centred along a structural axis. Therefore, it is necessary that buildings created at the corners of imaginary blocks are able to deal with this kind of changes.

Now that all the design rules have been defined, it is important to think about who is going to check if the rules are complied to or not. Since piece-by-piece development projects can last 50 years it is important that this is done by an institution that can guarantee the necessary continuity. The only real option for this would be a municipal planning committee. Also, because some of the design rules established here might run contrary to commercial developers’ interests, a public committee might not be a bad idea. This committee would be formed by the municipality at the start of each piece-by-piece development project and would, for most of the time, not have to be very large. Since most construction takes place at known intervals (around 10 years apart), the committee could be expanded at those moments with various stakeholders, and reduced to a smaller size for maintenance afterwards. This way continuity and quality are guaranteed without creating too expensive organizations.
With step 3 done, it is time to see how this could lead to a piece-by-piece developed neighbourhood. It is important to know that this design is just an example of how it could turn out. Any different choice at any moment would lead to a different end result, since designers in following phases would respond differently.

The first phase’s main element is the actual construction of the road that will be the structural axis (fig. 58). When this is done, the planning committee can lay out a line of imaginary plots next to the axis, in which some imaginary ‘blocks’ will be defined according to the ‘short blocks’ rule (fig. 59-60). After each imagined block space is saved for future infrastructure. Various developers can now submit plans to the planning committee who will judge whether they comply to the design rules or not. Developers should be seen in the broadest sense here: commercial developing companies, housing corporations, individual people, no one should be excluded. After plans are accepted, they may be constructed along the axis (fig. 61-63). When all the construction that is allowed for by the rule ‘space for future buildings’ is made, the first phase of construction ends, and only around 10 years after first construction had begun the second phase can start.

Figure 58. The starting situation with the newly constructed axis already in place
Figure 59. Next to the axis, a line of imaginary plots will be laid out.

Figure 60. Within the line of plots, some initial blocks will be defined. These are by no way definite and can be adapted when necessary.
Figure 61. Plans can be submitted to the planning commission and, if accepted, be constructed along the axis.

Figure 62. The result of step 1 is a diverse start of development along the axis.
When the second phase starts, an important decision has to be taken by the planning committee. This is why it is important that is enlarged with various stakeholders at this point. It has to be decided which part of the area they are going to develop first next to the axis. In this example, it is chosen to construct a new road as a shortcut to the centre and develop the area between this road and the structural axis (fig. 64-65). Because the design rules only count for the structural axis, this new area can be developed as is pleased at that time. However, according to the ‘space for future buildings’ rule some more construction can be added along the structural axis in the second phase, and these buildings do have to comply to the design rules (fig. 66-67).

Figure 63. Bird’s eye view of the area after step 1 (new additions indicated)
Figure 64. A new connection can be constructed between the axis and the existing road

Figure 65. The area in between can be developed in this phase, and some new construction along the axis as well
Figure 66. Step 2 increases the amount and diversity of buildings along the structural axis.

Figure 67. Bird’s eye view of the area after step 2 (new additions indicated).
Ten years later, the third phase starts, which has the same layout as the second phase. A location is chosen for the new ‘piece’ and some construction can be added along the axis (fig. 68-70).

The fourth phase also has the same pattern, but now, according to the ‘space for future buildings’ rule, some buildings along the structural axis can be replaced or heavily modified. A lot of information is already available at this point about the development of the axis (what are the problems? What is going well?) so design choices could try to steer towards another direction (fig. 71-73).

When the fifth and final phase starts, we are forty years after the first development. In this phase the last ‘piece’ will be added and some final replacements on the axis will be made. By now, some real conclusions about the development of the neighbourhood can be drawn, such as were the centre is, what type of commerciality is mainly attracted, which functions might be lacking, etc. These issues can now be tackled for the last scheduled time (of course there is always regular renovation). The centre can be marked by an iconic building and some buildings can be adapted or put into place to attract extra functions (fig. 74-76).
Figure 69. Again, this step increases the amount and diversity of buildings along the structural axis

Figure 70. Bird’s eye view of the area after step 3 (new additions indicated)
Figure 71. The area that could be developed in step 4

Figure 72. In step 4 some buildings along the axis will be replaced by new ones
Figure 73. Bird’s eye view of the area after step 4 (new additions indicated)

Figure 74. The final ‘piece’ will be added in step 5
Figure 75. In phase 5 there will also be some replacement of buildings along the axis, again increasing the diversity.

Figure 76. Bird’s eye view of the area after step 5 (new additions indicated).
After this phase the neighbourhood truly looks like a piece-by-piece developed neighbourhood, with parts from all the decades before and a diverse structural axis (fig. 77). It has developed itself over the years from a few buildings along the first indication of the axis to a well functioning urban area (fig. 78-82). Because actually different plans and vision have been incorporated into the neighbourhood over time, it is now a fundamentally flexible neighbourhood which can sustain one of its parts functioning worse than normal because it goes ‘out of style’. It is also a neighbourhood in which different people and companies can find their place creating a diverse and sustainable public life. The structural axis forms the functional and spatial centre ‘gluing’ all parts together into a coherent entity. This is not a neighbourhood likely to deteriorate twenty years later.

Figure 77. A true piece-by-piece neighbourhood (every colour indicates construction from a different phase)
Figure 78. View towards the north along the southern part of the axis after step 1

Figure 79. After step 2
Figure 80. After step 3

Figure 81. After step 4
Figure 82. Final result after step 5
Conclusion: towards a change in planning culture

This thesis constitutes an effort to find out how to design and develop more flexible neighbourhoods than those constructed currently and during the last fifty years. The demise of the post-war neighbourhoods is one of the claims of this study and has also been the main motive for it. In the case of Utrecht, the lowest appreciated neighbourhoods are almost exclusively post-war modernist districts characterized by various social problems.

Our initial hypothesis, that the main problem lies in the comprehensive way these neighbourhoods were developed seems to be confirmed by evidence collected. The single vision behind these neighbourhoods means that they are easily outdated once the context in which they were developed changes over time. The post-war areas were, besides comprehensively, also planned in a utopian way. This means that in their plans far reaching predictions have been made about how the existing city and society would respond to the new neighbourhoods. Since predictions in complex systems, such as cities, are fundamentally impossible, there is always a risk that the results turn out differently (and worse) than imagined. These two things are exactly what happened in the post-war modernist neighbourhoods. Because they were developed in such a comprehensive and uniform way they have no alternatives within them, and no way to adapt to the new circumstances and developments. These neighbourhoods are structurally inflexible.

The way to turn around this comprehensive planning dogma, still widely used to this day, is to look at the alternative: Instead of developing neighbourhoods comprehensively, develop them piece-by-piece. This is exactly the way districts were developed before the era of modernist comprehensive planning, and because these piece-by-piece developed neighbourhoods incorporate a multitude of plans and visions, they possess the exact structural flexibility that post-war neighbourhoods lack.

Piece-by-piece neighbourhoods almost always organise themselves around a structural axis: a diverse street with lots of commercial functions on it, which runs through the entire neighbourhood and has the
ability to bind the different pieces together spatially and functionally. These structural axes are therefore essential for the development of a piece-by-piece neighbourhood and often already exist before the first development starts. If we want to develop new piece-by-piece neighbourhoods, this research suggests that we ought to start with this structural axis.

To develop true piece-by-piece neighbourhoods, the initial plan cannot include more than a design for the first phase or ‘piece’ and a framework with guidelines and design rules for later stages of development. This first ‘piece’ will usually be the structural axis and some of its first buildings, since it will form the backbone structure of the neighbourhood. The forementioned design rules will usually only apply only to the structural axis, to guarantee its quality and ensure its compatibility and adaptability to future phases.

A municipal planning board should be installed to guide the whole process of development, which will take around 50 years, and to check if the design rules and guidelines are complied to. This planning board could be relatively small during times with low development activity and could be expanded when a new development phase starts and a new piece is designed.

The case design presented in this thesis should be seen as an example of how a process to develop a piece-by-piece neighbourhood could play out, the most important thing however is the outlined process. There are real risks involved in continuing neighbourhood development according to the modernist comprehensive planning tradition, and the Netherlands is starting to show that. The demise of the post-war neighbourhoods might only be the first phase, since the nineties’ VINEX developments are planned essentially in the same way. This thesis is meant as a small step to change the planning culture of what might be called an ‘overly planned’ country, and adopt a fundamentally more flexible and ultimately more sustainable way of developing neighbourhoods.

Changing a planning culture is not done over night, but there are some current trends that suggest the system is already changing. In various neighbourhoods throughout the country, parts for individual development are now reserved, which are a big success. There is a trend of ‘historizing’ neighbourhoods, which means that they are made to look like an old diverse city or village core and in general there is a trend of including more architectural diversity in neighbourhoods. The problem however is that all these neighbourhoods are still realised by means of comprehensive project planning, which is in essence contradicting with what they are made to look like. Piece-by-piece neighbourhood development can structurally create the diverse neighbourhoods with opportunities for individual development that are now sought after. Before that is possible however, this planning system and culture will have to be researched further. The
process and case design explained in this thesis are just a tentative step; a very fundamental translation of a concept, in order to keep it as clear possible. This process will have to be much refined, however. Especially, we ought to check whether such concepts can be incorporated into the current planning culture and system and what kind of legislation and cultural changes that might result. Perhaps a whole new system should be strived for. A new type of zoning plan will definitely have to be developed in order to deal with neighbourhoods developed piece-by-piece over 50 years. Project management and the cooperation between commercial developers and municipalities will have to be reviewed and adapted. There is still a long way to go.

The important thing however is that this thesis sets in motion a new way of thinking about neighbourhood development. One in which development over time plays a central role and which strives for quality now and in the future. The modernist post-war neighbourhoods have shown that we definitely need this.


