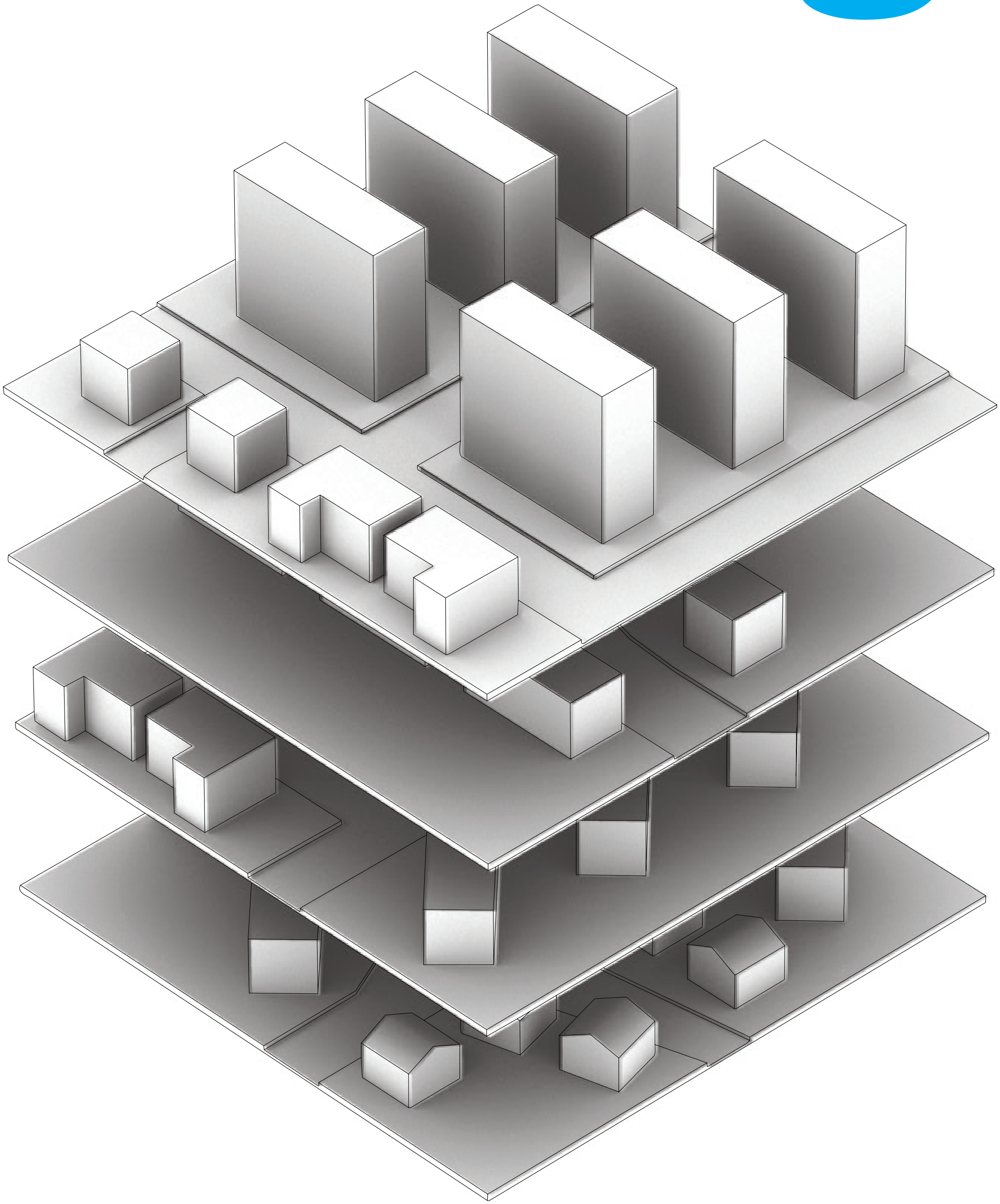
3D Villages



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Abstract

This thesisis part of a graduation project exploring the possibility of densifying the suburb to inner city densities, while maintaining its typical suburban qualities.

The research is made up of two parts, the first is a modelling exercise in which a suburban village is stacked upon itself and then evaluated for its physical qualities. The second part is a comparative analysis between the same suburban village and a number of iconic High-Rises with a focus on discovering the differences in physical and social quality between towers and villages.

It is found that towers generally have a high level of physical quality, while the suburban village has a higher level of social quality. In order to succesfully densify suburbs it is thus necesarry to develop a new system that achieves a reasonable success in both physical and social quality.

On the back of these conclusions I have developed a design system which incorporates the core quality of the suburban residence (a house with a garden) and the necessity of reintroducing natural and agricultural green space in between the suburb and the city with the physical and social requirements posed by the goal of creating urban density with suburban qualities.

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Introduction

I have long been fascinated by the idea of communities in the sky as alternatives for the current ground bound mode of organisation that is prevalent in most of the world. Although the ‘floating city’, often portrayed in science fiction, is still something that remains in fiction, the idea of reducing the footprint of human settlement is, in my opinion, one that merits interest.

Already 3.2 billion people across the world live in cities, and according to the United Nations World Health Organisation (WHO) this number will double by 2050 due to increases in, and shifts of, the population towards the city(Global Health Observatory 2014). Thus by 2050 a number of people roughly equal to our current world population will be living in the city, forcing us to find new ways of accommodating them.

Traditionally the solutions for growing the population capacity of most cities have been expanding their borders or increasing their density. However, with todays mega-cities we are at a point where in many cases growing the city horizontally is no longer a feasible, and certainly not a sustainable option. Therefore we need to focus on densification.

The phenomenon of densification has been the focus of architectural and planning theory before, and is often closely associated with developing vertically. The result of this vertically oriented approach has led to a tall building stock of highly varying levels of quality.

It is possible to roughly group this building stock into two categories that are strongly related to the socio-economic status of their users. The first being the metropolitan glass tower, and the second being the social housing tower.

The first type can be traced back all the way to the construction of the Home Insurance Building in 1884 in Chicago, officially the first steel skeleton skyscraper.

These multi-story office buildings evolved into the giant glass towers that we associate with the city centers of the worlds metropolises. Along the way they picked up housing functions, often offering high-end expensive apartments and penthouses with inner city allure for the richer segments of the population.

This type of tower focuses on offering high quality living and working environments for large amounts of money in order to produce profits. However they are inaccessible to most of the population due to the heavy financial requirements.

The second type of tower arose after the second world war when the need for cheap and efficient housing in large volumes led to interest in the tall building as a means for effieciently building these residences.

Le Corbusiers Unite d'Habitacion, which was part of his Cite radieuse, is probably the most influential design from this period, and sparked a flood of cheap Multi-Dwelling buildings, that as time passed were most often employed for social housing where budget and affordability were the main design criteria.

Remnants of his Cite radieuse and Unite d'Habitacion are still visible in the peripheries of many of the worlds cities, and have become symbolic for all that is wrong and can go wrong with cheap, high-density housing. Yet still many towns consider these quantity over quality towers as suitable housing options for their lower income residents.

In my opinion, the tower based (or really any other) densification strategy is only viable if it can appeal to more than just small segments of the population. To do this, we must offer complete and diverse living environments based on a large range of qualities.

Along with this, I believe that we can gain the most by densifying those areas that are now arguably the least dense, namely the suburbs. The difficulty lies in finding a strategy that allows us to densify the suburbs without compromising its core qualities, and while avoiding other problems that are generally associated with verticalisation and densification.

To do this, I have performed a number of small investigations that serve to clarify what qualities are offered by the suburb/village, and how these compare to those offered by examples from our current tall building stock.

I

In the first chapter I will delve in how the contemporary suburb came to be, and which alternatives and improvements we have seen in recent architectural and planning theory. Here I will also clarify my position vis-a-vis densification and veritcalisation, expanding on the theme of the verticalisation as an alternative to the traditional suburb.

In the second chapter of this thesis, I will define what constitutes quality in our current built environment for both horizontally and vertically oriented projects and try to link these findings to spatial solutions.

In chapters 3 and 4 I will evaluate and compare current vertical and horizontal systems for the presence of different aspects of quality to demonstrate the strengths and weaknesses of current vertical building practices.

The conclusions from the chapters on quality form the input for the organisational system (here dubbed '3D village') that I will propose in chapter 5 and then evaluate according to these inputs in chapter 6.

This work should provide the necessary ingredients as well as a recipe for uniting the qualities of the sub-urban village and the tall building into a verticalisation based densification strategy suitable for sub-urban areas. The final design can be viewed as alternative to urban sprawl, which in my mind is one of the mayor problems in contemporary urban planning.

Chapter 1

Of Towers and Cities

Many (theoretical) debates on tall buildings focus on verticality vs horizontality (or densification versus sprawl), this view is in my perception more of a hegelian dialectic than anything else. As such, this chapter is about the synthesis of these two extremes which I will refer to as 3-Dimensionality.

In this view I find myself supported by Jaap Wiedenhoff, the director of Arup in the Netherlands whom in his interview for the book The Vertical Village states that the future of urban development should not be either horizontal or vertical, but a combination of both (Samia Henni 2010).

Sprawl vs Densification

What follows is a short examination of influential theories that relate to the themes of sprawl and densification.

To start with my earliest, and possibly most famous, example. In 1898 the urbanist Ebenezer Howard published his seminal work Garden Cities of To-morrow (Ebenzer Howard 1898) which he based on the population shift from the countryside to the city, a trend that was rapidly emerging at the time.

In the introductory part of this book, Ebenezer describes the relationship between the town, the country, and a third region which he names town-country. He examines the movement of the population through comparing the three regions with three magnets pulling on the population. (fig. 1.1).

Ebenezer describes the strength of the magnets as the sum of the positive and negative aspects of the region for its resident population. In this model, he believed that it was the area in between the town and the country (ergo town-country) that would ultimately pull the hardest on the population, causing most people to choose to reside there (Ebenzer Howard 1898).

The rest of the book describes the implementation of this utopian ideal for the Town-Country; the Garden City. He presents us with a worked-out system of collective wealth, spatial organisation and social conventions. The organisational concept is a central city, which contains all the features that we expect from a city, with outlying cores connected to the

Figure 1.1 - The Three Magnets (Ebenezer Howard 1898)

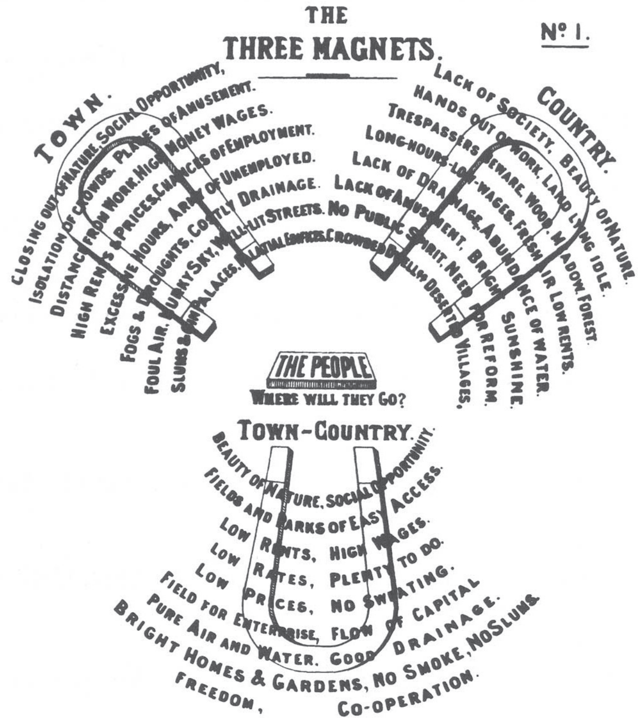
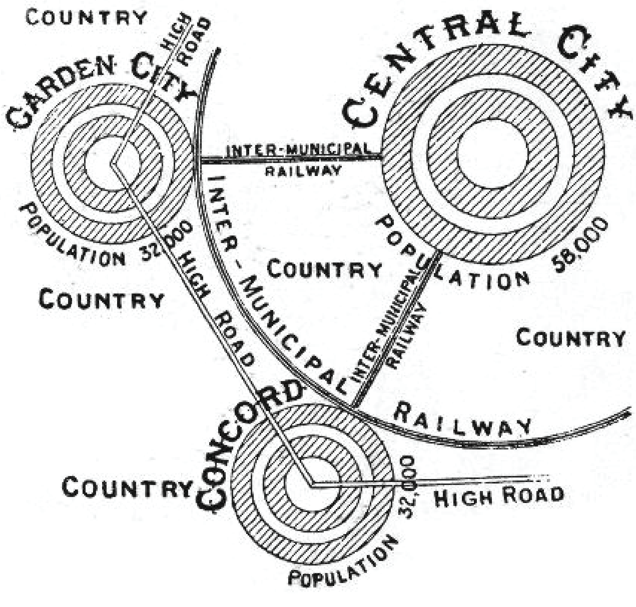


Figure 1.2 - Garden city principle (Ebenezer Howard 1898)



city by swift (public) infrastructure (fig. 1.2).

His predictions were correct. Most of the current world population now lives in and around the city, however the term ‘Garden City’ came to reflect a different mode of living than described by Ebenezer.

Seduced by the ideal of the ‘country home’ evoked by the term Garden City, people wanted a spacious home with a front and back yard outside the bustle of the city, yet near enough to take advantage of the services offered by the city. Thus the contemporary suburb was born.

The persistence of this ideal in the collective imagination speaks to the power of the home with garden principle. Actually, it can even be said that this is the motor of the suburb as it is the element that most sets it apart from inner city living.

This ideal, in combination with cheap fossil fuel and rapid developments in telecommunication, allowed for rampant city expansion, and for the distance between work and family life to become larger and larger.

The result in the Western World is a situation of almost limitless urban sprawl, with the free standing single family home as the dominant housing type in the USA, and row housing with front and back yards in Europe.

This type of expansion has its limits though, and we are now already increasingly confronted with its drawbacks.

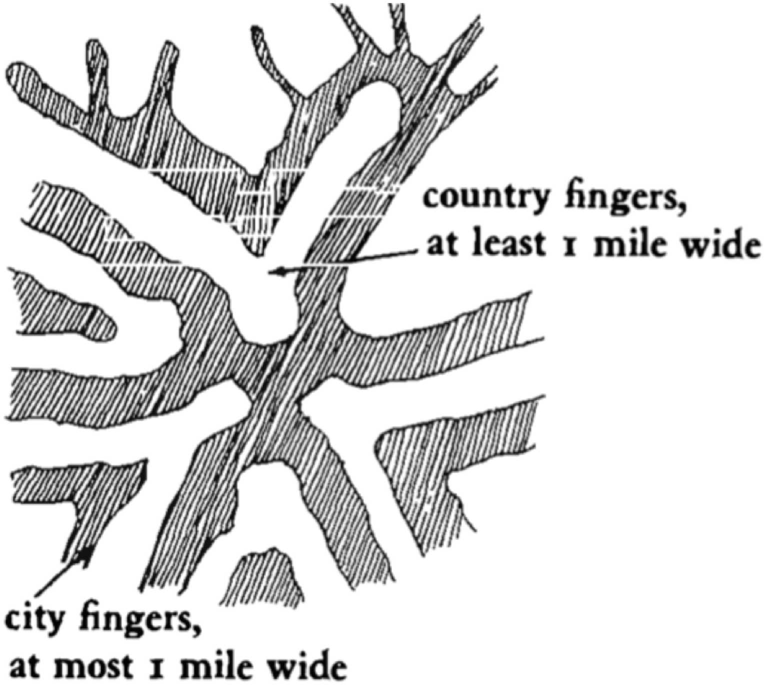
Depleting reserves of fossil fuels, and long congested infrastructures surrounding city cores are disincentivizing automobile focussed mobility, and increasing distance to, and overal shortage of, food producing landscape (Carolyn Steel 2009) are all calls to change our approach to land consumption.

If there ever was an argument for considering densification instead of expansion as a primary mode of development it would already be sufficiently covered by the previous paragraphs.

However, there is more.

The relationship between city and countryside has long been a theme in utopian literature. Thomas More spent a large portion of his novel on the fictional country of Utopia (Thomas More 1997) on describing the relationship between its residents and nature, and the organisational principles proposed here have been echoed in many influential works over the past centuries.

Figure 1.3 City-Country Fingers (Alexander, Ishikawa et al. 1977)



The first example of this is in Christopher Alexander's work A Pattern Language (Christopher Alexander 1977), where he argues that the city should be developed using the principle of interlocking city-country fingers (Fig. 1.3). He states that a strong relationship between city and nature is essential for a high quality living environment.

A more recent publication by Carolyn Steel describes the relationship of the western world in with regards to its production landscapes as broken, which leads to a disassociation between the city and its surrounding landscape. Her argument is that the city should embrace its production landscape, and that efforts should be made to include this landscape within city bounds. Here she is consciously restating the conceptual frameworks of Ebenezer Howard and Christopher Alexander (Carolyn Steel 2009).

A solution that has often been proposed to realise these visions has been through the implementation of vertical organisation methods. This would result in a decreased footprint of human occupation and an increase in land available for other uses than residential.

Christopher Alexander himself already lays the framework for this idea by proposing that residences should be built on the hills, leaving the valleys for agriculture (Christopher Alexander 1977) (Fig. 1.4). Thereby reducing the footprint of human occupation.

Nevertheless he argues against vertical organisation as having any merit in a community. His argument hinges on the fact that tall buildings destroy social life, which, although a valid argument, is in my opinion a design issue and not inherent to the phenomenon of vertical organisation.

Other advocates of the densification of land usage through seeking verticality are the brothers Das (Robert Das 1992). Whom propose medium height 'pyramids' with private terraces on the outside and communal space on the inside (FIg. 1.5).

A last example of the implementation of densification as a means of solving the dysfunctional relationship between city and country is the 2003 exposition 'sky high: vertical Architecture' held by the Royal Academy of Arts in London in cooperation with Sir Norman Foster. In the book accompanying this exposition, Chris Abel and Sir Norman Foster discuss the underlying reasons for creating tall buildings.

They centre their argument around the themes of density, sustainability and quality of urban life. They invoke Ebenezer Howard's model of the city in combination with vertical organisation as a solution for the problems of reduced quality in suburban areas. (Chris Abel 2003)

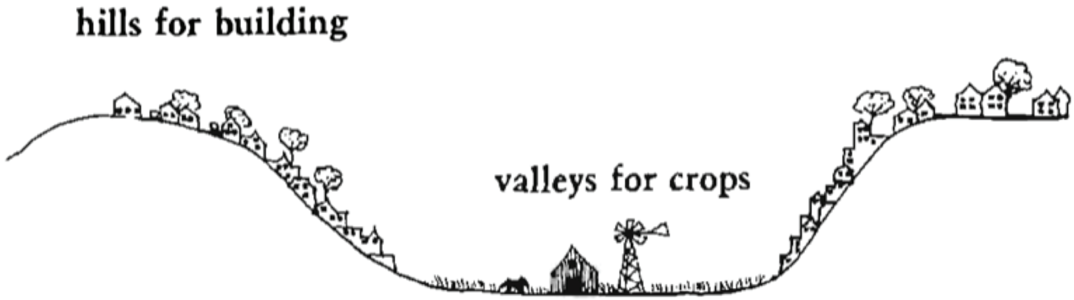


Figure 1.4 - Building on the Highland (Alexander, Ishikawa et al. 1977)

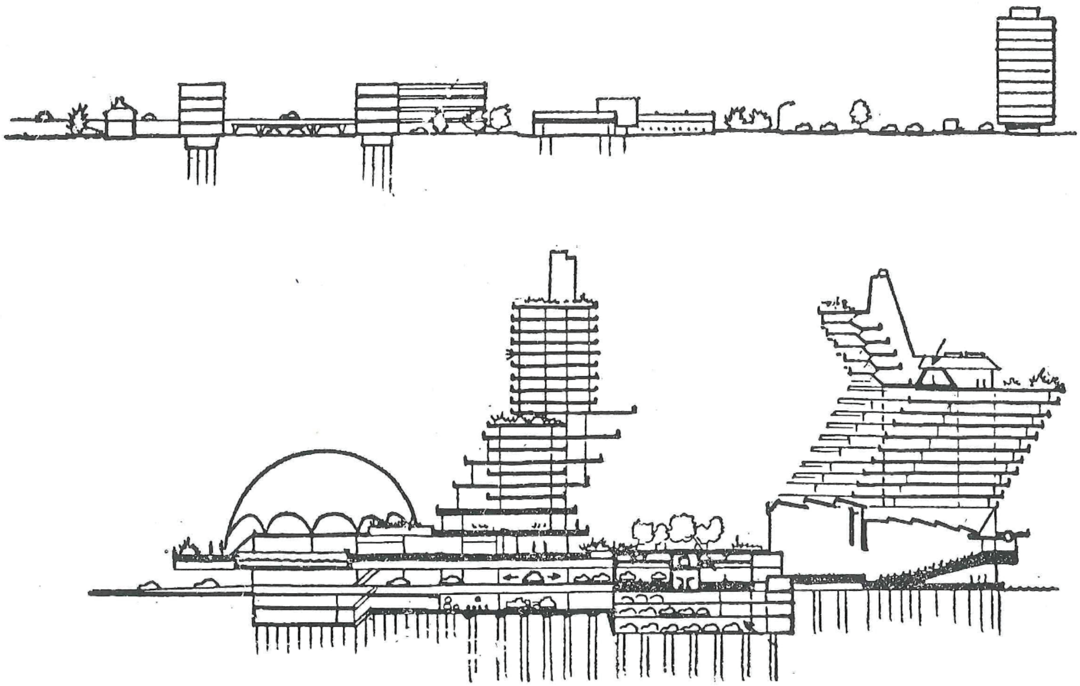


Figure 1.5 - Vertical Living (Das and Das 1992)

Increasing density is for them a necessary step in evolving the model of the city and its suburbs to cope with these developments, however this increase in density should not come at the loss of quality of life in urban environments.

Thus we once again return to the concept of quality, which is fundamental in advancing verticality's legitimacy and by extension my argument for 3-Dimensionality.

Conclusion

In my mind it stands beyond reproach that the best option for dealing with the expected expansion of cities is densification. However, I am also convinced that densifying by simply transforming areas with suburban characteristics into areas with inner city characteristics is not the way to go.

What we need is a densification strategy that can provide the core qualities of the suburb at inner city densities.

I was able to trace back the root of the appeal of the suburb to the ideals evoked by Howard's Garden City, most notably three aspects of this garden city.

1. A home with a yard
2. Close proximity to nature and farmland

The second aspect of quality has slowly been eroded by horizontal expansion of the city, comparing a section of the transition from country to city, based on the garden city (Fig 1.6) with a section of this same transition of current cities (Fig 1.7) the problem becomes apparent.

The red line in these diagrams represents a so called density curve, which in the garden city case shows two bumps, a low one representing the suburb followed by a valley which is the green space that seperates the suburb from being part of the city center, and then a hgher bump for the city center itself.

The expansion of the city has eaten away the in-between land, smothing out the density curve, and essentially annexing the suburbian village into the city. Reintroducing nature and farmland into the city landscape, and in particular in between the city and teh suburb, can be leveraged to raise the appeal of a vertical densification strategy over the current horizontal expansion model.

It is my main objective to densify the suburb with these two qualities as an uncompromising basis.

Figure 1.6 - Garden City Section

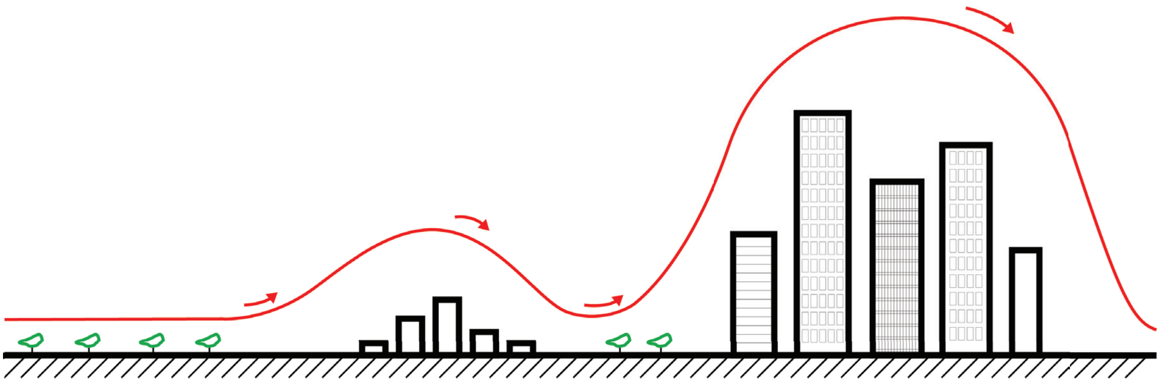
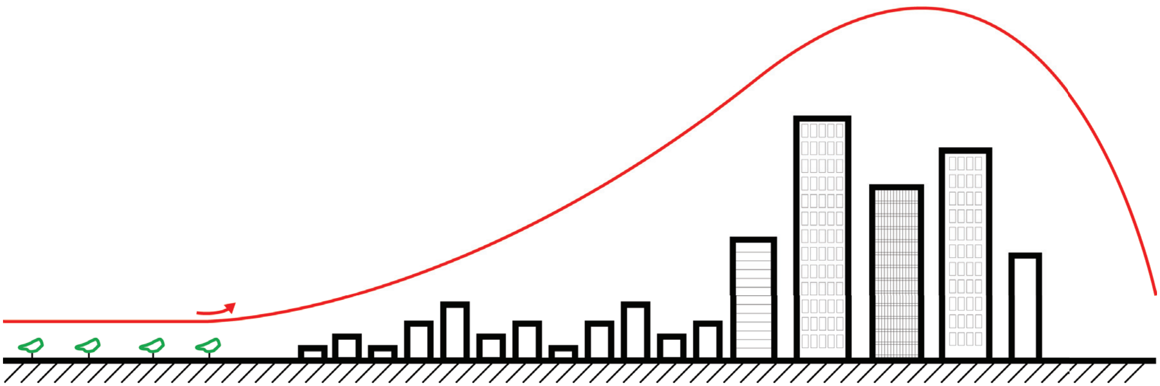


Figure 1.7 - Contemporary City Section



Chapter 2

Quality

The notion of creating quality is the conceptual basis of the 3-Dimensional system that I will propose during this thesis. Because of this I will take a full chapter to explain my definition of quality, and try to describe the role that architecture plays in creating it.

Quality in itself is a vague term, and generally describes the way a collection of individual elements work together. These elements or factors of quality are not always the same, and can even differ greatly from person to person. Thus aside from vague, quality is also subjective.

Yet there are many places that are collectively judged to be better places to live or work than others. Poorly lit basement offices are generally much less desirable than well lit high-rise offices, and everyone can agree that the desirable living conditions in present day central London are a far cry from the smog filled slums that characterized this area in the late Victorian period.

These differences are understood as improvements in quality, and are quite universal for our species (although there are undoubtedly people who prefer dank basements to bright offices). Thus although quality covers a diverse range of factors, and can be very subjective, there are definitely elements that generally contribute to a perception of high quality.

My aim in the following chapters is to discover which factors or elements of quality are present in horizontal and in vertical systems, and how these factors compare to each other.

Elements of Quality

The first step in analysing quality is improving the managability of the concept by dividing it into subsets. I have chosen to group factors of quality into three sets based on the nature of these qualities. These three groups are:

1. Physical Qualities
2. Social Qualities
3. Aesthetic Quality

Physical Quality

Physical qualities, as the name suggests pertains to the physical qualities in the living environment such as sunlight, daylight, fresh air, views, etc. These qualities are characterised by the fact that they can be relatively easily quantified, measured and, most importantly, predicted.

Through literature review it becomes very obvious that for as long as there have been tall/vertical buildings there have been studies celebrating their physical qualities.

Long views, fresh air, and ample availability of sunlight are the celebrated trio of qualities that almost all vertically oriented buildings posses. Of the books and articles written about these phenomena, perhaps the most comprehensive is the book that accompanied the similarly named convention in Pennsylvania in 1977 Human Response to Tall Buildings (Donald J. Conway 1977).

These characteristics are often combined with highly efficient infrastructure and ground usage that simply cannot be achieved in a vertical direction (Jean Gottmann 1966).

Because of the predictable nature of the physical qualities, there is no need to carry out an in-depth literature study. As they are the current selling points of building vertically, they should be amply provided for in any system that aims to improve upon the current situation.

For this investigation I will be focussing on the following factors of physical quality:

- Direct Sunlight
- View
- Distance to nearby shops
- Distance to nearby leisure space
- Distance to water

I have chosen these factors on the basis of the fact that they are relatively simple to measure and predict, making them suitable design tools for shaping a densification strategy.

Other factors that are important but that will not be evaluated within the scope of this thesis are:

- Fresh Air
- Wind
- Daylight
- Climate

These factors are dropped since they are either too difficult or time consuming to measure (Daylight, Wind, Fresh Air), or are related more to the individual object rather than the system (Climate).

Social Qualities

In the previously mentioned Human Response to Tall Buildings (Donald J. Conway 1977) an intriguing observation is made that plays a guiding role in many investigations into tall building quality from the 1980's on.

Authors that set out to determine residential satisfaction of living in a tall building, all seem to find that although the residents enjoy the high level of physical comfort offered by the tower, they are less enamoured by the lack of strong social ties and community feeling among residents. (Gerda R. Wekerle 1977) (Gilda Moss Haber 1977).

Tall buildings seem to lack qualities associated with strong communities and are often associated with factors that implicate disfunctional communities. Things such as low neighbour to neighbour interaction, low levels of prosocial behaviour, strain, fear of crime, mental health, suicide risk have all been associated with existing high-rise structures.

In a condensed literature review, Robert Gifford tries to frame these associations/accusations within their scientific context. Although he himself already points out that he did no new research, and that his research cannot be said to have conclusive evidence of whether each of the above mentioned aspects is or is not caused by verticality, he does find some suggestive relationships between height and several negative factors. (Robert Gifford 2007)

The factors that to him appeared to correlate with taller buildings are: strain caused by residential density, suicide risk, low pro-social behaviour, difficult social interaction and overall bad conditions for having children. (Robert Gifford 2007)

These are serious issues that need to be addressed if 3-dimensionality is to become a viable system of development. On the bright side, these are also problems that can potentially be solved through design (with maybe an exception for the suicide risk).

A core problem of social quality in general is that although its constituent factors can often be measured in existing neighbourhoods, they are extremely hard to predict and possibly even more difficult to steer.

Yet there is a way to, to a degree, objectively compare social quality in horizontal and vertical systems. This same comparative technique can also be employed to develop an educated guess on whether a (unbuilt) structure will function on a social level.

The method that I employ is based on the understanding that although architecture cannot enforce the formation of strong social bonds, it can certainly suggest and create opportunities for it to occur (Alain de Botton 2006). If we can isolate those elements that contribute to strong social environments, then it should be possible to compare horizontal and vertical structures on their potential social performance.

To simplify: if we can isolate the spatial elements that contribute to strong social relationships and wellbeing in an environment, and if we can find built examples that are known to be socially strong environments then we can also make a prediction about an unbuilt project through comparing the plan to the existing examples.

I will start with identifying those elements that contribute to social interaction based on the works of the famous Dutch architect, Herman Hertzberger and the equally famous Jane Jacobs. Whom are strong advocates of the rule that the higher the chance for interaction, the higher the quality of the interactions will become. This notion hinges on the principle that Hertzberger refers to as 'seeing and beeing seen'.

In order to situate this analysis, I have selected a Dutch village, Haren, as an example of a well functioning sub-urban area that is generally regarded as a high quality living environment both physically and socially. For the rest of this thesis Haren will be a reference point that represents horizontal organisation.

Herman Hertzberger

In his book, Lessons for students in Architecture, (Herman Hertzberger 1991) Hertzberger puts forward that community formation hinges strongly on the relation between private and public space, and the use of public space.

This idea already assumes the presence of one major factor that influences social quality, namely the availability of sufficient public space. The importance of this idea becomes easily apparent when we look at a plan view of any area within Haren (FIg. 2,1).

In this relationship he introduces a few concepts describing different aspects of this relationship. These are:

- Territorial Claims
- Territorial Differentiation
- Territorial Zoning
- In-Between Spaces

Territorial Claims

Territorial claims is simply the notion of what belongs to whom, or in other words how public or private is a space. The measure of territorial claim as described by Hertzberger comes down to two things:

1. Degree of Accessibility
2. Responsibility for the space

Degree of accessibility refers to how easy it is to access a certain part of the public space from the home. I would like to emphasise the last part of that sentence, as accessibility is often expressed in terms of infrastructure reasoned from main traffic arteries.

Responsibility for a space seems to be a quite straightforward term. However, determining who is responsible for the space is a more challenging concept since a simple statement such as “the person whom owns the space” is not a sufficient answer.

Numerous examples show that certain spaces, generally belonging to the collective, are often claimed to various degrees by private parties that reside near, or sometimes in, it. These parties feel responsible for this space, and thus aim to improve and maintain it.

This is decidedly not the case in most skyscrapers, where a building manager is in charge of all public space. Hertzberger argues that this shifting of responsibility to an institution actually reduces the tendency of people to form communities. By hiding behind common rules instead of seeking conflict people separate themselves from each other.

The most basic example that Hertzberger uses to describe the role of architecture in territorial claims is that of the door, and its function as a barrier. He claims that the nature of the door (materialisation, in which direction it opens) determines whom controls what part of the space around the barrier.

Although this example is on a smaller scale than that at which this project is situated, the idea is very transferable.

An important caveat to this is that although Hertzberger argues for a certain element of ambiguity with regards to ownership, Jane Jacobs in her seminal work The Death and Life of Great American Cities (Jane Jacobs 1992) blames this same ambiguity for making streets unpleasant to access for strangers and makes a strong argument for rigid boundaries.

Since both Hertzberger and Jacobs are strong advocates of the concept of eyes on the street, these two ideas about public space would at first

Figure 2.1 - Private Space vs Public Space

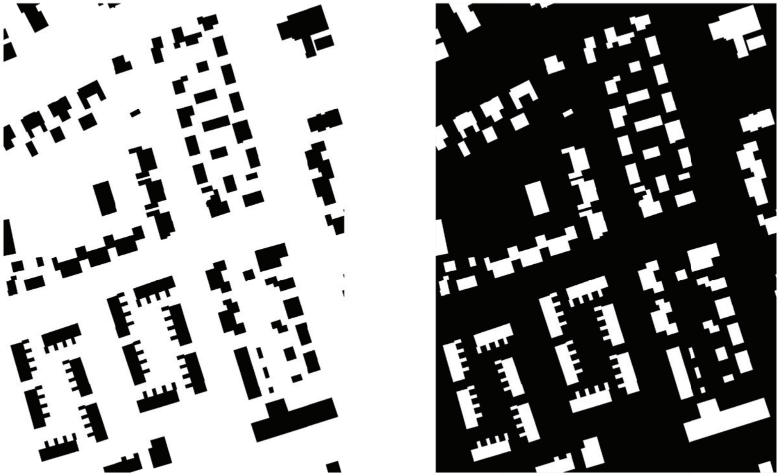
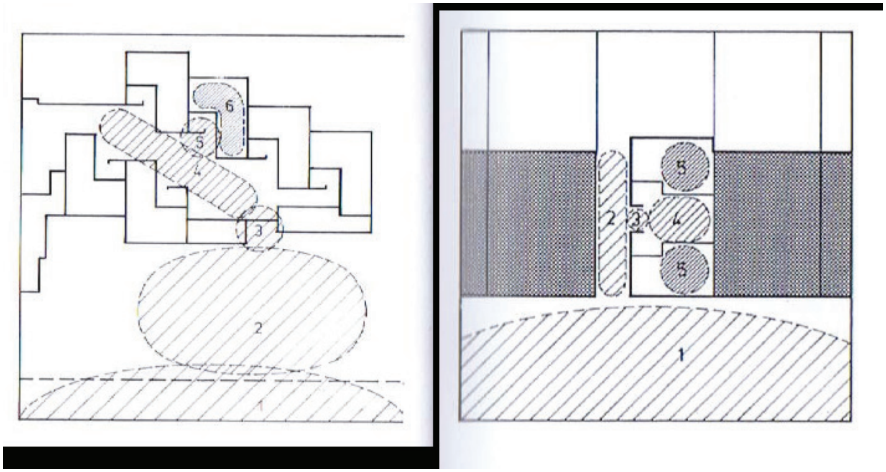


Figure 2.2 - Territorial Differentiation (Herman Hertzberger 1991)



glance seem to contradict each other. It is however my belief that they can coexist, resulting in an important characteristic that any street should have.

Streets should have a clearly public and clearly private zone, in between these there may be no, one, or more ambiguous zones (areas where the private atmosphere extends into the public, or vice-versa), however each zone needs to be clearly marked by a physical or at least visual boundary (Fig. 2.3).

An important secondary factor is how the space is accessed from the home. Clear demarcations of boundaries will not help if there is no strong connection between the interior private space and the exterior public space. By investigating this relationship it will be possible extrapolate how a given situation will perform on a social level.

Territorial Differentiation

Territorial Differentiation is more of a design technique than an actual element. By mapping access to spaces it is possible to determine which territories will fall into more public or more private categories (Fig. 2.2).

I have applied this technique to a few streets in Haren to illustrate the relationship of the private residences to the public streets. When looking at the analysis (Fig. 2.5) it immediately becomes clear that all residences have at least one, and often more, zones with a heightened degree of privacy leading up to their doorstep. This type of organisation of the public space can be found all throughout Haren, irrespective of the size and typology of the homes.

This differentiation in territorial claim on what is otherwise perceived as public space is exactly what Hertzberger means with territorial claim and differentiation, and is one of the core elements of what makes Haren a successful social environment.

Territorial Zoning

Territorial zoning is about the aesthetic consequences of the idea of territorial claim. Although this is not a strong organisational principle, as this is essentially a result of a system of organisation, it is a very important part of the elements of community as it is the bridge between spatial organisation and spatial expression.

A recurring theme in user satisfaction of the skyscraper type is the positive effect of self-selection on the reception of living in tall buildings (Belinda Yuen 2006) (Robert Gifford 2007). It is then only logical that allowing for large levels of freedom and user choice is a positive attribute of a future community centred skyscraper.

This would mean that traditional top-down design as usually employed in tall buildings is not sufficient to simulate the flexibility that is enjoyed in horizontally oriented systems. Rather, I shall propose a system which is highly similar to the “plot with infrastructure” development system that is usually applied in horizontal expansion.

In-Between Spaces

In between spaces is about the usage of barrier spaces as elements to stimulate interaction.

Due to the ambiguous nature of in-between spaces there are bilateral feelings of ownership and responsibility for these spaces. This is reflected in the territorial analysis of Haren that I mentioned earlier. The nature of the spaces between what is completely public and completely private dictate the way in which they can be used.

For example, the front yards that are prevalent in Haren serve a barrier function for strangers, but invite neighbours to visit, and can even combine with the street in collective activities such as community barbecues or childs play.

Figure 2.3 - Spatial Organisation Diagram

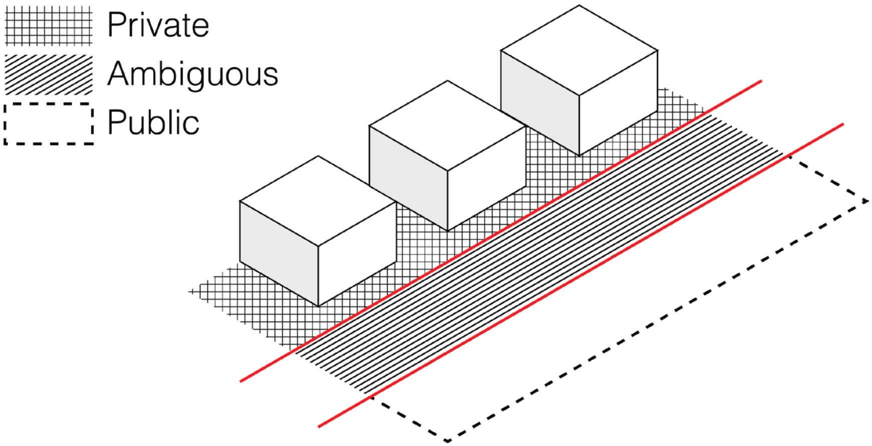
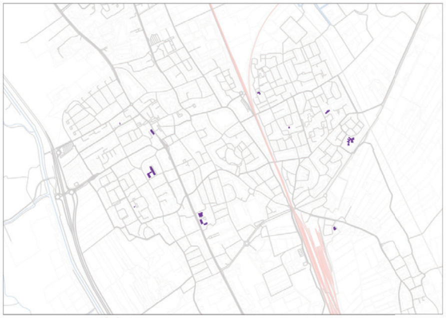
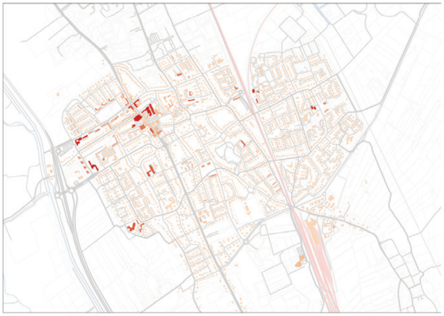


Figure 2.4- Function Maps Haren

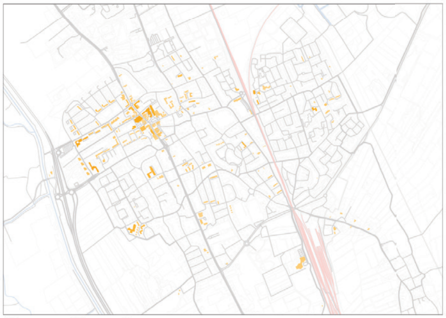
Haren



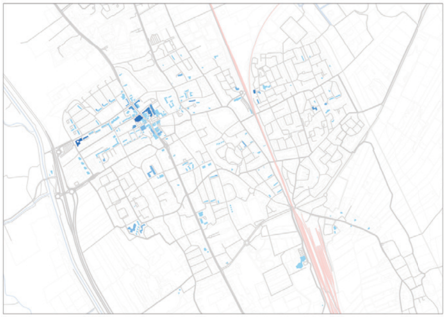
Haren - Healthcare



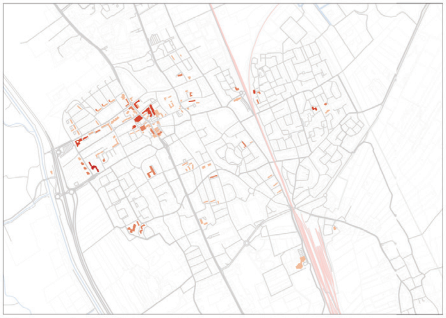
Haren - Living



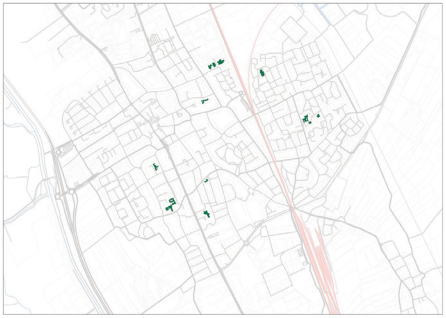
Haren - Shopping



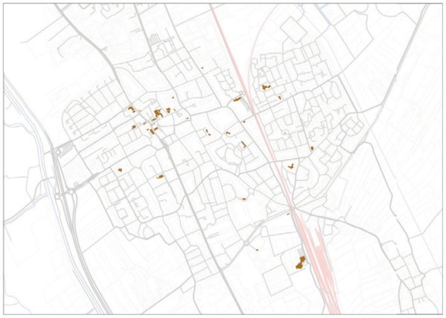
Haren - Offices



Haren - Industry



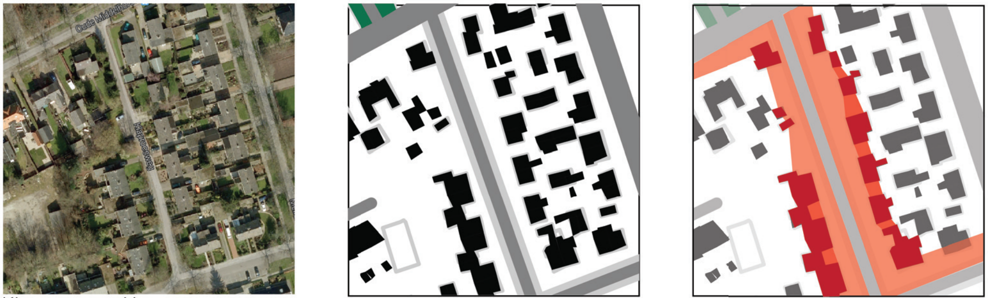
Haren - Education



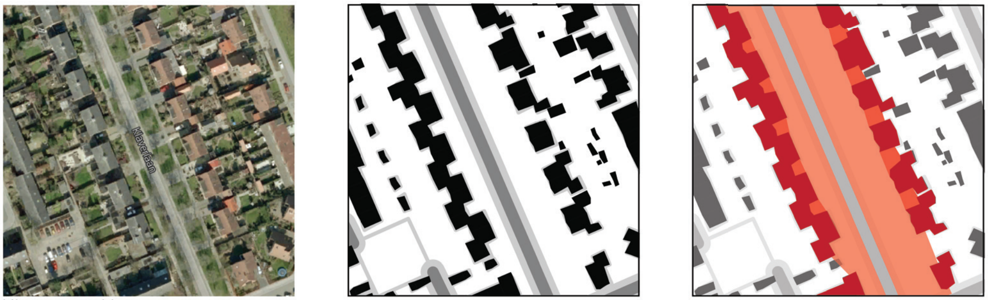
Haren - Gathering

Figure 2.5 - Territory Analysis

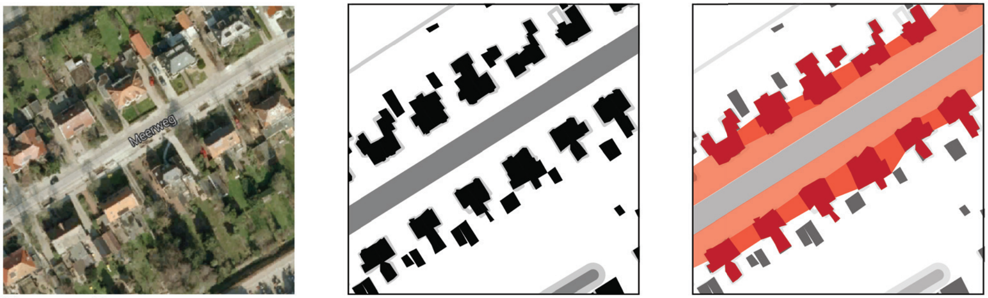
Blekenweg, Haren



Klaproosweg, Haren



Klaverweg, Haren



Meerweg, Haren

Other Social Qualities

Aside from the principles set forth by Herman Hertzberg in his book Lessons for Students in Architecture I have also drawn inspiration from its sequel, Space and the Architect (Herman Hertzberger 2000).

In this volume he examines the role of the urban structure in the development of communities. He even goes as far as to argue the need to configure buildings as cities, quoting one of histories greatest works of architectural writing, Leon Alberti Batista's De Re Aedificatoria Libri;

'… for if a city, according to the opinion of Philosophers, be no more than a great house, and, on the other hand, a House be a little City; why may it not be said that members of that House are so many little Houses.'

Since this project operates on the border between building and city/village I have studied several aspects of the organizational structure of Haren which plays a defining role in how a village functions. These elements all contribute indirectly, but prominently, towards the creation of social quality. Because of their importance as well as their ability to provide a design framework, these elements form the backbone for the 3D system that I have developed.

Network structure

One of the most striking qualities of the structure of a village is its network of streets. These streets perform a double function, as the backbone of the way that housing is organised in the village, as well as providing a route to a destination.

Telling is the fact that a popular approach to street planning is to avoid dead ends so that traffic may always circulate, and that every street becomes a destination and a route at once. This stimulates the local population to wander these streets, and explore different routes to their respective destinations, ensuring a great number of 'eyes on the street' and improving the number of encounters and thus interactions among locals.

In this network (Fig. 2.6) only the smallest streets are dead ends, and then they usually perform the dual function of acting as open public space where children playing on the street scarcely competes with the need to accomodate traffic.

A second characterisitc of this network structure is the Hierarchy (Fig. 2.7), by differentiating between high speed, medium speed and low speed zones we can predict the locations where social interaction is going to take place.

Figure 2.6 - Haren Roads

Figure 2.7 - Heirarchy of Haren Roads

This structuring produces clarity in the intended purpose of the common space, and at the same time offers a strong framework for the placing of the village programme.

Mixed Programme

The main characteristic of any human settlement is its mix of different programmatic elements. Even the most segregated cities require shops and small offices as well as educational and healthcare facilities interspersed between its residential programme.

At the same time, most settlements know some kind of centre where there is a higher concentration of non-residential functions and generally a higher density of residences.

The most extreme examples of this are city centres where population density is extremely high and there is generally a large offering of different programmatic functions. Even in small towns such as Haren this type of clustering is present as can be seen in the programmatic analysis (Fig. 2.4).

Perhaps the clearest way of visualizing how the programme is spread around the town is through a function heat map (Fig 2.9). What we see in this diagram is the number of functions that are clustered togethe; when the colour is hotter there are more functions located in close proximity.

This visualisation allows us to draw a few important conclusions about how to organise programme.

- There should be a defined center.
- Residential and non-residential function should be mixed.

Scales of Interaction

The last element of social quality that I have identified is a combination of Herzberger's notion of seeing and beeing seen, and my observations on organisational structure. I refer to this as 'scales of interaction'.
The scales of interaction theory hinges on two elements: proximity and shared use, I have visualized how this system works in a diagram (Fig. 2.8).

Starting with those that are nearest to us, we form relatively strong social bonds with our direct neighbours whom we see, meet and most likely converse with on an almost daily basis. This is the first scale of interaction, and comprises a fairly limited number of people.

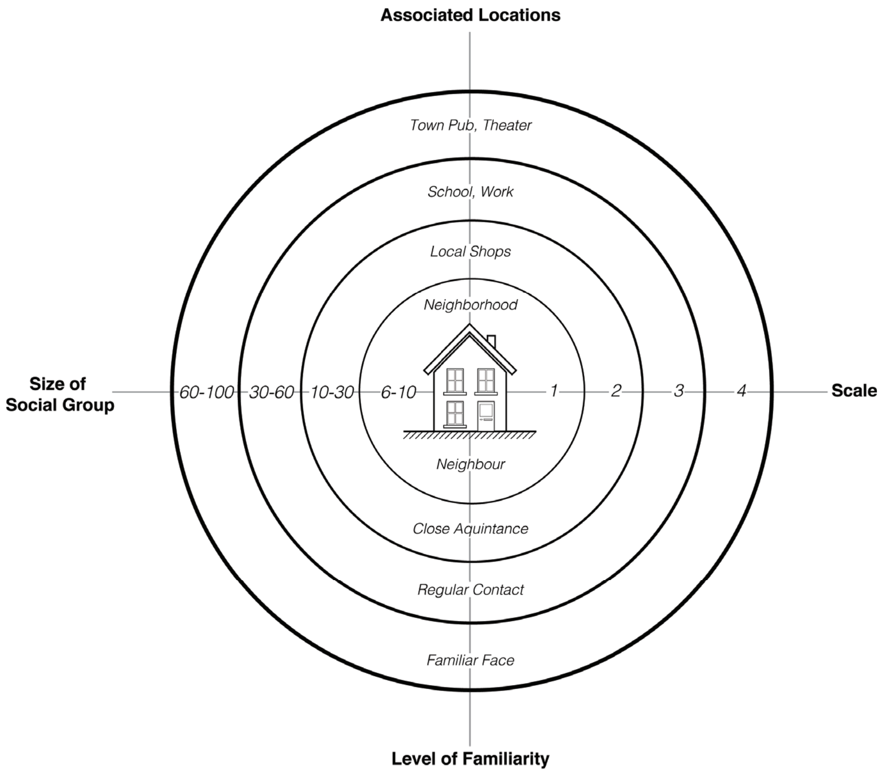
The second scale is comprised of the small neighbourhood facilities (such as the local grocer, bakery, etc.) and its visitors.

We meet our direct neighbours, but also those that live a few streets away in these settings, and construct an awareness of whom populates our social environment. Enough of these encounters may even result in the formation of friendships.

Next in line are those facilities that serve more than one neighbourhood such as schools or the workplace. These facilities perform the same function as the local shops, however the number of people we meet there is more diverse (although a colleague can also be seen as a semi-permanent neighbour). We may strike up occasional chats with people we meet in these circles, and we certainly familiarize with them.

The last circle in the diagram is populated by the type of functions that we visit less frequently, but that still have primarily social functions. Most of the people here are familiar, but are most likely not acquaintances. Nevertheless, these social contacts also contribute to a sense of community.

Figure 2.8 - Scales of Interaction Diagram



Aesthetic Qualities

The last characteristic, the Aesthetic quality, is and has been perhaps one of the most controversial topics in tall building design. The heavy, dominating visual presence of these mastodons has caused a sharp debate seemingly split on whether tall building design should aim to be as invisible as possible, or to be the exact opposite.

Although this debate does have its merits it is also highly subjective, which makes it a potential minefield for discussion.

Because of the strong emphasis on building construction and technology that is inevitable in tall building construction, I shall opt for a relatively modernist approach (not style) with regards to aesthetics, and leave discussion on the employment of aesthetics in tall buildings to someone else. Form in my system shall be primarily dictated by functional or technological constraint.

Conclusions

From this chapter we can conclude that there are a number of elements that influence our perception of quality.

First, there is the importance of physical quality such as sunlight, view, air etc. These qualities are measurable and predictable, making them useful tools for shaping the 3D village.

I will primarily focus on:

- Sunlight
- Views
- Distance to nearby facilities
- Distance to nearby leisure space

Further evaluation of these topics can be found in chapter 3.
More difficult are the social qualities of an area. These elements of quality are difficult to measure and steer, and thus require a slightly more complex approach if they are to be used as design guides.
The approach that I have chosen is one that focusses on physical/spatial elements that are associated with strong social performance. For this I have isolated the following spatial characteristics:

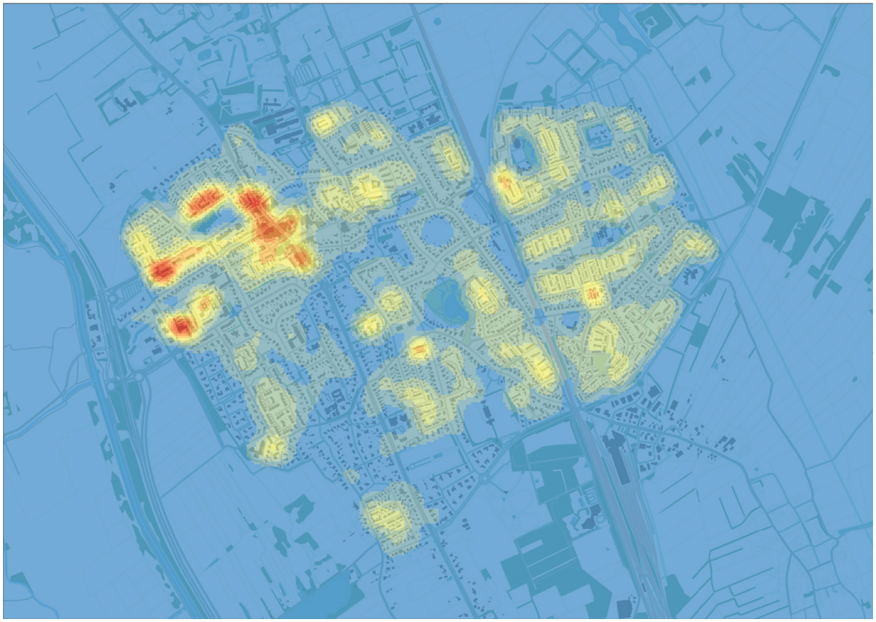
- It must be clear to what degree space is public/private or in between.
- Borders between spaces of a differing public/private character must be legible for both residents as well as strangers. (e.g. using obstacles or materialisation)
- The system must be adaptable to changing demands.

- The infrastructure must be network-like, allowing the street to be both a route and a destination.
- There should be a mixed-use and mono-functional area.
- There should be a possibility for interaction between the interior of private residences and the adjacent exterior spaces.

An in-depth analysis of this is performed in chapter 4.

To make the task of evaluating for, and applying, all of these quality aspects more manageable I have combined the above mentioned elements as well as some from the conclusions from chapter 1 into a scoring sheet which can be found in appendix A.

Figure 2.9 - Function Heat Map Haren



Chapter 3

Investigating Physical Quality

This chapter focuses on the physical elements of quality as mentioned in the previous chapters. I will start with explaining the method of investigating these qualities, and then go into the results of this investigation ending with recommendations for use in the designing of a 3D village.

Since there are no examples of built projects that are on a comparable scale to what I am attempting, I was curious to see what would happen if I simply stacked Haren on top of itself. To make this measurable I conducted a computer driven simulation based on this idea.

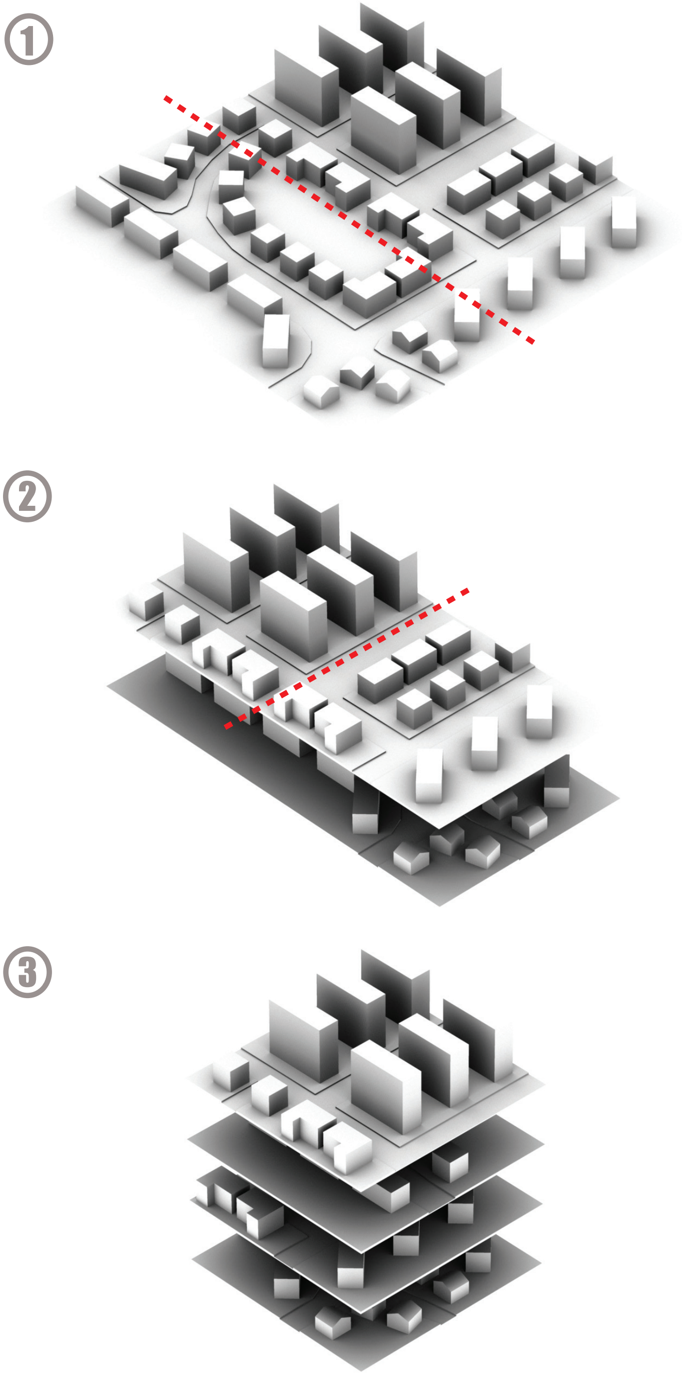
The principle behind Haren's simple transformation from horizontal to vertical comprises cutting a digital model of the town in half and stacking the pieces on top of each other. The resulting geometry is evaluated for a number of qualities, and then once again cut in half and stacked, etc (Fig. 3.1).

In this rudimentary transformation all parts of the town are translated into the vertical system without predjudice, causing some of them to lose their function (e.g. roads that cannot be accessed by cars).

Another thing that I expected to occur was that the stacked geometry would underperform on many qualities that are usually associated with tall buildings. It may seem strange to run an experiment which you expect to fail, however it helps in proving that there are a few things that tall buildings definitely do well that are not necessarily the result of stacking.

At the end of this chapter, the results of this investigation are plugged into the Physical Qualities segment of the Quality evaluation Matrix. Together with the outcomes of a benchmark analysis based on Haren in its current state, they provide insights into which physical elements form important design considerations.

Figure 3.1 -
Transformation Principle



Dataset

The first step consists of building a digital model of Haren that contains all the information necessary for performing a range of analyses. To do this I have compiled a dataset from several databases that feed the model. In this case the used databases are:

1. Basisadministratie Adressen en Gebouwen (BAG): a database containing information about a buildings physical conditions and use. (VU Geoplaza 2014)
2. Algemene Hoogtebestand Nederland (AHN): a grid of 25 by 25 meters containing height information for the whole of the Netherlands. (Het Waterschapshuis 2013)
3. openstreetmaps: online database containing geometric map information.(AND_data 2007)

The dataset comprises a vector based 2 dimensional map (shapefile) from openstreetmap, which is coupled with attributes distilled from the BAG and AHN databases.

The vector geometry is associated with the following attributes:

- Location
- Floor area
- Function
- Outline
- Height

After the geometry-attribute coupling takes place in ArcGIS , the resulting file is imported into the Rhino Grasshopper environment where the height information is used to translate the vector information into 3D geometry.

Parameters

Each step in the verticalisation process is evaluated for a number of parameters. These parameters are the constituents of the physical qualities present in the model and fall into three categories.

1. Object qualities
2. Environmental qualities
3. Height related qualities

Object Related Qualities

Object related qualities, are those qualities that are experienced at the object level. These qualities are typically physical such as sunlight, views, climate etc.

Of these qualities I am only interested in those that are not regulated by the object itself. Qualities such as interior climate are not measured since they are arranged at the object level, however qualities such as sunlight and views are the result of an objects position and the geometry around the object and thus of interest.

Sunlight

Sunlight is an important object quality, since it determines a large part of user satisfaction. It is well known that favorable positions with regards to sunlight are, especially in residential objects, strong selling points.

There is an important distinction with respect to direct and indirect sunlight. Where direct sunlight is a phenomenon that is relatively easily modeled and measured, indirect sunlight poses a more complex problem.

Due to the complexity of bouncing light, and the scatter caused by different types of materials it is very difficult to create an accurate model without knowing the material properties of each object. With the resources at my disposal this certainly does not fall within the scope of this research.

Another factor that has not been accounted for is daylight, which is a combined product of direct sunlight, and light refracted through the skydome. A few attempts to incorporate this into the analysis model resulted in an extremely slow script that was prone to crashing. For this reason daylight analysis also falls outside the scope of this investigation.

A detailed solar analysis within the scope of the research is sadly not possible. The amount of computational power necessary to carry out such an analysis on the scale of an entire village within a reasonable time falls outside of the available resources.

As such, the solar analysis is an approximation that creates an informed impression of the solar qualities throughout the transformed geometry. The method that is employed to measure sunlight is a mesh-ray intersection where the rays are cast from the vertical faces of simplified object geometry. Each face casts a number of rays that looks at the position of the sun at different moments of the day. For each facade it is recorded which rays do and do not have intersection events.

The number of rays that do not have any intersection events are counted, and resolved on an object level by comparing which facade receives sunlight at which hours. For each unique ray, which represents one hour of daylight, the object is granted one point. This results in a score for each object that is representative for the hours of daylight it receives. The range of this score is anywhere from 0 hours to 12 hours of sunlight per day.

The output of this analysis is then resolved for each object by adding the number of hours of sunlight per object facade. These are then sorted into ranges of 0, 1-3, 4-6…10-12 hrs of sunlight per day and passed to the data output components.

To develop an understanding of the distribution of sunlight in the transformed geometry, there is also a visual output. In this visualization objects are colored from black to white according to the hours of sunlight they receive during the day.

Views

Views are, next to sunlight, one of the most important characteristics of a residential building. They are also the traditional advantage of building vertically, as stacking removes obstructing geometry from the viewing plane.

In this investigation, a facade is determined to have a view when no other objects within the confines of the town block its line of sight.

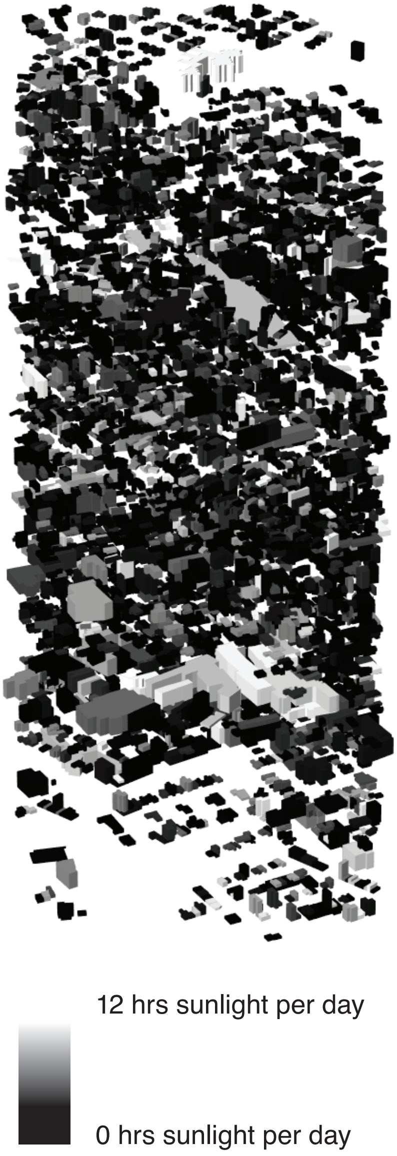
The way this is measured is by defining a vector at the center of a facade, that has a perpendicular direction to its surface. When this line does not intersect with any geometry the facade is determined to have a "view".

The number of objects with at least one facade with a "view" are counted and logged.

Just as with the sunlight parameter, the distribution of views is visualized to create an understanding of how the quality develops.

Figure 3.2 - Direct Sunlight Visualisation (B&W)

Figure 3.3 - Distribution of Views Visualisation (green to red)



Environmental Qualities

The environmental qualities are, just as the name implies the qualities that are present in the environment in which the residential objects are situated.

These qualities relate to the pleasantness of the living environment, and are thus both physical and intangible qualities.

The physical qualities mainly refer to the availability of nearby parks, shared facilities such as shops, schools etc. These individual elements are also indicators of the state of the social structure within the organisational framework.

Distance to Facilities

The first type of parameter that is measured is the distance between residential objects and different types of facilities. These distance are expressed as maximum, minimum and average distances and are calculated by measuring the distance between the centerpoints of geometries (Fig. 3.4).

Aside from these measurements, a color coded visualization is also generated. This provides an impression of the spread of facilities across the original and transformed village fabric.

What is important to note here, is that the distances measured are absolute and linear distances. This means that the measurements do not take into account additional travel time that is the result of not being able to travel in a straight line from one object to another.

Here a distinction should also be made between distances that are mostly horizontal vs distance that are mostly vertical. Horizontally we tend to move at walking speed within our direct environment, which is about 1,4 m/s while if we would traverse vertical distances we would most likely be using a combination of walking and elevators, which is significantly faster (most elevators move between 3-7 m/s) and also requires less effort.

Another limitation of the method is that it does not necessarily provide information about which distances are most often occurring within the extents of the measured domain. To gain an insight into this, the standard deviation from the average has also been measured.

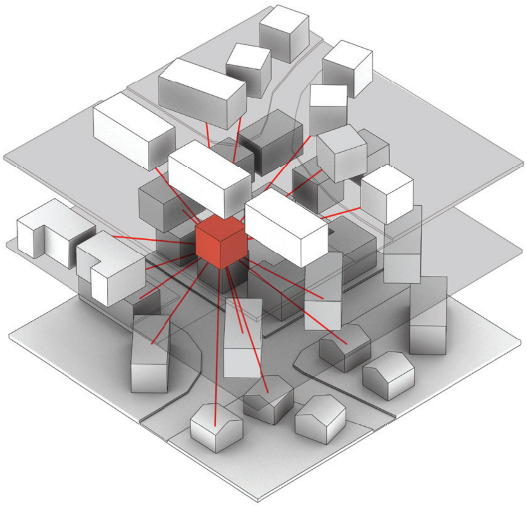
Distance to Leisure Space

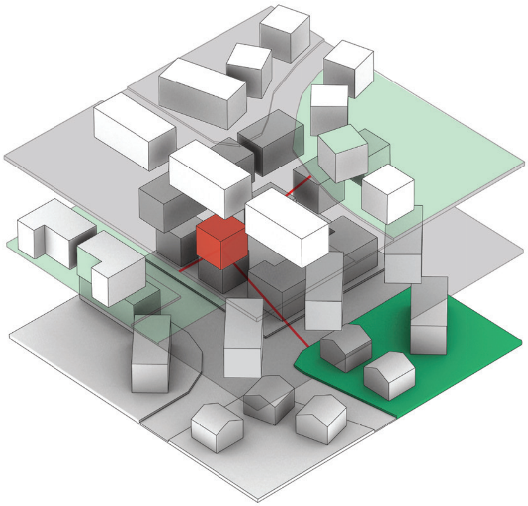
The distance to leisure space is measured in a similar fashion as the distance to facilities. The only notable difference is the fact that here the distance between the center of the residence and the closest point on the outer perimeter of the Leisure spaces is measured (Fig 3.5).

This difference stems from the fact that the Leisure spaces often occupy large areas, making their center a less accurate point to measure to.

Figure 3.4 (Left) - Distance to Facilities

Figure 3.5 (Right) - Distance to Leisure Space





Benchmark

To provide a dataset with which to compare my findings, I performed the above described analysis on the model that represents Haren as it exists today.

Below are the results of this analysis which form both the control/ benchmark for my experiment and at the same time the programme of requirements for the 3D village system that I will propose later on.

% Objects without view	% Objects with view
86,9	13,1

Footprint (km2)	Density (residence/km2)	% Open Space	% Built space
7,7	758,7	91,5	8,5

Distance to(m)	Shops	Offices	Industry	Sport	Gathering	Care	Education	Other
Min	20,6	30,5	8,6	11,3	9,7	144,0	10,3	6,4
Max	2014,8	2397,0	2866,8	2227,0	2501,1	2969,7	2346,5	2570,0
Avg	889,1	1235,8	1316,7	928,4	1221,5	1419,4	1070,8	1127,3
StandDev	367,9	567,4	683,0	386,3	598,3	688,6	496,3	601,2

Distance to(m)	Forest	Water	Park
Min	91,9	58,3	91,9
Max	2956,4	2954,2	1740,4
Avg	1687,3	1861,1	821,4
StandDev	663,0	534,6	327,8

hrs sunlight	# Residences
<0	5
<3	8
<6	45
<9	5714
<12	89

Percentage of	Forest	Water	Park
0%	0	0	0
20%	1	1	1
40%	0	0	0
60%	0	0	0
80%	0	0	0
100%	0	0	0
Area (m2)	618801,5	129742,0	68781,2

Figure 3.6 - Haren, Height

Figure 3.7 - Haren, Direct Sunlight

Figure 3.8 - Haren, 3D Representation of Spread of Functions

Figure 3.9 - Haren, Views

Model Analysis

Height and Footprint

One of the obvious results of this transformation sequence is the development of the height and the size of the footprint. Each subsequent step halves the footprint while doubling the height, creating an exponential relationship.

Object Qualities

The development of object qualities such as sunlight and view are actually quite easy to predict due to the simple nature of the transformation.

Sunlight

The first quality, direct sunlight takes a drastic hit in the first few steps when for half the town the sunlight is blocked by the newly created level above them. This trend continues for the next few steps as more and more sunlight is blocked by the floor plates of each level (Fig. 3.11).

However, as the footprint of the building starts to shrink, so do the sizes of the floor plates. Resulting in a rebound of the sunlight curves. It is at around division 8 that most residences once again start receiving light. These findings suggest that sunlight can potentially be a decisive limitation when designing a large building that has a heavy vertical component.

View

View wise there is not much of an unexpected development. There is an approximately linear relationship between the number of division and the amount of views (Fig. 3.10).

The objects that have these views are located at the edges of the floor plates as can be seen in the visualized transformation. A few very large objects stand out since they have many facades which contribute to a relatively high score in the view department.

This development of quality shows us that the creation of views is implicit in building vertically. Because of this, there is no need to place a heavy emphasis on developing this quality in a 3 dimensional system as long as a system is chosen that does not introduce a lot of obstructing objects in the facade (which is unlikely because of the strong relationship between sunlight and views).

Figure 3.10 - Development of the Number of Views

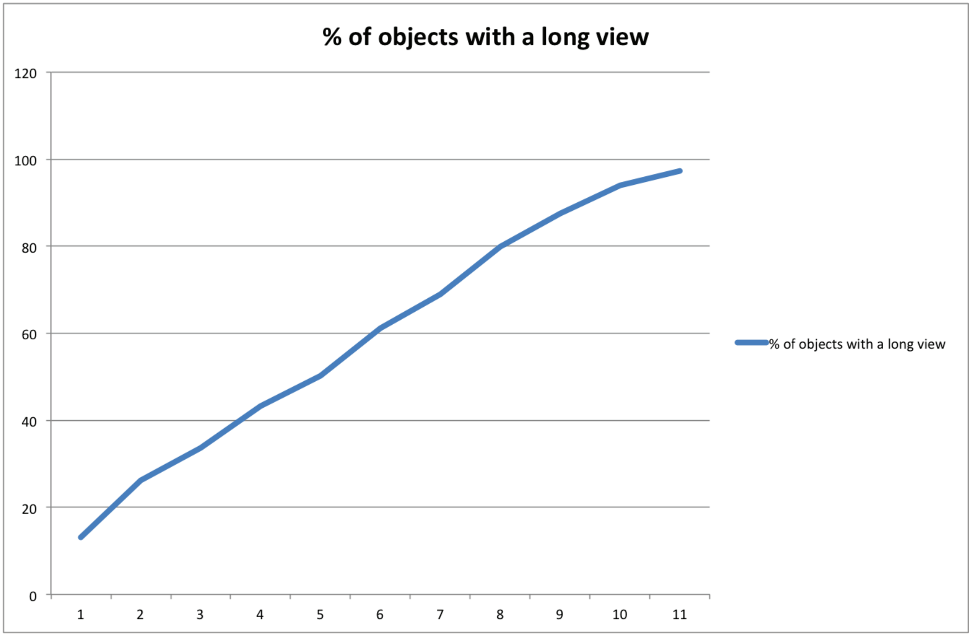
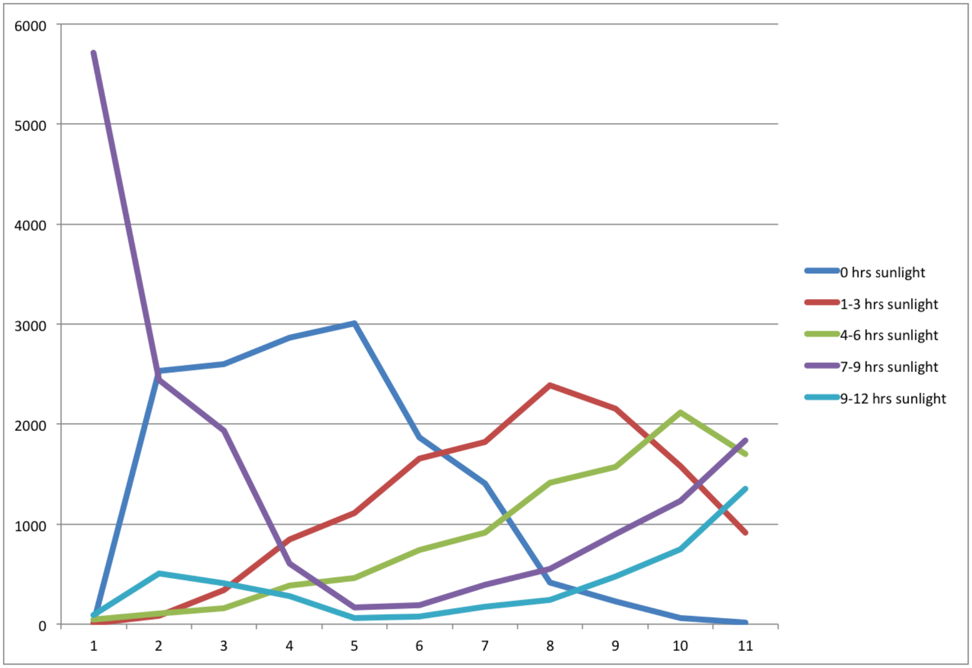


Figure 3.11 - Development of Direct Sunlight Quality



Environmental Qualities

Regarding the environmental qualities, one of the most prominent qualities that is developed is the nearness of facilities.

Distance to facilities

All distance developments follow approximately the same curve, of these I will use the development for the distance to shopping facilities as an example (Fig. 3.12).

The chart shows the maximum, minimum, and average distances that where measured along with a region of one standard deviation within which most of the distance fall.

It is clear that there is an optimum at 5 divisions, after which the height of the building starts to cause distances between residences and facilities to grow again.

This turning point can be seen as an indicator that creating a tower which is too high can be as detrimental to quality as extreme sprawl.

Distance to Leisure Space

Approximately the same pattern can be observed when looking at the distances to leisure spaces such as water, forests, and parks. However, some abnormalities are observed when the tower becomes extremely tall (Fig. 3.14).

Most likely these are the result of some discrepancies in the measurement script.

Conclusions

Before concluding anything on the basis of the research results, I want to stress that although some of these findings seem to argue against the entire notion of using verticalisation as a densification strategy because they introduce design problems that do not have to be solved in horizontal organisation, a few things should be kept in mind.

First of all the applied transformation is extremely simplistic, a system that was never designed for height is suddenly sliced into pieces and stacked on top of itself. The problems that emerge from this are indicators that we simply need to take into account different design considerations when building vertically vs horizontally.

Figure 3.12 (Left) - Distance to Shops Throughout the Stacking Process

Figure 3.13 (Right) - Visualisation of the development of View Throughout the Stacking Process

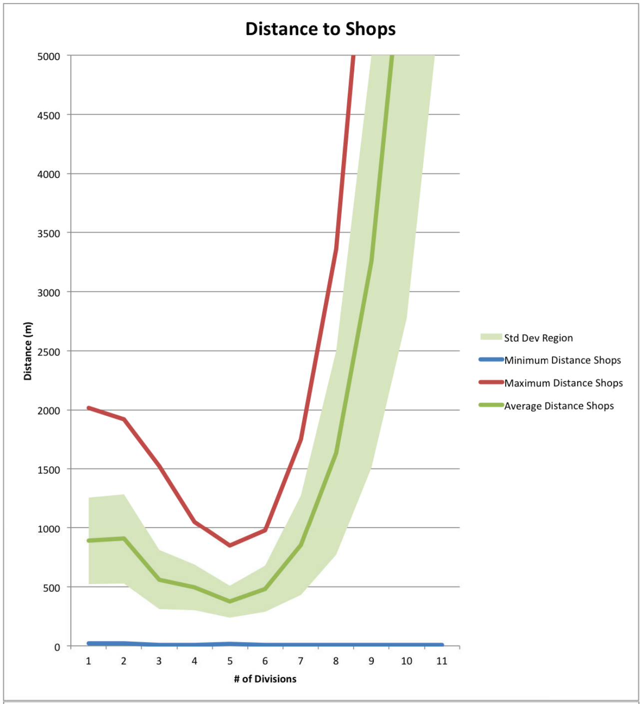
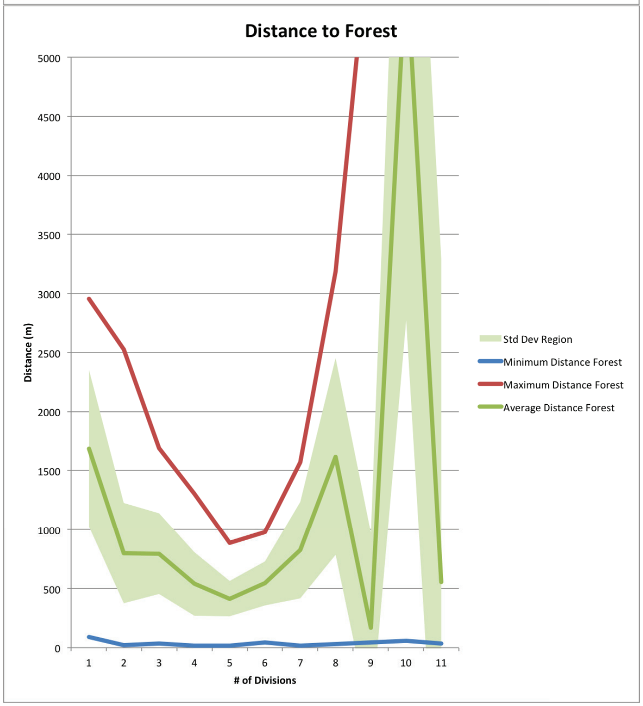
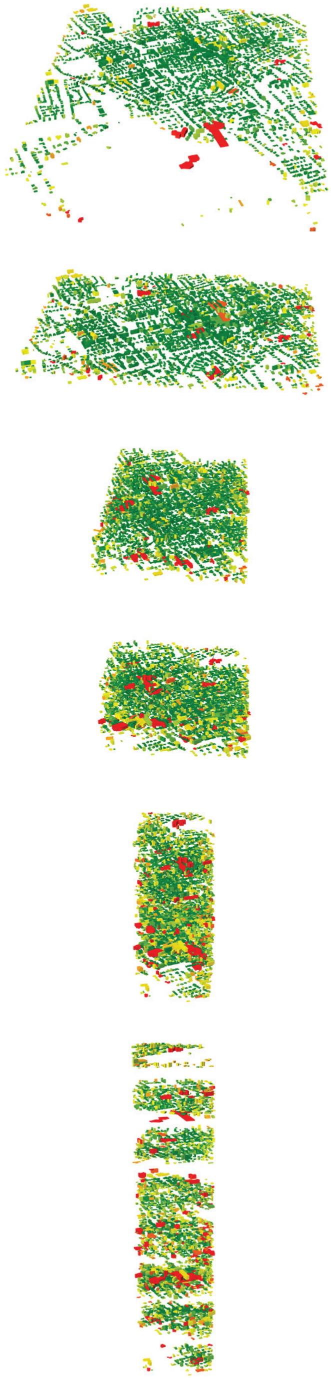


Figure 3.14 (left) - Distance to Leisure Space Throughout the Stacking Process





Second, the usefullness of the exercise lies not in a simple comparison that proves that one system is better than the other (Haren has had 100's of years to grow into what it is today, the stacking transformation ran in 5 minutes and was concieved in less) but in an uncovering of what we can expect to be determining factors when designing for a vertical system.

When we look at the development of qualities from this point of view, it is easy to isolate which of these features play determining factors.

It is clear that verticalising the system generally improves accessibility and distances between objects (with exception for extremely tall structures), and the number of objects with a view. Design should thus not be focussed on these qualities, but rather on organising the programme in such a way that every object recieves enough sunlight.

It would seem surprising that sunlight is a problem in a vertical strategy, since it is generally seen as an almost given quality for tall buildings. This is directly relatable to the fact that the stacking exercise was not driven by any sort of design consideration.

It might seem that by choosing for verticality, I am introducing problems on a fundamental level of physical quality. As I will demonstrate in the first subsection of the next chapter, this is not the case since we do have functioning vertically oriented designs which can supply us with practical design solutions also applicable in a vertical suburb.

		Haren	Step 2	Step 6	Step 10
Base Qualities					
Houses with gardens (%)		100	100	100	100
Distance to nature (max. m)		1000	520	580	9980
Density (ppl/km2)		2445.71	4828.72	67257.14	376640.00

Qualities		*Haren*	*Step 2*	*Step 6*	*Step 10*
Height (m)		0.00	20	580	9980
Footprint (km2)		7.70	3.9	0.28	0.05
% of object with 4+ hrs of Sunlight per day		99.78	54.99	22.40	71.36
% of objects with Views		13.1	26.13	61.13	93.91
Distance to Facilities (m)	*Average*	889.1	907.3	481.6	6240.5
	Min	*20.6*	*20.6*	*9.2*	*5.3*
	Max	*2014.8*	*1920.6*	*977.3*	*12960.7*
Distance to Leisure Space (m)	*Average*	821.4	756	488.4*	-
	Min	*91.9*	*31.9*	*205.5*	*391*
	Max	*1740.4*	*1649.4*	*813.1*	*9750*
Distance to Water (m)	*Average*	1861.1	804.1	551.5	81
	Min	*58.3*	*48.5*	*26.1*	*130.4*
	Max	*2954.2*	*2377*	*1047.4*	*11970.5*
** Number supplemented from step 5 due to data corruption.*					

Chapter 4

Comparing Towers and Villages

Now that I have charted the design requirements and constrictions posed by the demand on physical quality, I can focus on the area with the greatest potential for improvement with regards to current vertical building, namely social quality.

At first glance comparing towers to villages seems to be like comparing apples and oranges, and to a certain extent this is true. The fact that this comparison is a little strange is in itself an indicator that we need to change the way that we think about verticality.

To understand social quality I will carry out a comparative analysis between Haren and a few examples of currently realized tall buildings. The towers that I will examine are:

- Unite d'Habitacion - le Corbusier
- John Hancock Center - SOM
- The Shard - Renzo Piano
- de Rotterdam - OMA

These examples were chosen because they represent different periods, styles and mentalities with regards to tall building design. This list could be expanded with any number of other examples representing many more ideologies, types, etc. however it is my belief that one would be hard pressed to find an example that refutes the conclusions drawn in the following pages.

The comparisons are carried out based on the conclusions drawn in chapter 2. First the pysical qualities of the towers are evaluated in comparison with the Haren Benchmark found in chapter 3.

Second I will perform a more extensive analysis on the elements of social quality that can be found in these towers and Haren. Through these comparative analysis I will demonstrate which simple solutions can be implemented to improve the social performance of vertical systems.

Figure 4.1 - Tower Diagrams

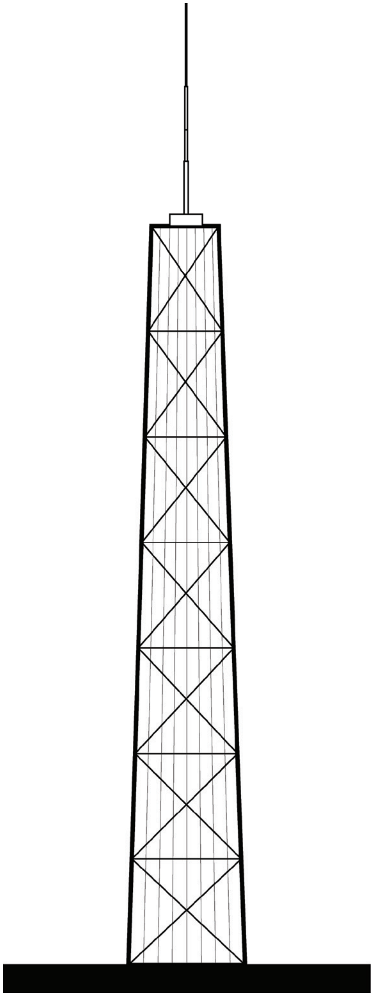
1. John Hancock Center - SOM

2. The Shard - Renzo Piano

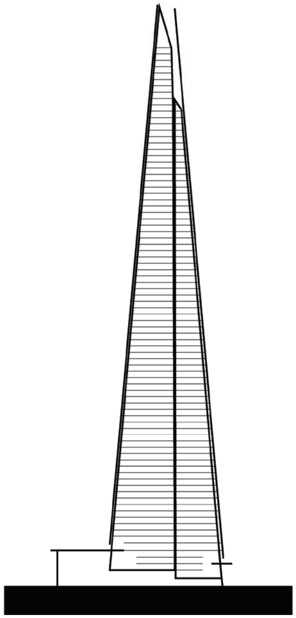
3. De Rotterdam - OMA

4. Unite d'Habitcaion - le Corbusier

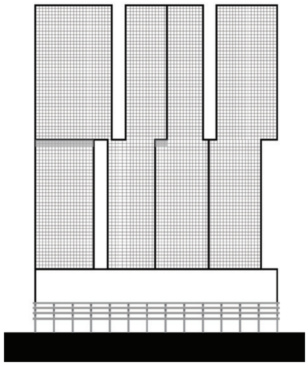
1.



2.



3.



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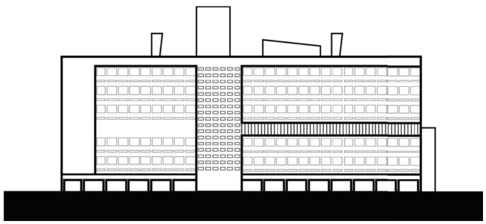


Physical Quality in High-Rise

On the basis of the previous chapter, the claim that verticalisation automatically improves the performance of a system with regards to physical quality was found to not necessarily hold for the experiment. This was probably due to the scale, thus it is good practice to evaluate the towers in this chapter for their performance in the physical categories.

The scoring of the towers is based on educated estimates that I have based on the available floorplans and sections of these towers in combination with my knowledge of the environmental situation in their respective locations.

For the solar estimate, I have taken a sunny day as a base assumption (just like I did in the previous chapter) thus the Shard might be getting the benefit of the doubt (London is not the place for a sun vacation after all). For all elements that I was not able to accurately measure (e.g. distance to nearest shops) I have opted to err on the side of caution and assume conservative figures.

The physical qualities of High-Rises are amongst their main selling points, and when we compare these towers with Haren (Fig 4.2), it is easy to see why. On nearly all aspects of physical quality that I measured for these towers outperform Haren. If we look back to the stacking transformation we can see that there is much to learn from the spatial organisation of the programme, if we incorporate these lessons into our design system we have already eliminated one of the apparent design constrictions posed by going vertical.

The most obvious conclusion is that all towers share the characteristic that those parts of their programme that are most in need of natural light are placed against the facade. Moving inwards, each element of programme is less and less dependant on natural light, ending with the elevator cores and emergency staircases that in principle don't need any daylight at all.

A second conclusion that might not be directly obvious is that there is a certain floorplate depth which is not exceeded within all of the towers. This depth is always around 50 meters in at least one direction (Although this is often coupled with a larger depth in another direction presumably to create more floorspace), an optimum that is most likely determined by the reach of natural light into the building.

Figure 4.2 - Physical Performance

		Haren	Unite d'Habitacion	John Hancock Center	The Shard	De Rotterdam
Height (m)		0	56	344	306	150
Footprint (km2)		7.70	0.002	0.004	0.004	0.007
% of object with 4+ hrs of Sunlight per Day		99.78	100	100	100	100
% of objects with Views		13.1	100	100	100	100
Distance to Facilities (m)	*Average*	889.1	56	150	150	75
	Min	*20.6*	*0*	*0*	*0*	*0*
	Max	*2014.8*	*110*	*344*	*306*	*100*

Figure 4.3 - Tower Floorplans

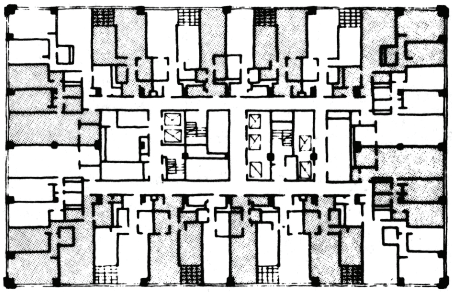
1. John Hancock Center - SOM

2. The Shard - Renzo Piano

3. De Rotterdam - OMA

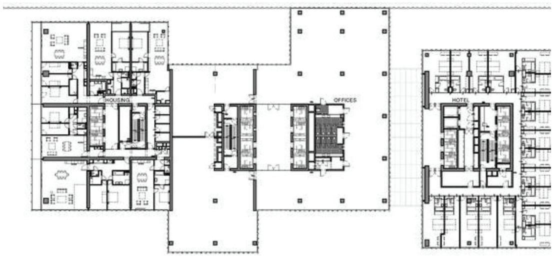
4. Unite d'Habitcaion - le Corbusier

1.



2.

3.



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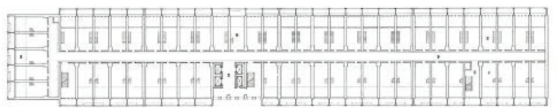


From Private to Public

When looking at the transition and relationship between private and public space one observation instantly jumps forward, namely the near absence of public space within the towers. Interestingly enough it is not an observation based on one of the social criteria that I have distilled in the previous chapters, but one that speaks of a much more fundamental difference between towers and villages.

When we isolate the public space in the floorplan (Fig 4.4), and compare this to a section of Haren (Fig 2.1 pg. 23) in which I have done the same, we see that there is an enormous difference in the amount of non-private space surrounding the residences.

The mere fact that the ratio of public space to private space is essentially inverted when comparing towers and villages speaks of a monumental difference in the design approach.

Based on this observation, it should be apparent that the presence of sufficient public space in a system should be one of the base qualities that a system is designed around.

Territorial Claims, Zoning and Differentiation

Because the spatial aspects of territorial Claims, Zoning and Differentiation all relate to approximately the same area I have grouped these together into one comparison. I have taken one floor level of a tall building to be the equivalent of a street in a village.

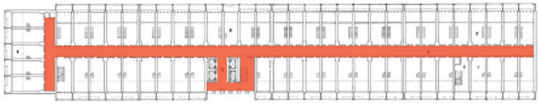
Taking into account the analysis already performed on the streets of Haren in chapter 2 (page 27) and the theories of Herman Hertzberger and Jane jacobs, we are looking for two things. The presence of Public, Private and Ambiguous space, as well as clear borders that define where these types of space end.

By comparing plan views we can get an idea of how control over the spaces is distributed, and how many barriers and transition zones there are between the private and public spaces.

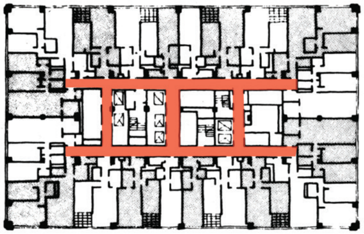
The plans of the different towers (fig 4.4) show us that there is essentially no ambiguous zone present between public and private space. Only in the Shard do we see small alcoves in which the doors are placed, creating a space that could arguably be percieved as an extension of the private space into the public (ergo ambiguous space).

Ofcourse the situation is somewhat mitigated by the argument that the corridors of a tower are not as public as the streets of a village, thus the

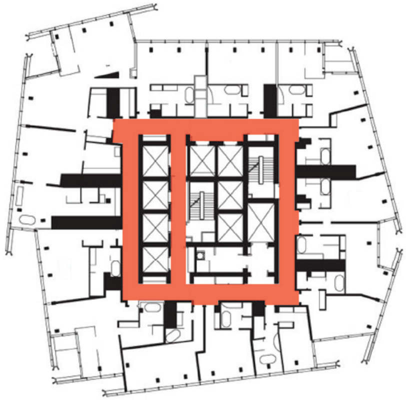
Figure 4.4 - Public Space in Tower Floorplans



Unite d' Habticaion



John Hancock Center



The Shard

De Rotterdam

corridors can be construed as already being a transitional space. Further investigation quickly reveals why this argument still falls short.

An important characteristic that I deduced in the chapter on quality was the necessity for interaction between private and public space. Much like Hertzberger's door, blind walls indicate that there is no relationship or hierarchy between the interior and exterior spaces. Walls with windows on the other hand allow passer-bys to look into the homes, and homeowners to look out upon them. This form of social control is also heavily emphasized by Jane Jacobs, whom goes so far as to describe her own street situation as an argument of why this is beneficial.

The significance of the opportunity to interact with the outside space (by which I mean those not part of the home) becomes apparent when we look at google images of the streets in Haren (fig 4.5) which we can easily develop three types of sections (fig 4.5) that describe the street morphology.

The Blekenweg and Meerweg can be diagrammatically represented by type A, the Klaproosweg by type B and the Klaverlaan by type C. It is easy to see that even this differentiation is caused by only minor differences in the street layouts.

What all of these sections share is:

- Green zone in front of the home
- Windows facing this green zone
- View on the street
- Neighbor across the street
- Parking on or adjacent to the street

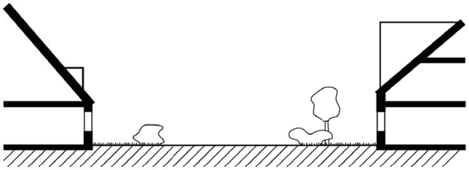
When we subsequently look at the sections of the different towers that correspond with the plans it is not difficult to spot the differences. It is apparent that none of the elements present in the streets of Haren are present in the towers with the exception of across the corridor neighbors in the unite d'Habitacion (which incidentally also has the floorplan with the widest corridors, hinting at le Corbusiers awareness of the importance of shared space for the development of neighbourly feelings).

In this comparison Haren represents the environment that is known to be qualitatively strong, the fact that the most prominent elements of the public space in Haren are missing in the towers implies that this is where the vertical building design misses the mark.

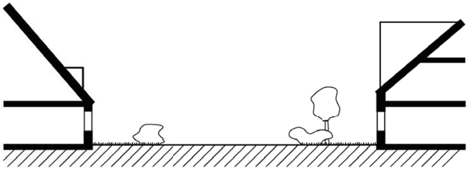
When thinking about these elements in terms of user experience, and looking forward to the results of the other comparisons, it is easy to develop a narrative that points out why this is the case but more on this later.

Figure 4.5 - Street Sections in Haren

Blekenweg, Haren

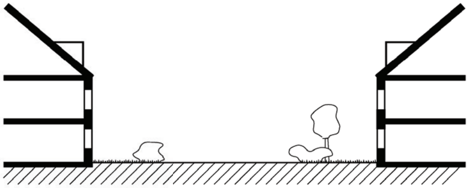


Meerweg, Haren



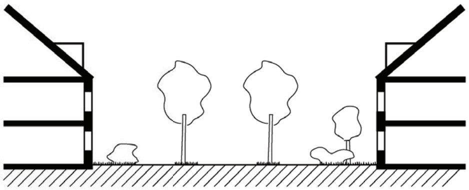
Type A

Klaproosweg, Haren



Type B

Klaverlaan, Haren



Type C

For now it can simply be concluded that there are very little ambiguous spaces, and that the materialisation of the walls (absence of windows) guarantees that there is no interaction between the interior and exterior spaces.

Network Structure

Comparing the larger scale elements of towers and villages would give context to the problems as pointed out previously, as well as strengthen the base for any narrative that relates to user experience of a tower.

It is possible to compare the structure of a village to that of a tower if the elevator shafts are viewed as the equivalent of the main roads in a village. They perform the same infrastructural purpose, however have a very different characteristic. I will discuss this difference in more depth later, for now I will focus on the form of the infrastructure.

In the chapter on quality I explained how the network structure of a village contributes to its social workings. The main observation was that there are relatively little dead ends, and that these dead ends generally serve a purpose other than being the mere consequence of planning restrictions.

The shape of Haren’s infrastructure takes the familiar form of a web with a recognizable but not necessarily rational organisation. It can perhaps best be described by the term organic, as it is clearly the result of a growing and evolving process.

If we compare this to the way that a tower is organised the difference is once again vast. The form of tall building infrastructure is very rational, or Mechanical which has clearly been planned in one go and with one goal; quick and efficient transportation.

This is of course to be expected, High-Rises are not built to grow and have to be planned in one go or we would not construct them. It is this drive for efficiency, and fear of temporary redundancy which I believe to be one of the limiting factors on the potential of verticality.

A second observation is the fact that tall building design is littered with dead ends. In fact, it is difficult to find any part of the primary and secondary infrastructure that does not have a dead end. These dead ends prevent the infrastructure of having the same dual nature as the streets in a village, they are just destinations and not routes.

This changes the way that we move through these spaces, if we combine this with the observation that there is very little connection between the

Figure 4.6 - Street and Corridor Sections

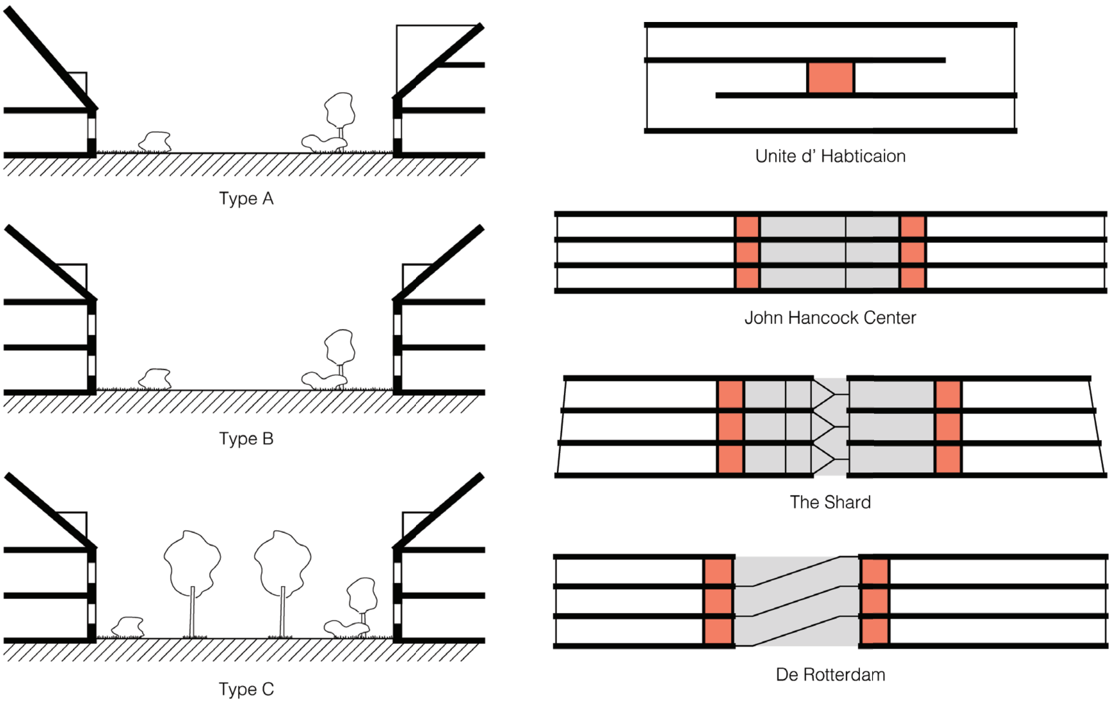


Figure 4.7 - Quality Evaluation Streets and Corridors

	Haren	*Unite d'Habitacion*	*John Hancock Center*	*The Shard*	*De Rotterdam*
Green Zone	x	-	-	-	-
Windows on Green Zone	x	-	-	-	-
View of the Street	x	-	-	-	-
Neighbors across Street/ Corridor	x	x	-	-	-
Parking on or adjacent to Street	x	-	-	-	-

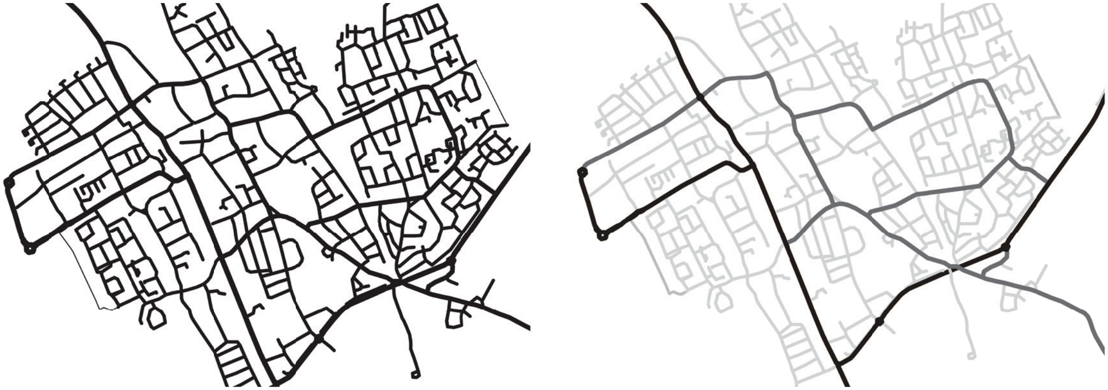


Figure 4.8 - Street Network Haren

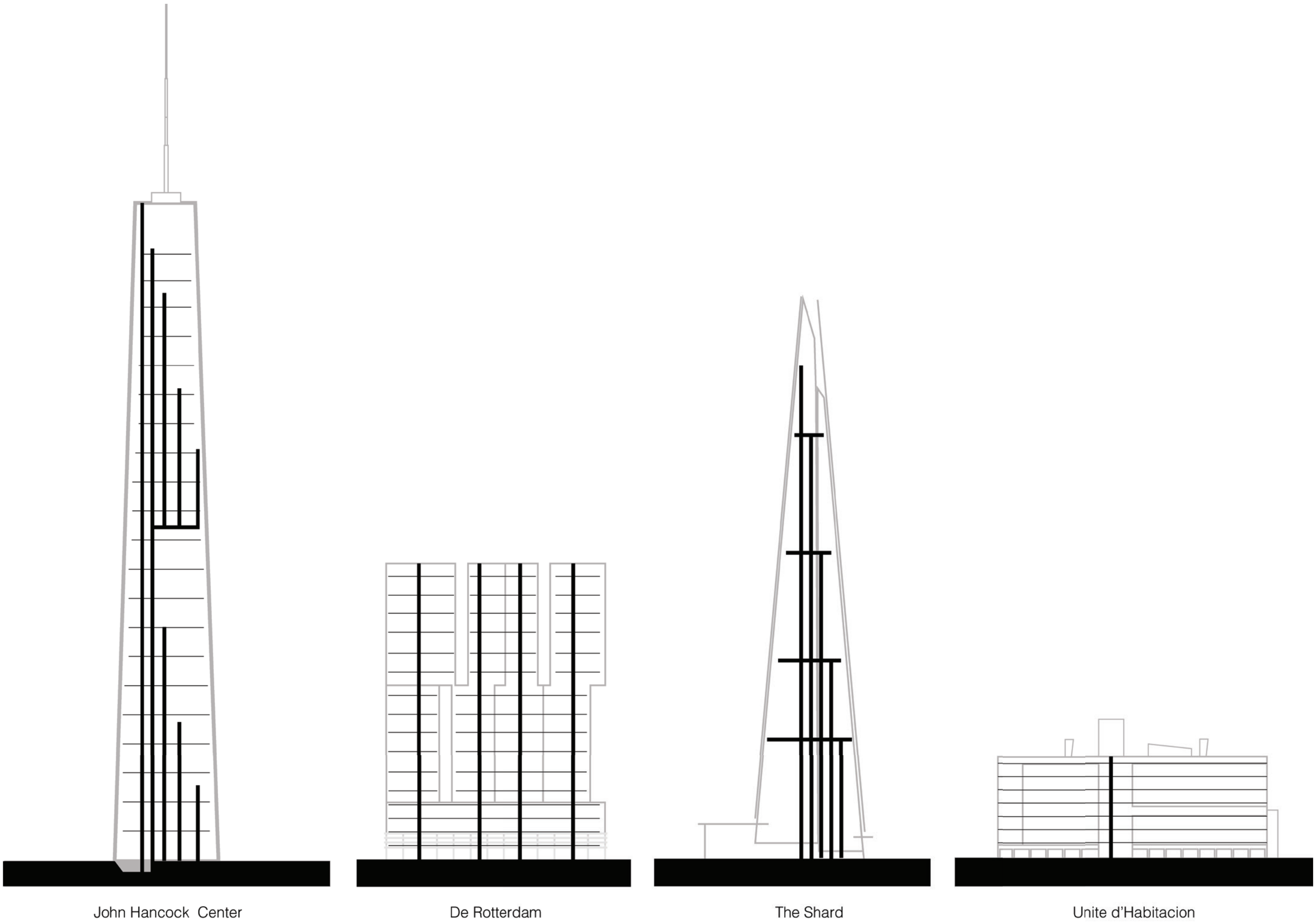
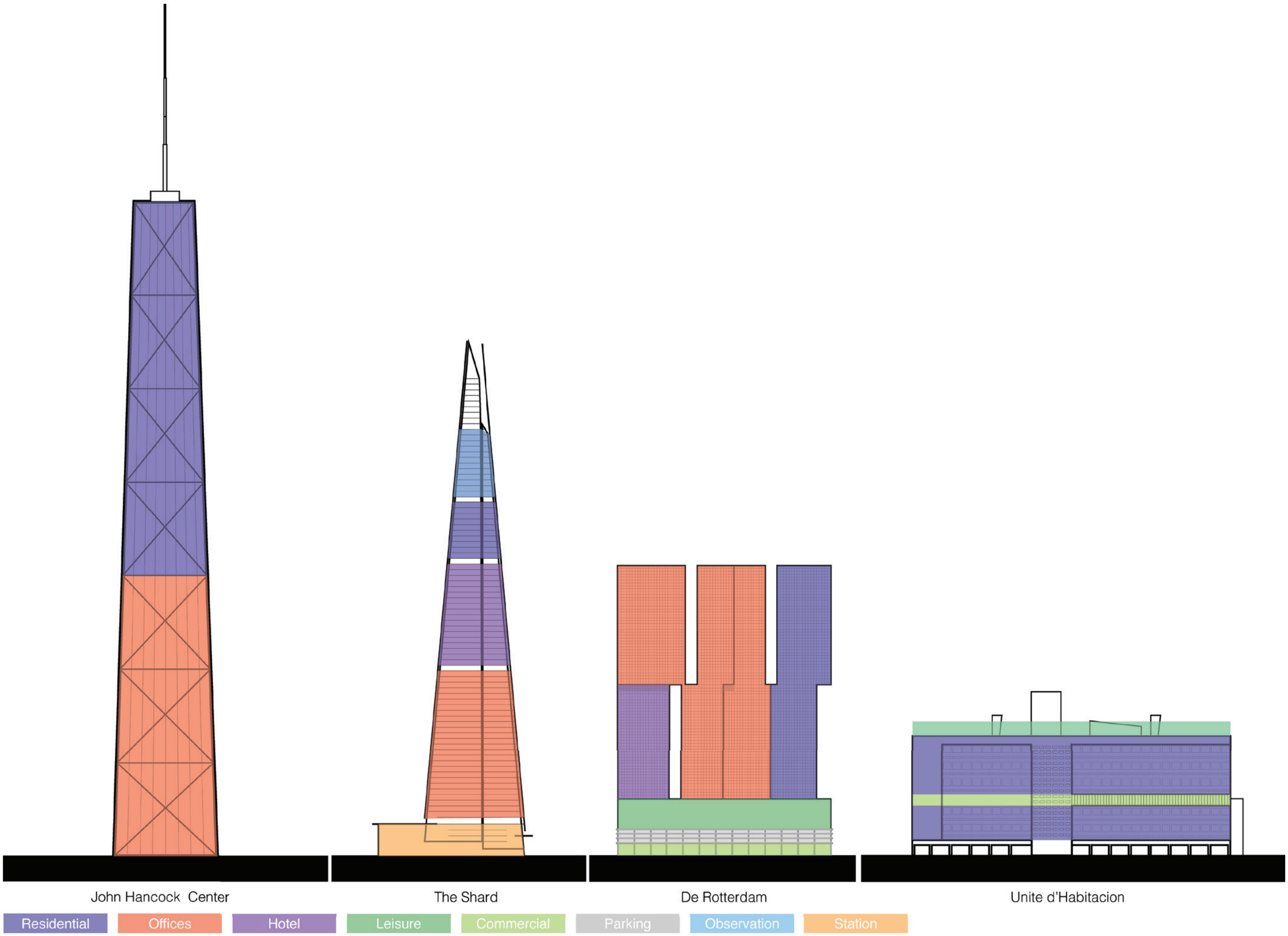


Figure 4.9 - Elevator Schemes Towers

Figure 4.9 - Function Mix Towers



home and the hallways it is easy to understand that the public space in tall buildings is nowhere near the type of social space that is offered in a village.

Improving these two elements would most likely go a long way towards improving the social workings of tall buildings.

However, I am not there just yet. There are two more elements of social quality that I have investigated that would seem to strengthen these findings.

Mixed Programme and Scales of Interaction

As I discussed earlier, the distribution of programme throughout a village is an important social factor that relates to my theory of ‘Scales of Interaction’. The presence of small (sometimes referred to as ‘mom and pop’) stores in a community form an integral part of the chain of social interactions that we experience on a day to day basis.

Looking at the programmatic mix of the example towers (fig 4.9), it is easy to see that the idea of ‘mixed-use’ is much more prevalent in the newer examples. This is most likely the result of the scale of the buildings increasing over the past decades, leading to a subconscious reinterpretation of the tower as a neighbourhood rather than a building. This change in design approach is only just becoming a conscious mentality as typified by Rem Koolhaas’s reference to de Rotterdam as a ‘vertical city’.

What this means is that the principle of scales of interaction is slowly finding its way into the tall building. However we still cannot speak of a total absorption of all functions of living on the scale of a single (system) of tower(s).

The diversification of programme is a good first step, however we still see defined areas devoted to one functional element, and we still miss many of those functions which make a village tick, most notably of which is the absence of functional public space.

Although some would argue that shops take the place of traditional public space in these systems, I do not believe in a public space with business hours. Thus I will leave this discussion for another time, and simply state that there is a shortage of real public space, even in mixed-use towers.

		Haren	Unite d'Habitacion	John Hancock Center	The Shard	De Rotterdam
Base Qualities						
Houses with gardens (%)		100	0	0	0	0
Distance to nature (max. m)		1000	-	-	-	-
Density (ppl/km2)		2,445.71	800,000.00	500,000.00	107,500.00	167,142.86
Physical Qualities						
Height (m)		0.00	56	344	306	150
Footprint (km2)		7.70	0.002	0.004	0.004	0.007
% of object with 4+ hrs of Sunlight (per day)		99.78	100	100	100	100
% of objects with Views		13.1	100	100	100	100
Distance to Facilities	*Average*	889.1	56	150	150	75
	Min	*20.6*	*0*	*0*	*0*	*0*
	Max	*2014.8*	*110*	*344*	*306*	*100*
Social Qualities						
Private, Public and Ambiguous space.		++	-	-	- -	- -
Clear Border between private,public,ambiguous		++	++	++	++	++
Open Ended System		++	- -	- -	- -	- -
Network-like Infrastructure		++	- -	- -	- -	- -
Mixed-use Areas		++	-	- -	o	+
Mono Functional Areas		++	++	++	++	++
Interaction from residence to street		++	- -	- -	- -	- -

Conclusions

What we can conclude from the investigation is that public space, and specifically the public space close to the residences is fundamentally different in tall buildings as it is in villages.

The best way to describe this is through a narrative of the user experience of these spaces as they make their way home from work.

Haren:

Residents drive home from work, or use the public transportation system and walk home from the train station or bus stop. While walking/driving home they encounter fellow residents and neighbours on the street. Those on foot might stop for a chat, or join others as they make their way home. People decide to make a short detour to a shop to get some last minute groceries or pick-up their children from school/daycare. When they arrive home their neighbours are standing behind the windows, cooking, cleaning, watching others make their way through the neighbourhood. Someone may be working in the front yard and is greeted by those that have just parked their cars or walk past them on their way to their residence.

Towers:

Residents that take the car park it in the underground garage, when they step out of their car they hurry to get to the elevator and out of the dark, fume filled space. They might meet another resident at the elevator doors, and strike up a chat. Once in the elevator they are joined by other less familiar faces, the close proximity with such strangers abruptly breaks the conversation until one or the other gets out onto their floor and is not seen again that day. In the hallway there is no one, and the resident passes unseen to his or her residence. Those traveling by public transportation suffer the same fate, however often enter the building through an overly formal (or dilapidated) lobby where the most familiar face is the doorman (if there is one), someone that is being paid to be there.

Obviously I have coloured these narratives in favour of my position, however they are based on my findings thus far. Although the tall building gets a scathing review, this simply means that it is clear how we can improve it as a type, but more importantly how we can utilise this type to form 3D villages in suburban regions.

Looking at the full comparison between the four towers and Haren we see what I have held to be true throughout these thesis, namely that the tall building can perform spectacularly on physical qualities but lacks the spatial elements that are often associated with social quality.

As a first suggestion, we can improve the nature of the public space through creating a stronger connection (e.g. sight-lines) and introducing buffer zones between residence and public space. My basic demand that residences in the 3D village have a home and garden can play an instrumental role in this.

On a broader level, the problem of the multitude of dead ends in the infrastructure of vertically organised buildings needs to be addressed. This is something that can only be done through design strategy, and any strong solution can potentially revolutionise tall building design.

My last recommendation relates to the mixture of programme. Although there has been tremendous steps forward in this, we have not yet achieved the level of mixing that is present in villages and other communities. In my opinion, this can be solved through implementing the traditional system of development for villages/horizontal communities, based on growth and evolution of the actual community fabric. This will require a great degree of flexibility in the 3 dimensional system that most likely will require some sort of temporary redundancy (e.g. a separation between structure necessary for the creation of residences, and the actual residences themselves).

The strategy that I will present in the following chapter will utilise these insights in order to explicitly abandon the idea of the 'tall building' as a singular building and to reintroduce it as a direction of development. Moving forward on the changing perception of the tall building, and to try and create truly 3 dimensional communities.

Conclusions

In the previous chapters I have tried to work towards a description of a system that is specifically designed to densify suburban areas without loss of, and ideally adding to, their inherent qualities. To start, I will quickly recap all the qualities that I have discussed, and their relationship to vertical systems.

Qualities

In the first chapter, we determined that the appeal of the village/suburb lies in three base qualities that stem from the ideal of the 'Garden City'.

1. A house with a garden (and ideally a front yard)
2. Close relationship/proximity to nature or farmland (production landscape)
3. Low density (green) barrier zone between city and suburb

These three qualities form the basis for the densification strategy, and their space intensive characteristic is a primary reason for choosing 3-Dimensionality as my densification strategy.

Physical

After the three base qualities, there are a slew of physical qualities, which should make life in the 3D Village more pleasurable. These are:

- Direct Sunlight
- Views
- Distance to Facilities
- Distance to Leisure space

Of these qualities there is one in particular, direct sunlight, which is of extra significance. The reason for this is that spaces with poor performance with regard to sunlight are extremely unpleasant, and in my opinion nearly uninhabitable.

For this reason I have determined that every resident should have access to space in or directly around their home that has at least 4 hours of direct sunlight on a daily basis.

Social

The final and most difficult set of qualities to implement are the social qualities, in order to do this I focused on spatial elements that are generally considered to contribute to the emergence of strong communities.

These are:

- Presence of private, public and ambiguous space.
- Clear boundaries between zones with differing public/private characters.
- Separation of private and public space that facilitates interaction between the two.
- Open ended system that can grow, shrink and evolve over time
- Network like infrastructure in which the streets can be both routes and destinations at the same time.
- A mix of mixed-use and mono-functional areas.

System

For the 3D village design I opted for a two pronged approach, moving from the large scale to the small scale, and vice versa. This allows me to address qualities that relate to different scales independently, and worry about fusing the different systems later on in the process.

I will refer to these two scales as the meta scale (design solutions developed on the level of the entire system) and the micro scale (design solutions developed on the level of the neighborhood or individual home).

Meta-scale

The first problem that I aimed to solve on the meta-scale was the problem brought to light in the stacking experiment in chapter 3. Based on this chapter it was easy to conclude that constructing one large tower would present a number of difficulties with regards to direct sunlight. Rather an interconnected system of towers, or linear elements with a width of no more than 50-60 meters (see chapter 4) is preferable.

Based on the need for an open ended system, I let myself be inspired by an early illustration of High-Rises that Rem Koolhaas uses in his work *Delirious New York* (Rem Koolhaas 1994).

In this illustration there exists a separation between the residence/plot and the structure that is holding it up in the air. This separation would lend itself incredibly well for an open ended system, where floors could be added, taken out or adapted as time and needs change.

So far I have two design conditions that characterise the system:

- The system is a composition of smaller building units/elements that are optimised for physical and social performance.
- In each of these elements there is a seperation between structure and programme.

It is my opinion that the street is the most suitable to form the base elements that compose the system. The reasons for choosing the street are fairly self evident:

1. It is a linear element along which all of the programme has to be arranged (ergo they are everywhere).
2. Streets represent a large amount of the public space, and play a determining role in creating social quality.
3. Streets constitute the smallest element of a neighborhood, and are at the same time the core of social interactions (neighbours are nothing else than people that share a street).
4. Streets can be of variable lengths and characteristics, which means that they can provide a large amount of variety in elements.

The configuration and stacking of the street elements with regards to each other is intended to form a network like structure, whose composition and height are influenced by two things; sunlight and density.

Plan view

In plan view the orientation of the streets, with respect to north, but also with respect to each other is based on creating solar quality. The best way to achieve this is by orienting elements where multiple floors are stacked above each other with their length along the North-South line, this allows for deeper solar penetration because most of the facade faces the morning or afternoon sun (which is significantly lower in the sky).

Elements that have access to top lighting can be placed along any orientation, however it is advisable to avoid giving objects only north facing facades.

When the street elements are placed care also needs to be taken that they do not block out each other's sunlight. A relatively simple method of doing this is drawing a line that runs perpendicular to the long axis of the element (Fig. 5.2), and avoid placing objects that would intersect this line within a distance of 2 times the height of shade casting objects.
Another factor that should be taken into account is the creation of routes. The aim should be to create one or two "main" routes, that can be

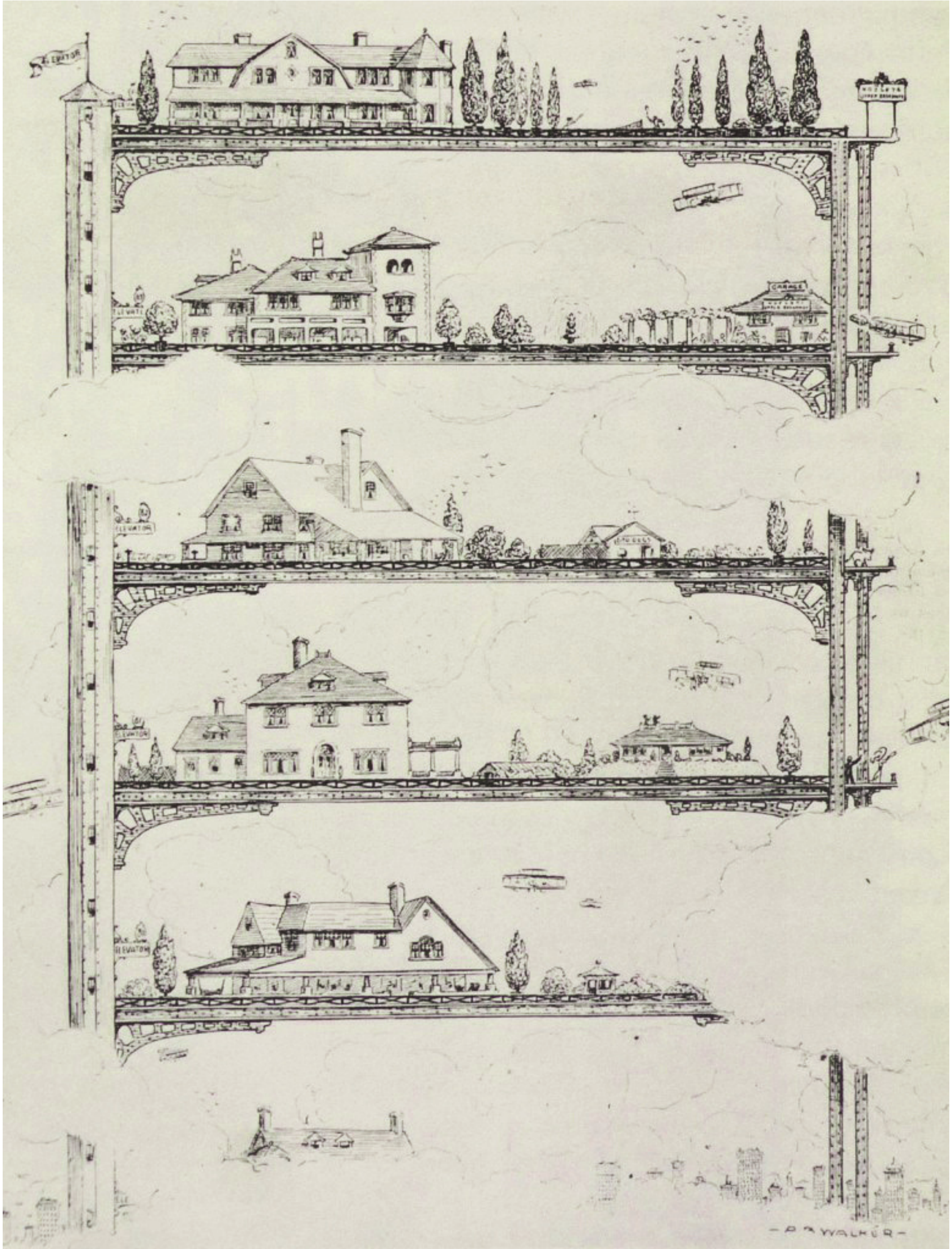


Figure 5.1 - Early illustration of a skyscraper concept

traversed in a continuous manner, and are charcterized by a mixed-use programme. Branching off of these main streets there are the mono-functional residential streets.

This way of designing has the spread of functions that is so attractive in villages, and at the same time the reduced distance to facilities due to the fact that these elements are stacked, and that elevators offer shortcuts throughout the system.

Section view (Height)

The height of the system is based on the density curve for the Garden City (Fig. 1.6 page 17) with a slight alteration. It is my goal to develop a suburb at almost inner city densities, yet with the qualities of a “regular” suburb, thus the two humps should have approximately the same height (Fig. 5.3).

I have equated height to density, as more height implicates more streets stacked above each other, and thus the system should have a relatively low height at the edges (both on the city and on the country side), and gain in height towards the center.

The low height arms of the building then act as detterants against the city trying to usurp the ‘density valley’ between the inner city and the 3D Village.

Micro-Scale

On the micro scale I have developed a design solution aimed at creating streets and residential/commercial objects of the same level of quality as what is expected from a suburban region.

As I stated in chapter 2, a certain degree of self selection or freedom to influence the system is important since this creates an open ended system that can evolve over time, accomodate growth and shrinkage, and caters to user demands.

I believe that the best way to solve this is by creating a system that can offer housing plots rather than ready-made housing. These plots should be designed in such a way that they generate appeal based on the physical quality that is offered on them. Based on my research I have set the minimum level of quality offered on a plot is comprised of at least 4 hrs of sunlight per day, and that every plot should have a long view.

The street serves as the main logistics device, carrying people and small carts on its surface and fresh water, sewage, power and amenities below

Figure 5.2 - Determining position of geometry based on sun angle

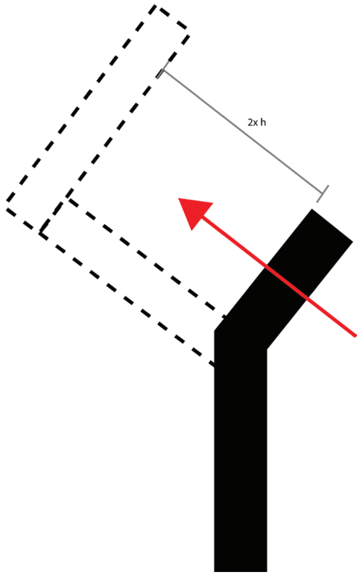
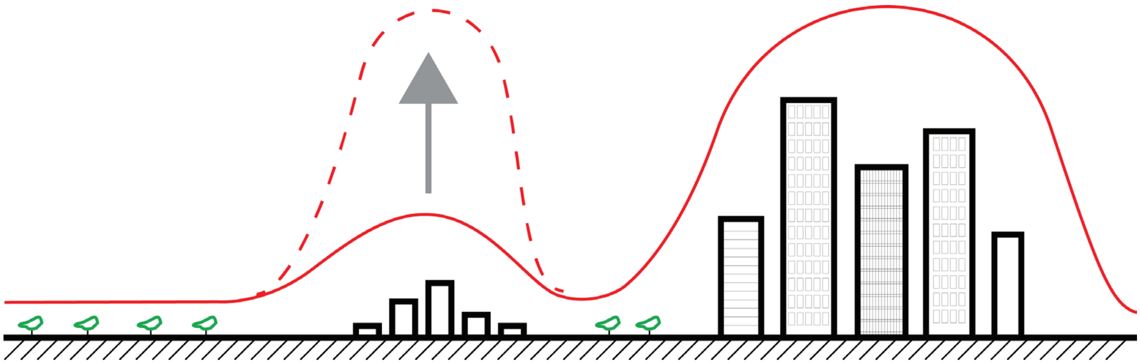


Figure 5.3 - Shift in Density Curve



it servicing each plot. Aside from this, the street is also the primary public space and should be given a width accordingly.

To preserve the quality of this public space, it is important to set a few guidelines for the use of the plots. In order to stimulate sunlight penetration deep into the building, there should be height restrictions on the buildings to prevent them from blocking out too much sunlight.

In chapter 2 I have made a case for the social benefits of private space that penetrates the public space. As such I would advise setting rules that force each residence to leave a certain space between its facade and the street, a principle that in the Netherlands is known as the “rooilijn”.

Finally, it should be considered standard practice to provide the residential objects with windows that look out upon the street and the front yards in order to create a strong connection between the private and public spaces.

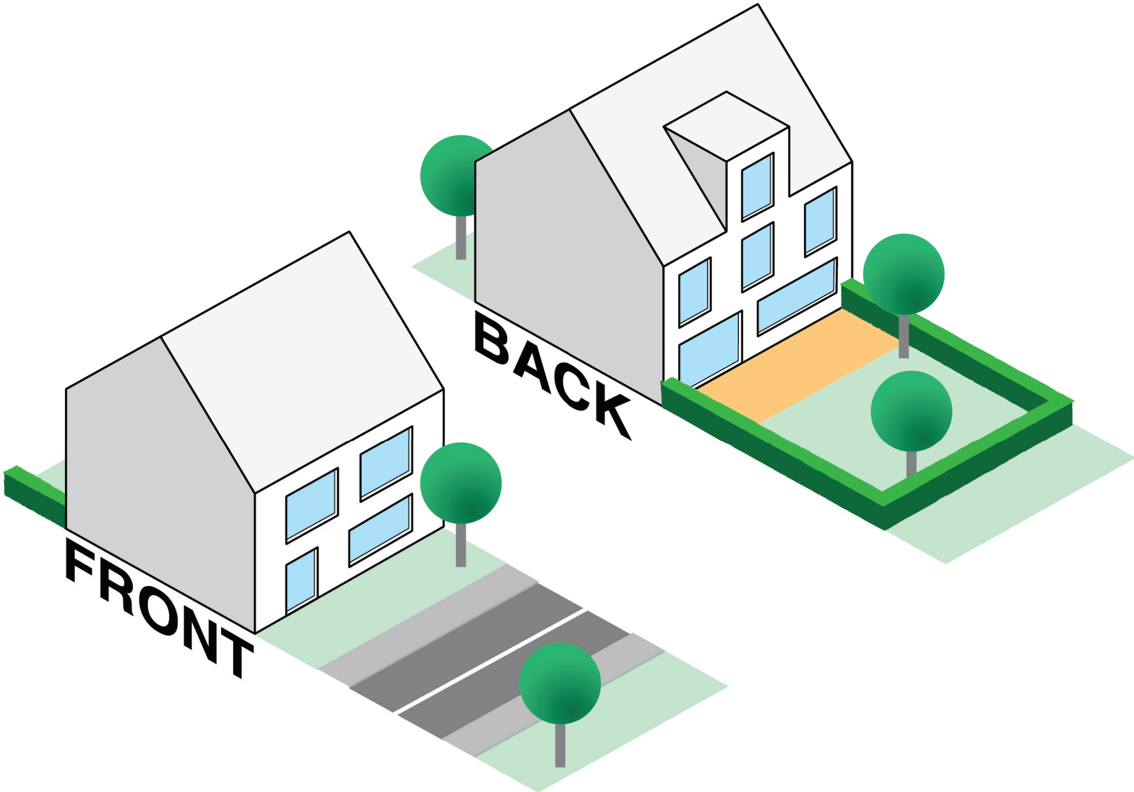
Conclusions

It is clear that designing a system with the density of an inner city and the qualities of a suburb is no small feat.

The design principles that I have expanded upon in this chapter should be seen as guides for a 3 Dimensional framework, or masterplan, that creates the backdrop for a plethora of designs made by different architects and designers over an extended period of time and with changing perspectives on the intricacies of living.

Only such a diverse approach can create a system with the character of a village, collaging together different interpretations of beauty, efficiency and spatial organisation to spawn a colourfull living environment.

Figure 5.4 - Typical Residential Unit



Bibliography

Abel, Chris. Sky High: Vertical Architecture. London: Royal Acadamy of Arts, 2003.

Alexander, Christopher, Sara Ishikawa, Murray Silverstein, Max Jacobson, Ingrid Fiksdahl-King, and Shlomo Angel. A Pattern Language. New York: Oxford University Press, 1977.

AND_data. “Openstreetmap.” openstreetmap.org, http://www.openstreetmap.org/.

Botton, Alain de. The Architecture of Happiness. Atlas, 2006.

Conway, Donald J., ed. Human Response to Tall Buildings. Pennsylvania: Dowden, Hutchinson & Ross, Inc., 1977.

Das, Robert, and Rudolf Das. Wegen Naar De Toekomst. Baarn: Tirion, 1992.

Geoplaza, VU. “Bag 2012.” Vrije Universiteit Amsterdam, http://geoplaza.vu.nl/cdm/singleitem/collection/gpz/id/238/rec/1.

Gifford, Robert. “The Consequences of Living in High-Rise Buildings.” Architectural Science Review 50, no. 1 (2007): 2-17.

Gottmann, Jean. “Why the Skyscraper?”. Geagraphical Review 56, no. 2 (1966): 190-212.

Haber, Gilda Moss. “The Impact of Tall Buildings on Users and Neighbors.” In Human Response to Tall Buildings, edited by Richard P. Dober. Pennsylvania: Dowden, Hutchinson & Ross, Inc., 1977.

Henni, Samia. “Ask the Experts.” Chap. 10 In The Vertical Village, 288: T?F, 2010.

Hertzberger, Herman. Lessons for Students in Architecture. Rotterdam: 010, 1991.

———. Space and the Architect, Lessons in Architecture 2. Rotterdam: 010 Publishers, 2000.

Howard, Ebenzer. Garden Cities of Tomorrow. Forgotten Books, 1898.

Jacobs, Jane. The Death and Life of Great American Cities. New York: Vintage Books, 1992.

Koolhaas, Rem. Delirious New York. USA: The Montacelli Press, 1994.
More, Thomas. Utopia. Dover Thrift Editions. edited by Paul Negri Dover: Dover Publications, Inc., 1997.

Observatory, Global Health. “Urban Population Growth.” WHO, http://www.who.int/gho/urban_health/situation_trends/urban_population_growth_text/en/.

Steel, Carolyn. Hungry City; How Food Shapes Our Lives. Great Britain: Vintage, 2009.

Waterschapshuis, Het. “Algemeen Hoogtebestand Nederland.” Het Waterschapshuis, www.ahn.nl.

Wekerle, Gerda R. “Residential Choice and Housing Satisfaction in a Singles High-Rise Complex.” In Human Respones to Tall Buildings, edited by Richard P. Dober. Pennsylvania: Dowden, Hutchinson & Ross, INc., 1977.

Yuen, Belinda, Anthony Yeh, Stephen John Appold, George Earl, John Ting, and Lanny Kumianingrum Kwee. “High-Rise Living in Singapore Public Housing.” Urban Studies 43, no. 3 (2006): 583-600.

Quality Evaluation Matrix

		Systam A	*System B*	*System c*	*etc.*
Base Qualities					
Houses with gardens (%)					
Distance to nature (max. m)					
Density (ppl/km2)					
Physical Qualities					
Height (m)					
Footprint (km2)					
% of object with 4+ hrs of Sunlight (per day)					
% of objects with Views					
Distance to Facilities	*Average*				
	Min				
	Max				
	Average				
Social Qualities	*Min*				
	Max				
Private, Public and Ambiguous space.	*Average*				
Clear Border between private,public,ambiguous	*Min*				
Open Ended System	*Max*				
Network-like Infrastructure					
Mixed-use Areas					
Mono Functional Areas					
Interaction from residence to street					
Clear Border between private,public,ambiguous					
Open Ended System					
Network-like Infrastructure					
Mixed-use Areas					
Mono Functional Areas					
Interaction from residence to street					

Tower Evaluation Matrix

		Haren		Unite d'Habitacion	John Hancock Center	The Shard	De Rotterdam		Step 2	Step 6	Step 10
Base Qualities											
Houses with gardens (%)		100		0	0	0	0		100	100	100
Distance to nature (max. m)		1000		-	-	-	-		520	580	9980
Density (ppl/km2)		2,445.71		800,000.00	500,000.00	107,500.00	167,142.86		4828.72	67257.14	376640.00
Physical Qualities											
Height (m)		0.00		56	344	306	150		20	580	9980
Footprint (km2)		7.70		0.002	0.004	0.004	0.007		3.9	0.28	0.05
% of object with 4+ hrs of Sunlight (per day)		99.78		100	100	100	100		54.99	22.40	71.36
% of objects with Views		13.1		100	100	100	100		26.13	61.13	93.91
Distance to Facilities	*Average*	889.1		56	150	150	75		907.3	481.6	6240.5
	Min	*20.6*		*0*	*0*	*0*	*0*		*20.6*	*9.2*	*5.3*
	Max	*2014.8*		*110*	*344*	*306*	*100*		*1920.6*	*977.3*	*12960.7*
Social Qualities											
Private, Public and Ambiguous space.		++		-	-	- -	- -		++	++	++
Clear Border between private,public,ambiguous		++		++	++	++	++		++	++	++
Open Ended System		++		- -	- -	- -	- -		++	++	++
Network-like Infrastructure		++		- -	- -	- -	- -		++	++	++
Mixed-use Areas		++		-	- -	o	+		++	++	++
Mono Functional Areas		++		++	++	++	++		++	++	++
Interaction from residence to street		++		- -	- -	- -	- -		++	++	++