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INTRODUCTION

The conditions of urban development are currently changing radically. Technological transformations such as automation and robotisation in industrial production are leading to new operating conditions for businesses and employees. New transportation and distribution systems are changing the scale and flow patterns of the urban agglomerations. The effects of the general application of information and communication technologies in everyday life are barely to overlook. Globalisation and internationalisation as well as the processes of European unification have led to increasing competition between urban agglomerations on European and world scales. On the other hand, the social contrasts within these agglomerations are growing. World-wide environmental problems, the necessity for a more efficient use of energy and natural resources as well as a limitation of CO2 emissions mean that we have to make adaptations to our urban structures and building fabric.

These developments have become a fundamental challenge for the discipline of Urbanism. New urban and regional models and new concepts of urbanisation in general need to be developed, new networks need to be established and the relation between the city and its surroundings needs to be defined anew. Existing urban structures need to be adapted, sites that have lost their function and waste sites need to be reoriented and redesigned. The changing role of the state and public private co-operation have led to new planning procedures, to new negotiation structures and to changed (and mostly longer term) planning perspectives. The shortage of ground calls for careful consideration, while at the same time economic interests have a great influence on the potential for realizing urban plans.

The new challenges require new approaches, new methods and instruments, and new strategies for urban planning. The planning of the future no longer can be based on the certainty of programs and conditions. Instead the planner is confronted with changing conditions and shifting programs. In this framework, more than before, design approaches will be pivotal. Exploratory research, the reflexive exploration of spatial potentials and the integration of design methods in spatial research will become a key issue for the scientific development of the discipline.

Due to the growing demands the Department of Urbanism of the Faculty of Architecture at the Delft University of Technology made great efforts during the last years to intensify and to enlarge the research in the field of urban transformation and sustainability. Special attention has been given to the development of Ph.D. research. The number of Ph.D. researchers working at the Department has been more than doubled.

To ensure the quality of the Ph.D. research the Department introduced a special procedure for periodic evaluation: after a period of nine months the potential Ph.D. candidates are asked to present their research design, theoretical framework and methodological approach to the members of the Department and to a peer group, drawn up by the professors of the Department and by external experts. Depending on the assessment of the peer group, the candidates will have the opportunity to continue their research at the Department.

In the meantime the (public) review sessions developed into an important element for the scientific debate of the Department. The sessions became a meeting point for the whole Department to discuss new research issues and new methodological approaches and to develop new research collaborations. In this framework the external members of the peer group are playing an important role. Their critics form a mirror for the scientific standards of the Department as well as for the scientific (and social) relevancy of the research issues.

With the publication of the series Urban Transformations and Sustainability we want to offer to a broader public the opportunity to deal with this debate. The different contributions are based on the papers the Ph.D. candidates prepared for the reviews and have been updated as a result of the remarks of the peer group and the discussion during the review sessions. As a result the contributions are reflecting the ongoing efforts to redefine the discipline of urbanism under globally changing conditions.

The review sessions of the Department started in 2004. This book presents the results of the sessions that took place on the 1st of June 2006 and the 1st of February 2007.
On the 1st of June 2006 three Ph.D. candidates defended their research proposals and presented their papers: ir. C. Sezer, ir. Q. Sheng and ir. E.H. Stolk. During the same session ir. J. van Schaick gave an update on his Ph.D. research. Participating peers for this session were: prof.ir. H.C. Bekkering (TU Delft), prof.ir. C.A.J. Duijvestein (TU Delft), ir. M. de Hoog (DRO Amsterdam), dr. E.D. Hulsbergen (TU Delft), prof.dr.ir. T.M. de Jong (TU Delft), prof.ir. E.A.J. Luiten (TU Delft), prof.dr.ir. B. de Meulder (Katholieke Universiteit Leuven/TU Eindhoven), prof.dr.ir. V.J. Meyer (TU Delft), prof.dipl.-ing. H.J. Rosemann (TU Delft) and prof.ir. J.M. Schrijnen (TU Delft).

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Initially presented 2nd June 2005 and provided an update of their work 1st February 2007.

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Reshaping urbanity. Economic rescaling, urban transformation and the shift of locations of service firms in Amsterdam.
Initially presented 3rd November 2005 and provided an update of his work 1st February 2007.

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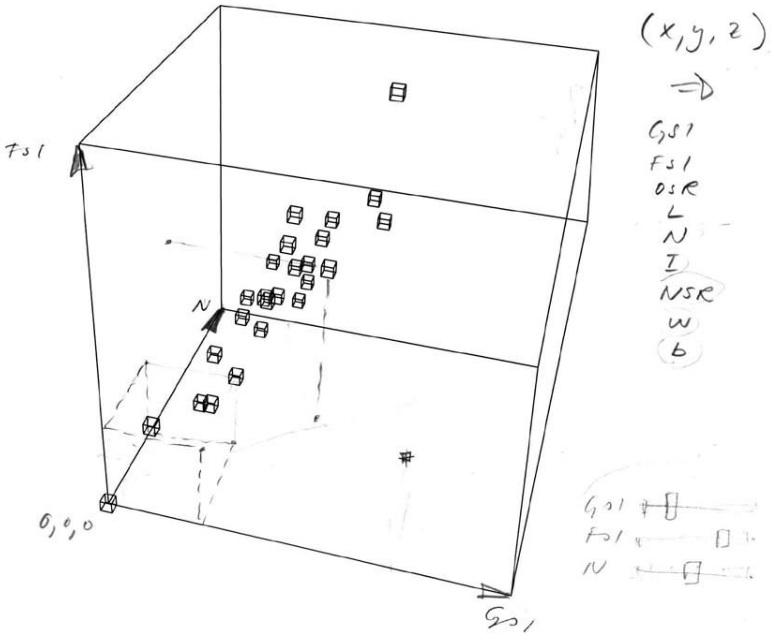
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IR. M.Y BERGHAUSER-PONT & IR. P.A. HAUPT

THE SPACEMATE: DENSITY AND THE TYPOMORPHOLOGY OF THE URBAN FABRIC

Ph.D. research: Spacemate – the spatial logic of urban density
Chair: Urban Compositions
Promotor: Prof.dr.ir. V.J. Meyer
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ABSTRACT

This article deals with current changes in the urban planning and design practice, and presents a tool based on the knowledge of the relation between physical density and urban form: The Spacemate.

INTRODUCTION

In general, one can say that two tasks are central to urbanism: the programming of the city and its design. A strong emphasis on programming can be described as the doctrine of the statistically ordered city. Planning surveys, quantified uses, zoning and demographic predictions are central to such an approach. A focus on the design, on the other hand, can be described as the doctrine of the visually ordered city.
Over the past centuries, the focus between these two aspects has shifted. Before 1900, the preparation and division of the ground surface was at the core and a fixed image was not a main issue. Later, in for instance Berlage's Plan Zuid in Amsterdam at the beginning of the 20th century, the design was seen as a *Gesamtskunstwerk* where architecture and urban design should be totally integrated. In van Eesteren's scheme for a garden city expansion of Amsterdam (Algemene Uitbreidingsplan or AUP) from the 1930s, a functional and programmatic zoning plan was dominant (see figure 1). These shifts in focus have continued, and it

is a question whether this kind of detailed control of the urban design (beit programmatic or as final image) is appropriate for present design tasks. We work today in a situation where projects are of a large scale and have a very long time span. On top of this comes the privatization of development initiatives, an unpredictable future and an increase of complexity of programs. Examples that illustrate these new conditions in the Netherlands are the Westelijke Tuinsteden, IJburg and Zuidoostlob in Amsterdam and Stadshavens in Rotterdam. Those large-scale transformations span over many decades and private investors gain influence at an early stage in the process. It is difficult today to imagine a grand design in the Netherlands with a detailed blueprint for a final image or program being executed in the same way as for instance Plan Zuid or the AUP.

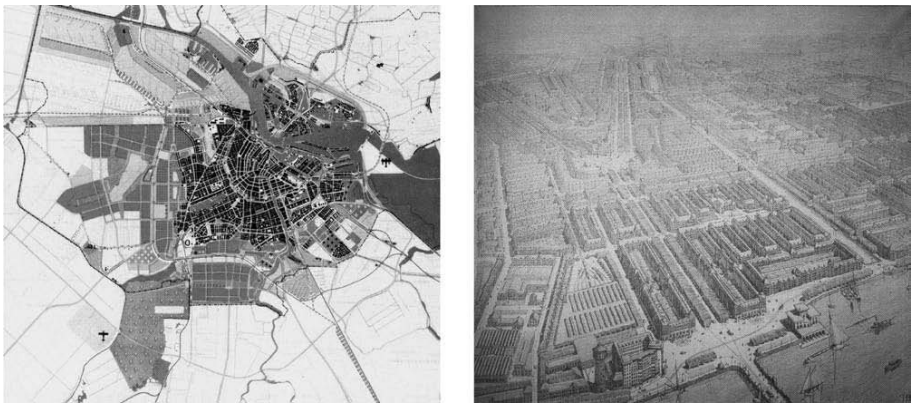


Figure 1. AUP and Plan Zuid.

What is needed in this new situation, according to some, are the knowledge and skills to design appropriate frameworks, or right conditions, for future developments, which are not fixed in the long term. How can we make plans where main issues and qualities are taken care of, but that still leave enough freedom to incorporate changes during the process from design until realisation? And how can we then, at an early stage in the design process, still gain insight in the economic costs and benefits of a plan? Our research aims at developing an approach that can assist in these new urban challenges. But how can this be done? We claim that, by understanding the relation between quantitative and spatial properties, we are able to define programmatic demands and spatial ambitions simultaneously, without fixing a detailed program or a final image. We suggest that a design and planning instrument based on a combination of density concepts can help planners and designers understand the capacity of space and assist in designing appropriate conditions for largely unpredictable developments.

Density is a subject on which little fundamental research has been carried out. Built densities range from spacious rural settlements, through the low densities of the suburban sprawl, via the balanced urbanity of the 19th century expansions to the extremely dense

downtowns of the world's metropolises. Measurement techniques used to describe these situations have differed over time and even at present there is much confusion as to which method should be used. Besides the need to clearly define a method, an investigation into the relation between density and built form might prove productive to both urbanism as an academic discipline and to the planning and designing practice. The Spacemate method described in this article provides a coherent measurement technique and reveals a linkage between densities and typologies of land development, urban environments, and non-built space. The first part of this article positions the research in a morphological context and argues for a mathematical analytical accent within this approach. It also sets out to explain the basic principles of measuring density using Spacemate. In this section, a series of variables is defined and the different scales of measurement (aggregations) are described. In addition, the Spacemate diagram is introduced. The second section covers the investigation of the relationship between density and spatial characteristics. It shows with examples how Spacemate can be used to classify different types of built environments. In the following two sections, we concentrate on densities on different levels of scale and network density as an important property of the built environment. In the final section of the article we introduce the concept of performance indicators and suggest possible applications of Spacemate as a control instrument and test framework for the planning and design practice.
This final part describes the advantages of using density in urban design and spatial management during the early phases of the planning process. This can result in an increase of planning control on a high level of scale combined with a maximum degree of design freedom on a low level of scale.

BACKGROUND: TYPOMORPHOLOGY

Morphology means knowledge of form, in this case knowledge of urban form. Rowe (1978) describes the city using a figure-ground analysis and defines two extremely different urban figures: one dominated by mass and cut through by voids, the other an accumulation of solids in an endless floating void. In typomorphology, various classifications of buildings and open spaces are used to arrive at a more detailed description of urban form. Moudon (1994) discusses three schools of typomorphology (Italian, English and French), all with different origins and research focuses.However different their purposes and methods, morphological research in general has generated a useful body of definitions since the 1950s, as well as a common language for describing architectural and urban form. Morphological studies also have provided some key insights by focusing on the evolution of form (morphogenesis). Further, the expansion into different scale levels has helped to increase our understanding of the mutual dependence of architecture and urbanism. However, in general, one can say that a quantitative analysis of the built form has not been applied thoroughly within morphology.

This means that morphology as such has contributed little to understanding the relation between quantitative and spatial properties of urban areas.
An interesting example of quantitative analysis within the field of urbanism comes from the Centre for Land Use and Built Form Studies, which institute was established at the School of Architecture in Cambridge in 1963. Leslie Martin and Lionel March (1966) studied the relationship between, among other things, floor space, distribution of free space, and building height. In a way these studies relate to the work of Cerda in Spain (end of the 19th century) and Unwin in England (beginning of the 20th century). Unwin talks, for instance, about "the balance between area of plot, area of floor space and area of street". A more recent study that fits into this series comes from the University of Geneva (1986). In this study, a wide range of spatial properties were quantified, analysed, and related to each other. Most important in all these studies is the recognition of related factors: the land available, the built form placed on it, and the roads necessary to serve them. We claim that quantitative analysis can help to expand the possibilities and the explanatory power of morphology. And we suggest that the mathematical-analytical approach, represented by Cerda, Unwin, and Martin and March, must be viewed not as a separate 'school' with little kinship with the detailed graphical mapping techniques of traditional morphology, but as an extension of the field of morphological research itself. The analytical techniques differ, but the research aims coincide: describing and explaining built form. We want to characterize our own approach as being positioned inside the morphological tradition, but with an accent closer to the mathematical-analytical tradition just mentioned.

URBAN DENSITY

One way to analyse built form in its three-dimensional presence is to examine the density of the built environment. Before looking for hard and fast definitions of density, it is important to realise that this concept can be approached in various ways. The individual perception of density can differ completely from density in technical terms. These are different categories, and it should be clear that it is dangerous to use analyses in one category to draw conclusions in the other. The emphasis in our research is on the physical/spatial aspects of density. That is to say, it investigates the physical, measurable characteristics of built areas. In the past, a number of indicators were defined and used for measuring physical density. These indicators take the form of quotients in which the denominator is the total area of land where the density is being measured, while the numerator can take a variety of forms: homes, inhabitants, rooms, total available floor area, total available built area. Angenot (1954) and Heimans (1965), two researchers at Delft University of Technology, present the most accepted methods that are of importance when determining density. Their retrospective goes back to the year 1912 when Unwin wrote of an upper density limit of 12 houses to

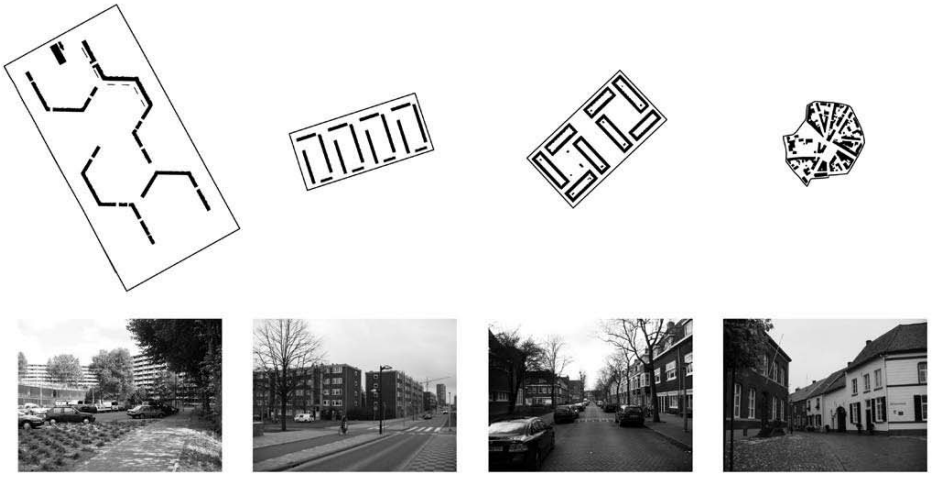


Figure 2. Examples with FSI app. 0.7

the acre (Nothing Gained by Overcrowding). Two decades later Wright suggested an ideal density of one house to the acre (The Disappearing City). In the Netherlands, the concept of density was used and prescribed in practice for the first time in 1934. Van Eesteren's scheme for a garden city expansion of Amsterdam (Algemene Uitbreidingsplan or AUP) was said to be based on pure scientific research and used density to define its environmental ambitions. Two recent Dutch publications by Urhahn (1994) and MVRDV (1998) deal with the subject in a less technical and more suggestive manner.

The most common variables to measure built density, such as houses per hectare or Floor Space Index (FSI) cannot efficiently be used to describe spatial properties. Houses per hectare does not take other programs (such as offices, schools, and other amenities) into account and, due to different sizes of the dwelling units, is a very elastic variable. FSI (ratio of floor space and ground area) is more informative as it reflects the building intensity independently of the programmatic composition. But, as the examples in figure 2 show, it is still not precise enough to differentiate between different spatial layouts. The four examples all have a comparable FSI, however, they differ greatly in the distribution of built mass and open space.

To demonstrate how these four plans can be differentiated from each other, three more variables have to be introduced that are useful when describing built space: Ground Space Index (GSI), Open Space Ratio (OSR) and Layer (L). The first, GSI, describes the amount of built ground in an area. The OSR describes the intensity of use of the non-built ground. Unwin explained this variable as follows: if the population of all the buildings in an area goes out at a given moment, how much room would there be for them in the streets and other non-built ground? The last variable, L, indicates the average number of floors in an area. The four variables are calculated using the same series of data – gross floor area, built area

and plan area – and are thus mathematically related. When working with FSI, GSI, OSR and L, it is important to agree how to calculate the underlying values of gross floor area, built area and plan area. It is not possible to discuss the definitions of these values in detail here (for more information on these issues, see Berghauser Pont and Haupt, 2004).

SPACEMATE

We suggest that if density is defined not only as intensity (FSI), but as a combination of intensity, compactness (GSI), height (L), and pressure on non-built space (OSR), it can be used to differentiate between urban form in a more efficient way. To assess all four variables simultaneously, we have developed a diagram, the Spacemate.

The FSI on the y-axis gives an indication of the intensity in an area and the GSI on the x-axis reflects its compactness. The OSR and L are gradients that fan out across the diagram. Combining these four variables gives every project a unique 'spatial fingerprint'. The four examples used before can now be seen to occupy different positions in the Spacemate (see figure 3).

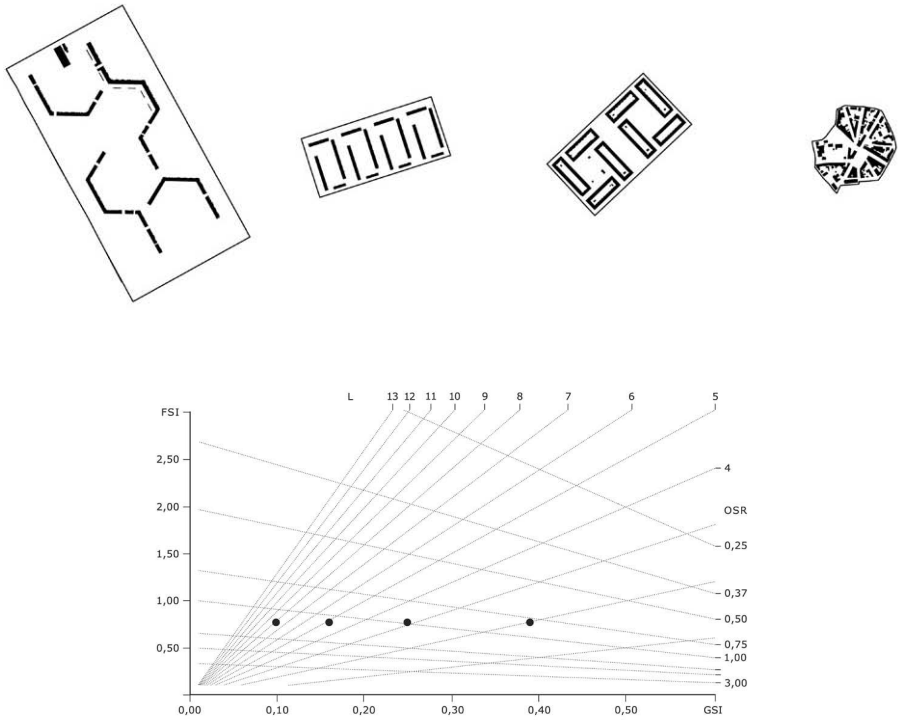


Figure 3.
Four examples in the Spacemate.

FOUR EXAMPLES

Four areas of Amsterdam – the Grachtengordel, De Pijp, Betondorp and a part of Osdorp (Zuidwest Kwadrant)– will serve to further illustrate the described method. The Grachtengordel (1613) and De Pijp (1875) are examples of orthogonal fabrics with traditional building blocks. The Grachtengordel was developed as an extension of the medieval city, which had become overcrowded due to the economic growth at the end of the 16th century. The urban fabric has an orthogonal and rational layout of streets, canals and blocks and is not based on the underlying landscape or the adjacent older fabric. De Pijp, on the other hand,

Figure 4. Four examples

1. the Grachtengordel **2. de Pijp** **3. Betondorp** **4. Osdorp**

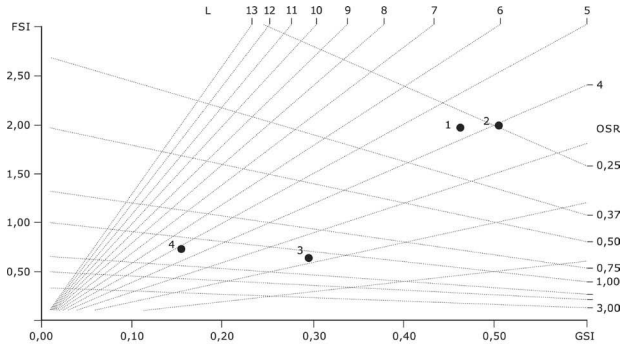


Figure 5. Four examples positioned in the Spacemate.

was shaped by the existing landscape, which has resulted in a smaller grain without canals. Both urban extensions consist of traditional closed (perimeter) blocks composed of a great many individual lots. In the case of the Grachtengordel, these lots were developed individually, while in De Pijp building developers sought to pack as many dwelling units as possible into relatively small blocks. However, the densities of the Grachtengordel and De Pijp differ little when it comes to GSI and FSI. Both have an FSI of approximately 2.0 and, with almost 50% of the fabric built upon, a GSI of 0.5. The third example, Betondorp ('Concrete Village'), was developed at the beginning of the 1920s when the housing shortage in Amsterdam was on the increase. Betondorp is the outcome of a competition organised by the City of Amsterdam for prefabricated working-class housing in the rural area of Watergraafsmeer. The density of this low-rise development is much lower than that of the two examples from the inner city. Its FSI of 0.64 is less than a third of the intensity of the Grachtengordel and De Pijp, and only 30% of the fabric is built upon.

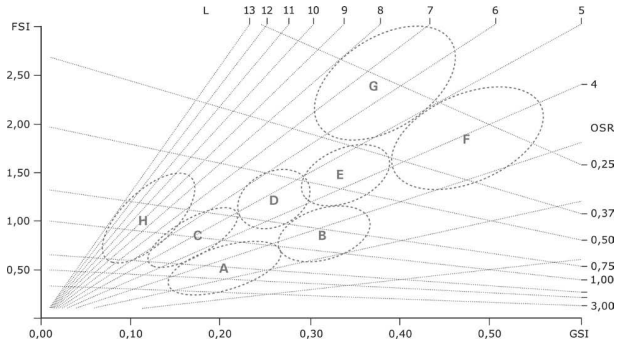
After the Second World War, when Amsterdam was again confronted with a huge housing shortage, the 'Western garden suburbs' (Westelijke Tuinsteden) were developed on the basis of Van Eesteren's AUP. The traditional building block was transformed into a half-open block where the inner courts became part of the public realm. This ideologically influenced way of building a garden city with lots of light, air and green space resulted in low densities. The FSI of Zuidwest Kwadrant in Osdorp (one of the Western garden suburbs) is 0.80 and thus comparable to Betondorp, but the GSI is much lower. Only 15% of the fabric is built upon. Due to these differences in density (FSI and GSI), the OSR differs too. Pressure on the non-built areas is four times as great in the Grachtengordel and De Pijp as in Betondorp and Osdorp.

TYPOLOGIES

In order to investigate the degree to which a relationship exists between the variables and the various building typologies, we selected 50 Dutch residential areas that clearly differ in terms of the degree of urbanisation and the type of land development. The typologies we selected and analysed can be categorised as low-rise (2–4 floors), mid-rise (3–6and 5–8 floors) and high-rise (> 7 floors).
Low-rise typologies are subdivided into areas featuring strip developments in either a 'spacious' or a 'compact' setting. These typologies are common in the suburban neighbourhoods of the 1990s, but also in post-war neighbourhoods and neighbourhoods from the 19th and early 20th centuries. The mid-rise buildings are subdivided into areas containing open, spacious, closed and compact building blocks. The open block is typical of the post-war period, while the closed and compact blocks are typical of pre-war cities. In the last ten years com-

Figure 6. Land development typologies

a. Low-rise spacious strip developments blocks
b. Low-rise compact strip developments blocks
c. Mid-rise open building blocks
d. Mid-rise spacious building blocks
e. Mid-rise compact building
F. Mid-rise closed building
g. Mid-rise super blocks
h. High-rise developments



pact building blocks have become popular once more. Due to their larger scale in terms of size and height (5–8 floors), they are referred to as super blocks. High-rise buildings can be subdivided into strip developments and tower blocks. Both have a very spacious urban layout.

When grouping the different residential areas in the Spacemate chart, it is evident that clusters are formed that display similarities in terms of spatial structure. Thus all the high-rise areas are gathered together in one zone in the diagram. This is also true of areas where closed building blocks, strips of low-rise developments or super blocks predominate. The interaction between the variables appears to be more significant than their absolute values; a high-rise area can have the same FSI as an area with closed building blocks.

The high-rise area is in fact built in a much less compact manner and so has a lower GSI. In Spacemate, the position occupied by the high-rise areas is different to that occupied by the closed blocks. In addition to the various land development typologies, aspects such as urbanisation, open space typology, granularity and functional blending can also be related to positions and clusters in Spacemate. This is an initial step towards quantifying the spatial

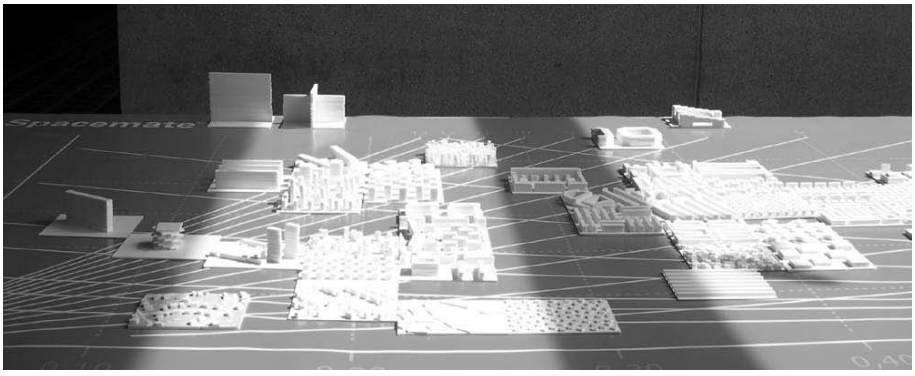


Figure 7. Student models positioned on a Spacemate chart for the exhibition Dwelling on Density, 2004.

characteristics of urban areas. The figure-ground analysis is hereby enriched with the third dimension and abstracted by quantifying the drawing. At the same time, the productivity (and resolution) of density as a concept for distinguishing between different urban typologies has been increased by integrating the figure-ground analysis in the form of the GSI.

AGGREGATION MODEL AND 'TARE SPACE'

So far, we have concentrated on the built floor area and the associated non-built area. The non-built area has not yet been further analysed. Interesting aspects of these non-built areas are the amount of public versus private ground, the amount of infrastructure, water and green space. Another limitation in the examples discussed here is their primary focus on the scale of the urban fabric. The results of this scale are important, but the relationship between different scales (aggregations) is also of great importance to designers and planners. Though the effect of a certain density at one scale on the densities at other scales is of great importance to designers and planners, this has not been adequately researched. By using the Spacemate method at all scales – from building to district or city – we hope to lay bare the logic of the surplus or 'tare space' which is added or subtracted when there is a switch of scale. The aggregations used in the Spacemate-project are as follows:

• Building. The plan area is the same as the built area. The borders of the built area are defined by the edges of the building footprint.

• Lot. The plan area is the sum of built areas and non-built private areas (tare space) such as gardens and private parking lots. In some cases the lot contains built areas only and thus corresponds with the entity of the building; no tare space is added. The lot is defined by the legal boundaries specified in the cadastral map.

• Island. In most cases the island will simply be a collection of lots. Sometimes, however, it will also contain public areas (tare space) such as playing fields, public car parks and green space. An island is limited by the borders of the transport infrastructure surrounding it. In places where no relevant transport infrastructure is present, a border is constructed between the lots and green areas or water.

• Fabric. The fabric consists of a collection of islands and the transport infrastructure surrounding these islands (tare space). The urban fabric is limited by borders drawn centrally along transport corridors relevant to the scale of measurement. In places where no relevant transport infrastructure is present, a border is constructed between the lots and green areas or water.

• District. This entity is composed of a collection of fabrics and large-scale non-built areas (tare space) not included in the fabric itself, such as parks, water and larger transport infrastructure.

Recent studies show that the added tare space differs greatly at the scale of the fabric. This space consists exclusively of infrastructure. A systematic inquiry into the relationship between the distribution of tare space at different scales and urban typologies could reveal insights that might be of great value for planners and designers.

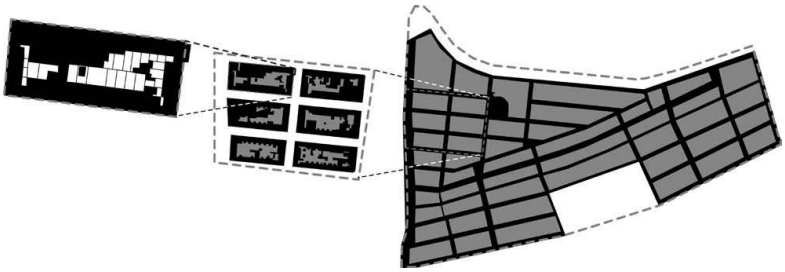


Figure 8. Three aggregation levels: island, fabric, and district.

Four examples

The four examples used above – the Grachtengordel, De Pijp, Betondorp and Osdorp – can also serve to describe the differences in building densities between the scales of island, fabric and district. The Grachtengordel and De Pijp show great similarities at the scales of island and fabric. In the Grachtengordel, 27% of the island consists of tare space (non-built private) whilst in De Pijp this figure is 25%. At the fabric scale, 37% of the Grachtengordel and 33% of De Pijp consists of tare space (network). At the scale of the district, however, the areas show a clear difference. Only 4%of the Grachtengordel district is tare space. In the case of De Pijp, the district tare space is 16%. This is due to the fact that in the Grachtengordel almost the entire public area consists of streets and canals, whilst in De Pijp 35% of the public area is a park (Sarphatipark). In other words, in the Grachtengordel the public area is evenly spread out over the district and in De Pijp a part of this public area is concentrated in the Sarphatipark. The other two examples show a different logic. Betondorp and Osdorp are comparable at the island scale, where respectively 59% and 63% consists of tare space. At the scale of the fabric, however, they show a slight difference. In Betondorp 29% of the fabric is needed for infrastructure, compared with 39% in Osdorp. The same thing happens at district level; less non-built space is added in Betondorp (district tare space 7%) than in Osdorp (18%). Thus starting with the same amount of non-built space at island level, differences occur at the higher levels due to the amount of infrastructure and the added large-scale open areas (green space).

NETWORK DENSITY

Although the Spacemate method increases insight into the logic of urban form by using a set of quantifiable variables to describe the built environment, the form remains abstract and lacks scale. Aspects such as the distribution of the footprint and the size and shape of the grain of the fabric remain unknown.
Studying the relationship between networks and the various forms of built environments might make these more explicit. In order to measure network density we need to define the term 'network'. In this case, network is primarily defined as infrastructure with a certain structural robustness. In most cases this will amount to motorised infrastructure with a width larger than a certain measure. This will for instance exclude a small path winding through a park. Further study will include formulating the most productive and relevant definitions of network. The length of the network is used to determine the network density (N). This network density can then be used to calculate:

- The average distance from street to street (fabric width/grain size);
- The porosity of the fabric (width of open space);
- The street profile.

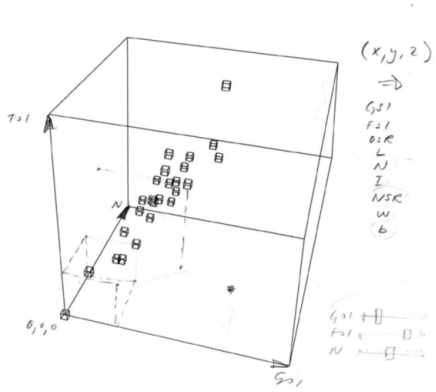


Figure 9.
SpaceMatrix

The new variable N not only contains quantitative information but also gives an indication of the dimensions of the urban form. This was not possible using only the FSI, GSI, OSR and L, as these variables are dimensionless. Thus, by adding the variable N to Spacemate, the 'spatial fingerprint' of an area becomes more precise. A three-dimensional extension of Spacemate – the SpaceMatrix – visualises this spatial fingerprint with three coordinates: the

FSI on the y-axis gives an indication of the intensity in an area, the GSI on the x-axis reflects the compactness of the buildings and the N on the z-axis introduces the network density. Combining the research on network density with the aggregation model may lead to new conclusions concerning typologies. It is important to note that the network density described above only can be applied at the scale of the urban fabric. Network density must be seen as a specific case of a more general 'transitional density', which can be defined on all levels of scale. In the case of the island entity,a density of lot divisions describes (indirectly) the average size of the lots composing this island. At a higher scale, the density of borders or transitions between different fabrics describes the size of these fabrics and thereby also gives an indication of the heterogeneity of a district.

Four examples

To illustrate network density in relation to building density we return to our four examples: the Grachtengordel, De Pijp, Betondorp and Osdorp. By measuring the length of the network within the urban fabric of the selected examples, we are able to describe the density of this network, the grain of the fabric and the street profile. It should be noted that the following theoretical values for grain and profile width are derived solely from the network density. The Grachtengordel has the lowest network density, 110m/ha, due to the large scale of the building blocks. This means that for every hectare of the plan area, there are 110metres of network. As a result, the grain of the fabric is quite wide, 182 metres, and the average street profile is 38 metres. If we compare this to De Pijp, which has almost the same building density, we see a big difference. Here, the network density is more than double that of the Grachtengordel (230 m/ha) and the grain of the fabric is half the width (87metres). The average street profile is only 16 metres. This shows that although the building densities are comparable and the building typologies belong to one family, little is said about another important characteristic of the urban fabric, size. By using the network density in addition to the building density, new families of different urban patterns can be identified. The third example, Betondorp, has almost the same network density and fabric grain width as De

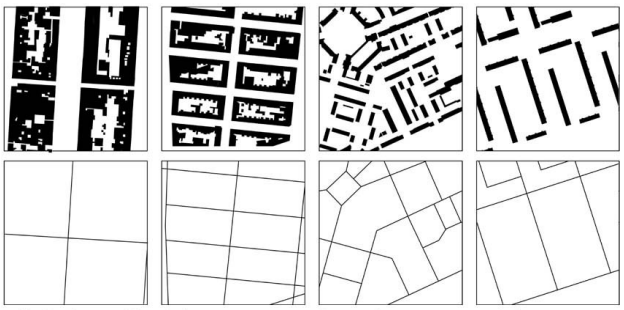


Figure 10. Figure-ground and network analysis of four examples.

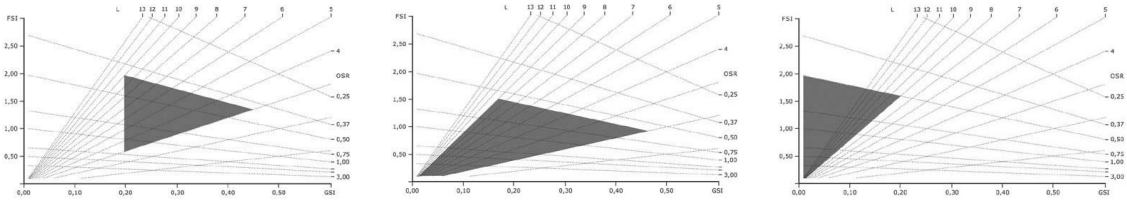
Pijp. From the perspective of network density, they resemble each other, while they differ in building density. The fourth example, Osdorp, has a network density lower than that of Betondorp and De Pijp but higher than the Grachtengordel. The fabric grain width is 113 metres.

PERFORMANCE INDICATORS

In addition to describing fundamental properties of built space such as the ones sketched above, Spacemate can also be used to investigate and describe the "behaviour", or the performance, of certain factors under different density conditions. Examples of such properties are private exterior space, urbanity, programmatic blending, parking, light access, accessibility, energy consumption, pollution and water management. The behaviour of these properties can be described by performance indicators.

Figure 11

Urban environments defined in the Spacemate, used as guidelines for transformations of the Westelijke Tuinsteden in Amsterdam.



These performance indicators can produce important information about which problems and possibilities can be expected for different densities (positions in the Spacemate). Every performance indicator can be viewed as a descriptive layer that, when combined with the others, can be used to clarify different qualitative aspects of urban environments, as well as identifying conflicting programs. By understanding the logic of these issues and their relation to density, the design task can be formulated more precisely and difficulties, or inconsistencies, can be spotted at an early stage in the design process. For instance, at which combinations of intensity, compactness and network density does it become necessary to look for built solutions for parking? Up to which densities can single family housing with ground access be realised? And what potential do different densities have for urbanity and functional blending?

CONCLUSIONS

As we have seen above, it is not only the FSI that matters when it comes to urban density. The three other variables of Spacemate (GSI, OSR and L) are just as important in describing built density. In addition, network density is important to describe the built environment. At an early stage in the development of a plan (for example when drawing up a list of requirements), Spacemate can help clarify the relationship between the spatial objectives and the development program. Depending on the stated starting point in a planning process (program, public space, building type), the diagram can be utilised in different ways. By setting out upper or lower limits, zones in the diagram can be delineated.

In summary, Spacemate has a number of qualities that can aid the design practice:

- Spacemate sets out a clear relationship between measurement units and graphic representation.
- Agreements made on the basis of Spacemate have an objective character.
- Spacemate increases control opportunities at a high level of scale and design freedom at a low level.

The quantifiable information embedded in density concepts has proven helpful in describing certain primary aspects of spatial form. This can be used in developing an instrument for planning (programming) and design (form).

Figure 12. Data of the four examples.

	grachtengordel	**De Pijp**	**Betondorp**	**Osdorp**
Fsi	1,98	2,01	0,64	0,80
gsi	0,46	0,50	0,29	0,17
osr	0,27	0,25	1,11	1,04
l	4,30	4,02	2,21	4,71
tare island (gardens) (%)	27	25	59	63
tare fabric (network) (%)	37	33	29	39
tare district (parks) (%)	4	16	7	18
N (m/ha)	110	230	250	150
grain fabric (m)	182	87	80	133
street profile (m)	38	16	13	29

By understanding the relation between quantity and form, the design task can be formulated more precisely. Densities can be used to define conditions under which formal ambitions can be realised. Densities can also be put to work in assessing the qualitative consequences

of such factors as parking, accessibility, street profiles, and dwelling type. By making relations explicit, difficulties and inconsistencies can be spotted at an early stage, thus improving the design process.

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NOTES

1. 1 acre = 0,4 hectare (app.)

ILLUSTRATIONS

- Figure 1: Algemeen Uitbreidingsplan van Amsterdam, 1934 and Gemeentearchief Amsterdam.
- All other illustrations have been produced by the authors.

IR. L. BUDIARTO

RESHAPING URBANITY
ECONOMIC RESCALING, URBAN TRANSFORMATION AND THE SHIFT OF LOCATIONS OF SERVICE FIRMS IN AMSTERDAM

Ph.D. research: Reshaping urbanity:
Economic rescaling, urban transformation and shift of location of service firms in Amsterdam from 1950's to present
Chair: Urban Renewal and Management
Promotor: Prof.dipl.-ing. H.J. Rosemann
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ABSTRACT

This paper is based on research into urban form which attempts to show a consistent relationship between a topological spatiality and distribution and organisation of functions (e.g. economic programmes) in the city. In the last couple of years, reconfiguration of urban economic space has become a key issue. Salet (2005:33) argues that this reshaping cannot be separated from the fact that from the beginning of 1990s urbanity (including urban economy) "...has shifted to a new form in which regionalisation has come to prominence", replacing the 'traditional' city and along with it has raised the issues of accessibility and re-scaling from city to metropolitan region as the relevant unit of planning and governance (Musterd & Osterdorf, 2003). However, how exactly reconfiguration of economic space may impact on the form of cities remains unknown. As a contribution to this discussion, this paper offers a perspective from urban morphology. It begins by proposing an understanding of the physical-material environment as a structure of 'place-world' (Braudel, 1979) which constantly evolves in space-time. Based upon the understanding of the city as animated by variously scaled movements and connections (global, regional, metropolitan, city and local) –a view that hinges on the concept of 'place-region network' (Budiarto & Read, 2003),

this paper aims to develop a renewed understanding of location. It is argued that 'location' needs to be understood as a construct emerging from the structure of relations whose logic resides in the material form of the city itself, rather than as empty surface waiting to be filled with functions. On the contrary, it is proposed to see location as carrying an active role in situating (economic) function. An empirical study in Amsterdam will be considered. It is argued that the location of business service firms is shaped with regards to the so-called metropolitan scale movement network and how in the last fifty years this location has been reshaped and shifted due to the transformation in the urban movement pattern.

I. INTRODUCTION

No one would deny that specific relationship exists between social and economic phenomena and the physical material form of the city. It is not, however, equally clear what the nature of this relationship is and to what extent they are interrelated. Do social patterns produce spatial forms or is it rather spatial forms that mould social behaviour? Soja (2000:7) believes that current literature, including urban studies, is heavily 'underspatialised'. He refers here to the fact that spatiality (including spatial form) is still predominantly seen as a mere product of the historical or social process. Many those claiming as 'spatial theory' often consider space merely as an extension of political, economical or social functions and, for different reasons, we are reluctant to consider seriously that the spatiality itself has a causal or explanatory effect. Given this fact, it is not surprising to find that the currently available theories trying to explain how (social) economic activities become located in space (from the classical to the contemporary ones) still heavily rest upon non-spatial presuppositions. Blinded by these presuppositions, many 'location theory' have failed to see an 'other space' beyond the economic, politic and social space.

The currently available location theories have failed because of at least two primary reasons. First, most of them surmise that the organisation of economic activities and the way it leads to a distribution in space completely follows the pure economic logic. For instance, the universal principle of minimum cost and maximum accessibility (Hagget, 1996; Abler, et.al., 1971, and Knox & Agnew, 1994:66-7) are thought to be the determinants of location. Starting from von Thunen's (1826) who took spatial distance as the only criterion for the definition and organisation of economic activities in space, the same argument has been resurrected by Alonso (1964) and most recently by Fujita and Krugman (1995). For these authors, space possesses a uniform and neutral character; an empty surface on which human activities will be optimally distributed according to the logic of economy. Second, the so-called location theories incline to think that economic player (either an individual human player or a firm) carries certain freedom in choosing where to settle and take action. In contrary,

in everyday life we see that the place where actions are being carried out is only made available through spatio-temporal 'structurations' (Giddens, 1979) that provide 'grounding' to those (economic) actions. As result, location theories have failed not only to notice that every human action (economic or social) is necessarily spatially situated, but also to consider that it is the location that determines actions rather than vice versa. Thus, despite Christaller and Krugman spans almost two centuries in history, they (and many other theories) sit in fact on the same camp: they unjustifiably assume that economic logic must have been the underlying force in every human action which as result they have become too much obsessed in systematic rules driven by the imperatives of economic logic and fail to reflect and unfold the richness and differences that exist and are generated by space. As once argued by Braudel (1979:39), this is exactly where those self-proclaiming 'location theories' have missed the connection with the real world: the absence of the very important concept of inequality (including centralities) that already exists in space even before space appropriated by human (economic) programmes. It is crucial to notice that the centralities mentioned by Braudel (ibid.) are those that play an active role in 'situating actions in place', rather than those that are 'generated by human actions or functions' as in Christaller's central-place theory (1933, 1963).

Only recently, after neoclassical economy and hence neoclassical theory of location began to lose their hegemony (Thrift & Amin, 2004:4), have we come to realise that economic logic alone fails to provide a compelling account for understanding 'location' on the basis of pure economic arguments alone. As effect, we begin to see the redirection of interest to alternative reading of the economy in the contemporary economic geography (Yeung, 2003). Also, there emerge different efforts to rewrite location theories from a non-economic basis in response to the intervention from Amin & Thrift (2000) and a more expanded one by Peck (2005). As Yeung (ibid.) explains, this 'new economic geographies' is not to be confused with Krugman's & Fujita's New Economic Geography (NEG), which is still heavily driven by economic-based arguments. The aim of this paper is not to extend this polemic endlessly but to seek the possibility to develop a plausible explanation from the perspective of urban morphology. Throughout this paper I try to put forward the understanding of urban space as a 'structure of places' within and through which human actions become intelligible. It aims to contribute towards an understanding of material urban space as having the ability to transform 'locations' to different human social activities, including those which are initially considered as driven purely by 'economic' motives. Illustrations will be taken from empirical study of Amsterdam to show a consistent correlation between the structure of places created by the configuration of urban material fabric and the effects of such a structure on the distribution and organisation of functions (here economic programmes) in cities. A particular focus of this paper is to show how 'centralities' change as places are being constantly made and remade, and, as a result, locations change spatially and temporarily.

The initial position of this paper owes to the Space Syntax theory drawn by Hillier (Hillier & Hanson, 1984; Hillier 1996a; Hillier 1996b). The Space Syntax theory focuses on understanding the 'causative' powers of material urban space. Hillier (1996b) proposes that the configuration of the urban grid (i.e. the material fabric of the city or simply the arrangement of voids and non-voids on the surface) has in itself the ability to generate the movement of people (i.e. natural grid-movement). He claims, then, that such a fundamental grid-movement has a pervasive influence on the distribution of urban activities and hence the pattern of urban function, for example, by attracting movement-seeking functions (e.g. shops) to spaces along which the sheer number of natural movements are conveyed, and send all less-movement-seeking functions to the rest. This process results in what Hillier conceptualises as 'cities as movement economies' (1996b). Thus, it is obvious that the Space Syntax theory stands in direct opposition to the traditional location theories that see the emergence of spatial pattern exclusively as the outcome of social and economic processes, and that the material form of the city is subservient to the social and economic processes creating it (Mumford, 1939). Building upon the theoretical position taken by the Space Syntax theory, this paper proposes that it is the urban material fabric that plays an active 'powers' to situate or locate human social and economic actions. This theory rejects the idea of (urban) space as empty surface waiting to be shaped by human actions. It sees, on the contrary, that the material form of the city is capable of producing effects on the 'natural' distribution of human activities. The implication of this radically 'spatial' view is that the analysis of the material form itself must be taken seriously and considered as having an explanatory power in itself.

To start, the concept of location will be first explored. This paper use the word 'location' differently to the way traditional location theories use it. In this paper, the word location refers not to a specific point in the geographical surface where particular activities are found, but a set of relations that endow particular activities to take place; or in other words, this paper argues that it is the location that 'enacts' actions (Budiarto, 2006). The aim of this paper is to expand this renewed concept of location and to consider the possibility that this set of relations has dynamically changed in history which should be made evident through a morphological analysis on spatial material transformations and their relations to the shifts of location.

II. TOWARDS A RENEWED UNDERSTANDING OF LOCATION

In order to put the above mentioned concept into operation, the Flat-city model (Read, 2005a) will be considered in this paper. The Flat-city model has been built with the intention of extending the functionality of the traditional Space Syntax model to investigate cohesion

in the urban periphery and contemporary metropolitan landscape (ibid.). The model basically proposes that the city can be understood as configurationally constructed by different layers of movements, interwoven by their scales and temporalities or speeds. These different layers of movements are, furthermore, seen as capable of producing a 'strata of places' (Budiarto & Read, 2003). Subsequently, drawing from Casey (1996:24) who defines a 'region' as "...area concatenated by peregrinations between the places it connects", we have proposed, then, that our physical environment be structured into strata of 'place-regions' (Budiarto & Read, 2003); each with their own definitive scales and each with their own connective matrix enabling the 'regional' (as Casey uses the word) movement to connect 'places'. The shifting between places of different scales goes almost without notice in our everyday movements (e.g. going to work in another city, shopping in the city centre, buying groceries in the local market) and seems to happens 'naturally' while, in fact, it involves a rather sophisticated systems of points of translations and orientation.

The concept of the place-region network has since then been extended to explore the question of location (Budiarto, 2006; 2007). It is proposed that each 'place-region' layer (which is constituted by a definitive scale of movements) carries also a certain 'centrality' which determines 'location'. Here, it is crucial to note that in this paper, the word 'location' is not a substitute for 'site' or a portion of empty space which later may be occupied by 'things' (e.g. functions). Also, the difference between the two is not that 'things' (or 'actors') are mobile while 'locations' are fixed. It is argued that in the actual urban formation, the word 'location' concerns a particular region-place network, while 'site' may, in fact, contain a series of regions of places. Location, as I use the word in this paper, is quite close to the notion of 'place'. Places are, according to Urry (2000, 2006) not fixed or passive, but they are in themselves 'fluid' or 'mobile'. Furthermore, places are always open, made and remade, and contested on a daily basis (Creswell, 2003:27). Above all, places are inherently implicated within the movement and spatial practice (de Certeau, 1984:97). In a similar vein, I define 'location' as a place produced by a particular scale of movements (or by the interaction between two or more scales), in which a certain set of (human) socio-economic actions becomes facilitated and made effective in a particular site; in other words, it is the location that enacts actions.

The example I would like to consider here in order to illustrate the concept of 'location' and to explain the distinction between 'location' and 'site' is a particular site in Amsterdam called Beursplein. There one can immediately see that Amsterdam's Beursplein (which is a site or an empty container of activities) is made up of various scales of connections. At the top scale, it is made up of connections that link Amsterdam to Paris, Milan and Brussels. This is the circuit of the global/regional economy and space facilitated amongst others by the Euronext financial network, the amount of air travel between those cities and the

high-speed train network. In terms of activities, this scale of place can be seen through the cluster of globally oriented firms residing on the site (e.g. financial firms on Beursplein 5). Simultaneously, Beursplein is connected to places like Amsterdam West and Jordaan by the urban network on a slightly lower scale (neighbourhoods) by the so-called middle-scale networks (e.g. tram/metro lines, bicycle-paths) and also by a particular scale of economies (e.g. department stores, amusement centres). Finally, at the lowest scale, Beursplein is also connected to locally adjacent places and particularly the 'local' economy (e.g. a café in Damrak, a corner shop in Warmoesstraat, connected by a series of alleys and pathways). In this example, we can see that Beursplein is not necessarily the same place from the perspective of someone sitting in the Paris stock exchange as it is to someone sitting in a café in Damrak. Place is situated in relation to a particular network of scale and according to the particular context of one's immediate needs, orientations and performances or actions.

The task of this study is to investigate how locations are produced exactly. One can only tackle this if he seriously considers that every action is spatially situated. Regarding this, there are key concepts that need to be explained first. Firstly, the notion of 'centrality' is crucial to the understanding of location as it explains how action is specifically situated in a particular network. It is proposed that each region-place network entails a particular scale of 'centrality' (e.g. metropolitan, middle or local-scale) which starts to give form to the *process of appropriation* (through which urban forms gain functional attributes, e.g. shopping streets, business centres, residential areas). It should be clear that the centralities here are network-generated centralities (determined based on relations between places), contrary to the more conventional concept of centrality. Following this hypothesis, it is expected that urban (economic) functions operating on a particular urban scale (ranging from the metropolitan to middle and local scale, e.g. company headquarters, shopping mall, bakery shop) will locate themselves, almost mechanically, in the region-place network, carrying the appropriate scale of centrality. In this sense, the region-place network starts to organise, regulate and coordinate the distribution of urban (economic) functions in the urban surface.

Secondly, the place-network hypothesis, as the reader might have been aware already, anticipates that economic functions of dissimilar types or operating on totally different economic scales may eventually share the same site without necessarily sitting on the same place-region. In other words, different activities do not necessarily occupy the same 'location', although they may physically sit on the same site. For example, an investment firm and a café sitting side by side in the Beursplein, are neither operating in the same space-time (in a spatial and economic sense) nor are they located in the same place-network, because their *'situatednesses'* are produced by two distinctively different circuits of place-network. Yet, somehow, these different networks have become converged together in a single site and they may start to produce certain locational effects that strengthen their ground-

ings to that particular site. For example, the café might rely for its business on certain local rhythms, from the lunchtime habits of firms' workers to catering for the needs of social gatherings in the after hours. This means that we should not expect to find a simple and straightforward relationship between the centrality that a place has and its functions during an empirical study. Bruyns & Read (2007) claim, for example, that qualities and potentials delivered by one 'place-region' stratum are often 'grounded' and 'realised' in a lower 'place-region' strata. So, metropolitan-scale functions may end up realised in a lower ('urban') stratum, but oriented (and related by a 'topological depth' relation – a concept familiar in space syntax) to the 'metropolitan' network.

Thirdly, in this perspective, 'place' and 'network' do not represent two separate categories as we usually think – there is no place without a network and there is no network that does not create place. The argument is also provided, among others, in Salet (2003:54). He argues that the quality of place and space lies in its degree of interconnectedness (ibid.). The consequence of this view is that the quality of place should be indicated as a 'network quality' instead of a static, locally and territorially bound quality. Furthermore, such qualities of place are largely found in non-territorially bound networks of communication, such as the interconnectedness of levels of knowledge, labour and culture as well as physical accessibility (Salet, 2005:23). Furthermore, Salet argues that the location of firms and the concept of place are intimately related, even in the context of the contemporary economy. The concept of 'footlooseness' – that firms can locate virtually anywhere given the advances of telematics – which is focused on decreasing the significance of place, is according to him strongly exaggerated in general as 'place' definitely keeps its sense, albeit for reasons other than the historical costs of transportation (Salet 2005:21-22). He also underlines that the particular characteristics of place (which can be a city or a region) still make sense and is even 'multiplicated' instead of being neglected (Salet, 2005:23). It can be concluded, then, that the concept of place (and physical access from the appropriate level of network) is still relevant in the discussion about the location of contemporary service firms, albeit driven by reasons other than territorial ones (e.g. catchments area of customers, proximity to resources). In respect to his idea, our idea of place-region layering is developed with the intention of systematising the idea of place-quality (which, again, occurs on different scales as argued further by Salet) and to render it operational in research carried out on urban form.

III. TRANSFORMATIVE CITY; FORM, CENTRALITIES AND LOCATION AS A PROCESS

From the last ten years or so, we have seen a profound change in the shape of the 'economic city' due to increased mobility. The city 'explodes', as Wright & Stewart (1972:2) put

it. The functions that were formerly 'urban' have been undergoing a functional rescaling to the 'metropolitan' or regional scale (Salet, 2005:23) and, in terms of location, they are shifting to the edge of the city and the periphery, as Garreau (1991) has shown. Although speculating that changes in the material form may result in profound changes in centralities, and hence locations of functions (i.e. as different places are now generally better connected than they were in the past) seems very attractive, we need to be critical of such simple causal-effect relationships. Of course, material transformations (e.g. new infrastructures) may potentially lead to violent and swift changes of land use due to the rescaling-effect in the place-region network. Yet, there are also examples of non-linearity, in which any direct effect of physical change could have been hampered by the inherent time-lag in property development. Furthermore, the effect of change may also depend on the scale and volume of changes that occur and such effects may also lessen due to stabilisation (of the changes that occurred in the previous period) and the extremely stratified nature of configuration of both the changes in the physical environment and societal development. This means that the effect of physical change on the pattern of space-use may be less straightforward.

On the other hand, Ceccarelli (1972:8) notes that the physical environment may also be 'resistant' to societal transformation. He asserts that this occurs especially since changes in the socio-economic phenomena and organisation of the physical environment take place not only on a different timescale but in different ways. According to him, the nature of changes in the physical environment and societal development themselves makes 'combinatory' production possible, making their interrelation extremely complex. For example, today we can easily find the superimposition between 'modern' physical elements on pre-existing environmental system. Thus, the straightforward effect of transformation in one system on another in general hardly occurs (ibid:8-13). He suggests, then, that in an attempt to understand and to draw a correlation between physical and socio-economic changes, we need to turn to the 'behavioural/ ecological' approach, which focuses to consider the behaviour that exists in every society's fixed 'dominant' group whose behaviour characterises or has the largest effect on the structure of the environment. In this regard, he the introduces a hypothesis that "...adjustment of the environment to a socio-economic system takes place only through the adjustment of some of its elements to the ecologically dominant units; it follows that when the correspondence among these terms goes below certain levels, a critical period should begin." (ibid:12)

As a contribution to this particular issue, the questions this paper tries to address are: (a) *to what extent has the metropolitanisation of the 'economic city' caused a transformation of 'economic' places and a reconfiguration/reshaping of 'economic' centralities? And (b), how can we demonstrate that the logic of these changes can be articulated by way of our 'structure of places' urban model?* The answers will be pursued through an empirical study

on the location of business service firms in Amsterdam from 1955 to 2005 by investigating to what extent changes in the form (speed and scale) of movements may be correlated with changes in the pattern of urban functions. This paper will focus its analysis on the change of 'orientation' rather than 'position'. Change of position is usually measured from a fixed spatial datum. For instance, the distribution of functions is usually measured by taking the 'city centre' as an absolute point of reference (e.g. in/outward movement, sprawl or compactness). To measure change of orientation, on the contrary, we need to invent various spatial data; a system of axis and points of reference that is able to change dynamically in relation to the objects being measured. The spatial data being used in this paper will therefore be developed according the model presented in Bruyns & Read (2007), which classifies the urban movement network into four distinctive scales: the global, metropolitan, middle, and local scale network (ibid.).

The remainder of this paper will be used to present an empirical study in Amsterdam, which should provide an illustration regarding the concepts outlined before. The choice to focus on the location of firms is made, firstly, because a morphological study on urban fabric and location is rarely taken beyond retail-based activities. Therefore, this study intends to fill this lacuna. Secondly, data on firms is both widely available and highly reliable. The current database also allows us to retrieve historical information regarding changes in their office locations. Focusing on business service firms located in Amsterdam, this paper finds that the 'metropolitan' is the relevant scale for analysis. As argued by Salet (2005:27), Amsterdam has experienced a shift from the 'urban' to the 'regional' economy. For instance, Western Europe now constitutes a distinctive economic space, in which Amsterdam, Brussels, Paris, Frankfurt and Milan are linked together into a vast urban network (which is, as yet, sitting on a lower hierarchy than that between New York, London and Tokyo). In this paper, the word 'metropolitan' is chosen to represent this 'new economic space'.

IV. RESHAPING OF ECONOMIC SPACE AND URBAN FABRIC; THE CASE OF AMSTERDAM'S SERVICE FIRMS

A spatial model of Amsterdam has been developed and explained. The model is based on the layered grid movement model (Budiarto & Read, 2003; Read, 2005). Figure 1 shows how Amsterdam's urban movement network is sliced into four different layers. The first layer, the global scale, connects Amsterdam (as a place) to other 'global places' like London, New York or Tokyo. Slightly below this scale, there is the metropolitan scale, consisting of networks that perform by connecting Amsterdam to cities like Rotterdam, Utrecht, The Hague, Brussels or Frankfurt (i.e. the network of Western European cities). An example of this network is the European/ national highway. The third layer of urban networks is performed by

district level movements, for instance, those between places like Amsterdam Centrum to Geuzenveld, Jordaan, de Pijp, Zuid or Osdorp. Examples of this 'middle scale' network are the tramlines, bicycle paths and major thoroughfares. At the lowest level, we have 'local scale' networks consisting of backstreets that connect individual buildings.

Just as we have classified the urban network into four distinctive scales, firms may correspondingly be fit into the same categories: those servicing on the global, metropolitan, middle and local scale. Examples of firms that belong to the local scale are those of "... the soft institutions carrying the functions of lubrication for economic exchange." (Amin & Thrift, 2001). These include, among others, face-to-face meeting facilities such as restaurants and cafés. Stepping up in the scale-ladder, we find the middle scale functions which are just large enough to generate city-scale movements. Examples are city-scale shopping facilities, amusement parks or leisure centres. The third tier of services is formed by various types of firms that provide 'localised' services but do not necessarily require face-to-face contact. Examples are services that are tied to local regulations (e.g. lawyers, accountants and tax-advisers), or those which supply their clients with insights to local taste (e.g. media, advertisement) or providing local know-how (e.g. marketing, business research and development,

Figure 1.
The breakdown of place-region strata in Amsterdam (Bruyns & Read, 2007); metropolitan network (dark lines, bold), middle-scale network (dark grey), and local network (light grey)

real-estate), or even various types of services that simply cannot be provided remotely (e.g. cleaning services, couriers and package deliveries). Finally, at the top of the scale-ladder, we find functions that provide services at the global scale. Examples are the (European) headquarters (EHQ) of multinational firms. These EHQs are, by definition, not necessarily large, but they hold a top-level management function in firms internal organisation –they are where crucial decisions are made. This classification of firms is crucial since this paper sees each of them as occupying a distinctive spatial scale (since every firm consists, factually, of a set of spatial operations) and, thus, each is able to constitute and produce its own place, as place, following De Certeau (1984:97), is produced by a spatial practice of people.

This paper will in particular deal with the location of business service firms (the third group of firms mentioned above). First, data concerning location and changes of location of these firms from 1955 to 2005 (with a ten-year interval) are collected through official registers and phone directories. The sample number is proportionally taken from the total firm population in that year, growing from around 500 to 2000 respectively. Samples are selected based on business activity, i.e. they must provide services in at least one of the following activities: accounting, business management, tax and legal services; investment and other financial institutions; design, advertising and media-related industries. After that, the data are put on a map and superimposed with the model of the urban network from the same period, drawn using the layering-method as explained before (see Fig. 2a-f). This series of maps is expected to produce a visual demonstration which provides us with some indications regarding the relationship between the transformation in the material urban fabric and the reconfiguration of location; does reconfiguration in the 'metropolitan' urban network have an effect on the location and distribution of service firms and to what extent?

This series of maps reveals that the 'city centre' of Amsterdam, once regarded as the obvious nucleus of urban economic activity, has been constantly challenged by its 'peripheries'. Its dominance as an urban nexus has been significantly eroding, particularly after the end of 1980s (Fig. 2d). When compared to the fast growth of the peripheries, the inner city seems to lag behind, despite the fact that the whole region experienced an economic upsurge after the 1970s, both in terms of economic growth and total employment (Netherlands Scientific Council for Government Policy, 1990). Although from the 1970s onward one can obviously see the seeping out of firms to sites around the 'ring road' (Fig. 2c), it is not until the beginning of the 1990s that the reconfiguration of urban pattern becomes quite plain to see (Fig. 2e). With regard to this pattern of transformation, Amsterdam South seems to gain the most; there has constantly been a large number of firms moving to Amsterdam South long before the plan for Zuidas was ever conceived. In a closer look, this pattern is created by two different flows: first, a swift exodus of banks and legal service economies from the inner city locations to the urban circular (to the south-eastern side of the circular at first and to

Figure 2a. Amsterdam 1955. Location of firms and the metropolitan scale of the urban network (bold).

Figure 2b. Amsterdam 1965. Location of firms and the metropolitan scale of the urban network (bold).

Figure 2c. Amsterdam 1975. Location of firms and the metropolitan scale of the urban network (bold).

Figure 2d. Amsterdam 1985. Location of firms and the metropolitan scale of the urban network (bold).

Figure 2e. Amsterdam 1995. Location of firms and the metropolitan scale of the urban network (bold).

Figure 2f. Amsterdam 2005. Location of firms and the metropolitan scale of the urban network (bold).

the south circular in the second wave). The second flow, which occurred shortly after the first, is led mainly by accounting firms and other large financial institutions. This fact suggests that although we observe a radical transformation in the geographical position of firms (from city centre outward to the south), we can still find a 'residue of relations' between related activities (banks, legal services and accounting), which may reflect upon the topological features of space and patterns of centrality. This, however, remains to be clarified in a further study.

While this outward pattern occurred up to the 1990s, mainly the result of the relocation of the headquarters of large companies, financial institutions, business administrations and legal services, the 1990s were marked by an 'inward' movement which turned the inner city from a financial and legal services centre into a site for a varied 'new' (creative) economy (design and media related industries in particular) besides, of course, bolstering its eminence as a tourist centre and just-in time leisure economies. So, left by the firms performing on a 'metropolitan' scale, i.e. those who ostensibly have the largest finances at their disposal, the inner city has turned into a breeding ground for generally 'smaller' firms or those with fewer financial powers compared to previous ones. This example shows how two different economic spaces were created at that time: the large development axis to the south of the city, along the motorway (in particular in the case of European Headquarters of multinational firms), and the economic space for lower scale economies in the inner city. The emergence of Zuidas is, according to Salet (2005:33), simply an indicator of a shift from an 'urban' economic space to a large 'metropolitan' (i.e. greater-than-urban) scale.

V. A SHIFT IN THE PLACE-REGION NETWORK AND ITS IMPLICATION ON URBAN LOCATION; ZUIDAS AS AN EXAMPLE.

How Amsterdam has in time economically and spatially expanded into a 'metropolitan' place (in the case of Zuidas) while, at the same time, reinvented its inner city with other types of economy is a quite fascinating phenomenon that deserves an explanation. Salet (ibid.) argues that the reshaping of the economic space and configuration cannot be separated from the fact that from the beginning of the 1990s urbanity (including urban economy) has shifted to a new form in which regionalisation has come to prominence replacing the 'traditional' city, in which the issues of accessibility and re-scaling from city to metropolitan scale planning have been raised. The shift, as his explanation goes, is led by an economic upsurge in the rise of the global economy that "...pushed aside social problems and local rivalries in the past decades." (p.24). This kind of explanation, as it can be immediately seen, is unfortunately still resorts to social-economic rather than spatial arguments. To start with a spatial argument, this paper proposes that we need to see Amsterdam as inherently metropolitan. This contradicts the traditional city evolution theory which saw the city as evolving through

different stages; from the primate city (e.g. the isolated city surrounded by hinterlands) to a modern city and, finally, a (post) metropolis (where city borders finally dissolve). Part of the difficulty we have in overcoming this mindset is because for too long we have lingered on scrutinising facts about changing states of the city using terms such as size or compactness. Instead, we must investigate how the technological connections that link cities together have been evolving in space-time. For example, place-region may have changed in form today than it was in the past.

Such analysis can be done by observing changes in the metropolitan network from 1955 to 2005 as shown in Fig. 2a to 2f. By relating the morphological changes of metropolitan network to firm's location, it is plausible to suggest that the 'clustering' of firms is more likely to occur along the metropolitan scale network or at the point of transition/ shift between the metropolitan to the middle-scale. This suggests that the structure of visibility and access in the total urban network (topological, contrary to architectural visibility) may correspond to the structuration of places in our perception – in other words that the logic which underpins these changes is one which is founded on a Heideggerian principle of place as a 'structure of presence' and intelligibility. The series of maps shows that sites 'closer' to the metropolitan scale network appear to be constituted as a 'metropolitan place' at a much higher level of consistency than spaces topologically farther from the network (which in this case are the highway exits). This 'closeness' is measured here not by metric distance, but using the concept of topological depth, which is adopted from Space Syntax. Topological distance is measured using the number of steps being taken – in this case, the number of turns needed to be taken off the metropolitan network to that particular site, the more turns needed to reach that place, the farther it is (disregard the actual metric distance).

The series of maps below also suggest that although changes in the metropolitan scale of the urban network in Amsterdam from 1955 to 2005 have certain effects on the shift of places, not all places are evenly affected. For example, some places have drastically moved up the scale, e.g. Zuidas, while others have declined, e.g. Centrum. More than the plainly visible fact about the draining of firms from the inner city, the map also shows the patterns of formation of new urban centres (in this case, business clusters). In the period between 1995 and 2005 (Fig. 2e and 2f), for example, we can see that a certain number of sites has gained more from the overall relocation of firms while other sites have been drained of firms. While there may possibly be different explanations, this paper offers a spatial explanation: most of the 'sites that have gained' are those with a direct orientation to the highway (i.e. less topological depth, but not necessarily in the proximity of the highway itself), while the 'drained sites' are those without this advantage. The reason why this pattern has become particularly obvious during that particular period is likely due to the fact that in those years Amsterdam experienced relatively minor physical changes to its metro-

politan scale network compared to those in the previous periods –as the ringroad has been completed in 1990/1991, there has been practically no transformation of centrality during a period of almost 15 years, which ostensibly produces stability in the location pattern.

VI. DIRECTIONS FOR FURTHER STUDY

This paper has outlined the possibility of explaining the location of firms using a basis other than an economic argument. As stated in the beginning of this paper, it attempts to explain the workings of the economy by using the understanding of the inhabitation structure of the urban landscape. To do so, the study presented in this paper has sought a substantial part of the explanation by using urban material form as the basis for discussion, in particular by showing the persistent correlation between the changes in urban form and reconfiguration of functional patterns.

While trying to do so, I have to admit that some of my arguments are, unavoidably, still rooted in economic logic. This century is marked with the realisation that it is unjust to consider 'economy' as a separate discipline to social, cultural, political and spatial studies –a division which is long rooted in history, ranging from Weber who once claimed economy as a special category of social action to the expulsion of economy from sociology by Durkheim. Redirecting interest to everyday life is still in its infancy and for the same reason, non-economic explanation of the economy is still scarcely found. In the field of economic geography, for instance, Yeung (2003) complains that the current literatures in this new field of inquiry (which is often dubbed as 'the new economic geographies') are still focusing too much on 'why' a movement away from (neo)classical economic arguments is desirable, but they are rarely accompanied by clear answers on 'how to do it'. The study outlined here is a preliminary attempt, which still requires further exploration.

Reflecting upon the results achieved so far, the urgent issue that need to be clarified in further study, with regards to the idea about shift of orientation of the 'traditional city' to contemporary socio-economic conditions as presented here, is to gain a sufficient understanding about how the shift of orientation and transformation of place occur; it has occurred in the past and it is not unlikely to occur again in the future. For example, the metropolitan place has shifted from the harbour in the 18th century, to the inner city and around the CS at the start of the 20th century, and towards the Zuidas in the beginning or 21st century. Part of the task in our profession is to anticipate and come up with a conclusive concept to address this issue properly. In this regard, what the author's ongoing research hopes to contribute is to develop a reliable methodology that will enable us to account for and assess the transformation of the 'traditional city' to contemporary conditions or new functional orders.

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IR. C.S. CHIANG

SPATIAL QUALITY AND CITY RANKING

Ph.D. research: Generating spatial quality platform towards city competitiveness
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ABSTRACT

This research investigates to what extent spatial qualities contribute to city competitiveness. Globalisation has increased pressure on city competitiveness, and free market determinism has created a gap between global wealth and local poverty. A 'both-and' trend can be observed in that on the one hand, cities are competing for footloose capital mainly driven by market forces, and on the other hand, they are strengthening their own specialisations. In such circumstances, cities have to increase both their attractiveness and quality of life, maintaining their competitiveness whilst diminishing future risks. This paper is the first step in the research, exploring what role spatial quality plays in the existing different spatial, economic-based ranking systems. By introducing the nature of competitiveness, the argument is that city competitiveness cannot be viewed simply from the perspective of economic performance. Subsequently, by investigating different types of ranking systems on national, regional and city scales, the relevance of spatial quality can be outlined. Finally, conclusions will be drawn on each different scale as guidelines for further research.

1. INTRODUCTION

1.1. Globalisation and City Competitiveness

Globalisation has escalated the pressure to compete in many aspects of our everyday life. Free market determinism implies the *survival of the fittest*; a concept relating to the competition for survival or dominance. The gap between global wealth and local poverty has made it clear that global competition has produced an unbalanced distribution of wealth,

instead of promoting equitable growth which leads to different risks. In advanced societies, the restructuring of welfare states has had—and will continue to have a direct impact on some unfavourable individuals, groups and areas (shrinking cities in Europe and U.S.). Among developing societies some are able to benefit from the advantages of relocating industrial manufacturing jobs over others. Nevertheless, globalisation is not merely in a linear fashion constrained in one single dimension of economic globalisation, its collateral effects on information, ecology and culture (*Beck*,2000) have a "widening, deepening and speeding up of worldwide interconnectedness in all aspects of contemporary social life" (*Held* et al. 1999). If globalisation (Transnational Companies) ideologically blurs the national boundaries (*Sassen, Castells, Harvey*), then the city-regions will logically be on the frontline to confront global challenges and improve their attractiveness for direct investment since "pretty much all of the globalisation work has been done in the cities" (*Sassen* 1992, p.630) and more than 60% of the world's population will be living in urban areas by 2030 (*UN*: 1999). In European governments, the European Commission, many regional governments and agencies recognise that to *achieve national economic success it is necessary to have successful cities* (*OECD* 1998, 1999, 2000, 2002; *EU Commission* 2000). Therefore, city competitiveness becomes a major concern in many fields of study that seek an adequate concept to achieve, to improve and to maintain, while diminishing the future risks of competition. Despite a common consensus on many municipal and academic levels that the idea of a sustainable society should be evaluated in terms of the balance between economy, ecology and society; city competitiveness is significantly focusing on *benchmarking and evaluating economic performance*. Undoubtedly, economic importance is essential, but many economic performance indicators are the *outcomes* (i.e. GDP, GDP per capita, foreign direct investment, and so on) rather than the *reasons* for being competitive. That is to say there are other driving forces forging urban dynamics (i.e. human resources, cultural, socio-spatial, environmental, tax reasons, and so on) and the complexity of city competitiveness should be underpinned in a broader content.

Understanding the complexity of city-making, this paper researches the relevance of spatial quality among various spatial economic based ranking systems and how spatial quality can be quantified in the array of econometric indicators. The central objectives of this paper are to identify:

- One ranking system's competing units, dimensions, decisive factors, methodology, results and limitations.
- The economic and non-economic drivers.
- The spatial elements involved, their importance, and what spatial elements are missing.

1.2. Overview. The Selected Ranking Systems

Table 1 shows the categorisation of the selected ranking systems in terms of scale and attributes.

On a national scale, three major rankings—the *Factbook* from the Organisation for Economic Cooperation & Development (OECD), the *Global Competitiveness Report* from the World Economic Forum (WEF) and *World Competitiveness Yearbook* from the World Competitiveness Center IMD were selected. All three supra-national systems focus on macro-economic indexes from rather comparable categories. The Factbook is built on pure statistical data whilst the other two combine a statistical approach and a survey from a national-based executive survey. Despite their methodological differences, the results are also very comparable. In 2005-2006, the 15 same countries are simultaneously rated in the top 20 in both WEF and IMD rankings.

On a regional scale, rankings with different ideas and approaches can be seen. The four regional ranking systems are: *Randstadmonitor* developed by the Netherlands Organisation for Applied Scientific Research (TNO), the *Regional Competitiveness Indicator* from the Department of Trade & Industry (DTI) in the United Kingdom, the *Regional Investment Climate* from ECORYS-NEI and a Joint Venture from the Silicon Valley Network. The criterion for selecting these four European and North American based rankings is the long history emphasising their regional development. Randstadmonitor monitors the economic position of Randstad Holland compared to the other nineteen European major city-regions. The DTI regional competitiveness indicator presents statistical information for developing regional economic strategies based on UK territory. From a business viewpoint, ECORYS-NEI has developed a so called "competitiveness tree" concept by surveying entrepreneurs to illustrate regional competitiveness. The Joint Venture - the Silicon Valley index compares ten US based high-tech regions, not only in terms of economic growth but also quality of life.

On a city scale, border initiators, approaches and territorial settings are involved. The *Chinese City Competitiveness,* initiated by the National Social Science Academy is to investigate the industrial clustering of 200 Chinese major cities. The *Creativity Index*, developed by Florida, is gauging how the "creative class" (re)shapes the new economy by using indexes of social composition, high-tech growth, innovation and a gay index. The *Mercer Quality of Living* (QOL) is an indicator for multi-national companies to (re)locate their expatriates. The *Cushman European City Monitor* is based entirely on a business viewpoint about where to invest and locate a business in a European context. '*Where Do The Core Cities Stand?*' published by the Office of the Deputy Prime Minister in the UK, is aiming to compare British core cities with other European cities on both economic and social levels. The *Sustainlane US City Ranking* is evaluating US major cities on their sustainable development in terms of their ecological footprint. The spectrum has been enlarged from pure business to pure ecological concerns, and they are all telling some part of the story of city competitiveness.

Interestingly, there is a gap between the ample spatial-economy theories (mostly investigating the increasing return of cities) and the benchmarking territorial competitiveness practices, namely the role of spatial planning, which is not clear in these rankings. There is a need to investigate how spatial quality can—and will affect competitiveness from the viewpoint of spatial planning.

Table 1. The category of territorial ranking practices and their general method of measuring

			National scale	**Regional scale**	**City scale**
Attribute of measure	**Statistics**	**economic growth**	OECD Factbook	-	-
		economic growth + sociological growth	-	Randstad Monitor	-
		business development	-	UK DTI- Regional Competitiveness Indicators	-
		clustering structure	-	-	Chinese cities Competitiveness
		sociological growth	-	-	Creativity index
		living quality	-	-	Mercer-quality of living
	Survey	**entrepreneurs of 40 regions in North-West Europe**	-	ECORYS - NEI - regional investment climate	-
		senior executives from 501 companies from 9 European countries	-	-	Cushman - European City Monitor
	Statistics + Survey	**macro economic hard data + executive opinion survey (nation-based)**	World Economic Forum Global Competitiveness Report IMD World Competitiveness Yearbook	-	-
		micro economic data on high-tech clustering + sociological data	-	Joint Venture (Silicon Valley Network)	-
		micro economic data + questionnaire for economic development officials in 30 European cities	-	-	Competitiveness European Cities: Where do the Core Cities Stand?
		Ecological footprint	-	-	Sustainlane US city ranking

2. NATIONAL TERRITORIAL RANKING

Three major sources for measuring national competitiveness will be examined:

- OECD's Factbook;
- The World Economic Forum (WEF)'s Global Competitiveness Report;
- The IMD's World Competitiveness Yearbook;

The above three measures rely on primary existing data gathered by central governments, except for WEF and IMD who simultaneously use surveys amongst senior executives for their weightings.

2.1. Organisation for Economic Co-operation and Development (OECD)'s Factbook

The OECD Factbook is a pure *statistical* presentation of OECD member states to evaluate their economic, social and environmental trends. It consists of 10 major factors (see table 2) with a special chapter on globalisation. The Factbook is based on comparable transnational data, with a total of 100 indicators and tries to identify the trends of one nation on a macro-level.

Table 2. The 10 major determining factors of OECD Factbook

Determining factors
Population and migration
Macroeconomic trends
Economic globalisation
Prices
Labour market
Science and technology
Environment
Education
Public policies
Quality of life

The latest Factbook 2006 incorporates new features such as 'brain drain', 'Tsunami recovery aid', and 'cultural and leisure activities'. It also includes data on key non-OECD member countries, namely Brazil and China. *The spatial quality* can be observed in terms of Science & Technology, the Environment and Quality of Life (see table 3). These spatial aspects are expressed statistically (i.e. hotel nights account for tourism).

Table 3. OECD's decisive economic factor, non-economic factor & implication for spatial quality

Decisive Economic Factor	Decisive non-Economic Factor
Macroeconomic trends	Population and migration
Economic globalisation	Science and technology
Prices	-Environment
Labour market	Education
	Public policies
	Quality of life

Implications for spatial quality & characteristics		
Science & technology	**Environment**	**Quality of life**
Size of ICT sector	Air, water and land	Leisure: tourism & culture
Computer & internet access in household	Natural resources	Society: income inequality
		Crime
Telephone access		Transport

2.2. World Economic Forum (WEF)'s Global Competitiveness Report

The World Economic Forum's *Global Competitiveness Report (GCR)* positions economic competitiveness among 125 economic bodies (2006) and has two sets of indices on macro and micro economic pinpoints respectively to measure national competitiveness. The reason GCR addresses both macro and micro aspects is because 'a solid foundation of macroeconomic stability alone is not sufficient to ensure rapid economic growth' (p4, 2006) and many aspects cannot be read from a macroeconomic level (i.e. capital investment will not translate into rising productivity unless the forms of investment are appropriate, the company skills are to make investment efficient, and so on). Therefore, GCR includes the microeconomic foundations to underpin the source of the prosperity. The two indices are:

(i) The *Global Competitiveness Index* (Global CI), which focuses on the macro conditions of global competitiveness as the set of institutions and economic policies supporting high rates of growth

(ii) The *Business Competitiveness Index* (BCI), as a wealth generator, uses micro-economic indicators to measure the set of institutions, market structures and economic policies supporting high current levels of prosperity.

The determining competitive factors in both Global CI and the BCI are listed in Table 4. The Global CI comprises 9 main pillars with total sub-factors of 90. A statement has been made that none of these factors *alone* can ensure competitiveness. The BCI includes measures of micro-economic competitiveness in the form of two sub-indices: company sophistication and the quality of the national business environment.

Table 4. Global Competitiveness Report's determining factors for national competitiveness

Global Competitiveness Index (macro)	Business Competitive Index (micro)
Pillar 1: Institutions	sophistication of company operation & strategy
Pillar 2: Infrastructure	quality of the microeconomic business environment
Pillar 3: Macroeconomy	
Pillar 4: Health & primary education	
Pillar 5: Higher education and training	
Pillar 6: Market efficiency	
Pillar 7: Technological readiness	
Pillar 8: Business sophistication	
Pillar 9: Innovation	

The methodology is based upon Porter's 'Diamond Theory'(1990)- factor conditions, related and supporting industries, demand conditions and context for firm strategy/ rivalry. The GCR divides nations into three phases of development and employs this category in both Global CI and BCI. Each different stage of development receives a different weighting for its requirements (see table 5). Nations fall into the *factor-driven* category, referring to countries based on low-cost labour and unprocessed natural resources. Countries in the *investment-driven* category comprise the competitive advantages of efficiently producing standard products and services, and countries in the *innovation-driven* stage are characterised by being able to produce innovative products and services using advanced methods.

Table 5. Global CR's weightings for each country's different stages of development

	Stage1 Basic requirement (pillar 1-4)	Stage2 Efficiency enhancers (pillar 5-7)	Stage3 Innovation Sophistication factors (pillar 8-9)
Factor-driven	50%	40%	10%
Efficiency-driven	40%	50%	10%
Innovation-driven	30%	40%	30%

For Global CI, the method adopts a combination of hard data (public data) and survey data (Executive Opinion Survey). The coefficients of a multiple regression of the sub-indexes on GDP per capita, using pooled data from 2002 to 2005 to smooth year-to year variations result in a weight of 0.8 for the national business environment and 0.2 for company operations and strategy.

The result in the 2006/07 report shows that Switzerland, Finland, and Sweden respectively are ranked as having the most current competitive environments for having better institutions and structural profile (innovation and highly sophisticated business culture), while countries in Sub-Saharan Africa are performing relatively poorly in most of the factors.

Spatial-quality plays a critical role in terms of national-scale infrastructure (see table 6). It is scientifically proven that a sound infrastructure is essential for reducing transport time and communication, and for the efficient distribution of energy supply. A weak infrastructure (i.e. sub-Saharan Africa) can impede both the development of public-private sectors and leads to a lower real GDP per capita.

Table 6. Global CR's decisive economic factor, non-economic factor & implication for spatial quality

Decisive Economic Factor	Decisive non-Economic Factor	Implications for spatial quality & characteristics
Macroeconomy	Institutions	Infrastructure:
Market efficiency	Infrastructure	overall infrastructure quality
Business sophistication	Health & primary education	railroad infrastructure development
	Higher education & training	port infrastructure quality
	Technological readiness	air transport infrastructure quality
	Innovation	quality of electricity supply
		telephone lines

2.3. Lausanne Institute of Management and Development (IMD)'s World Competitive Yearbook

Published since 1989, the annual report on national competitiveness, the IMD's World Competitiveness Yearbook (WCY) identifies that "competitiveness needs to balance economic imperatives with the social requirements of a nation as they result from history, value systems and tradition". Among 61 nations, the WYC ranks and analyses the ability of a nation to provide an environment in which enterprises can compete.

The determining competitive factors underlie four major pillars: Economic performance, Government Efficiency, Business Efficiency and Infrastructure. The breakdown of competitive factors can be seen in table 7.

Table 7. WCY's breakdown of competitive factor

Breakdown of competitive factor			
Economic performance	**Government efficiency**	**Business efficiency**	**infrastructure**
domestic economy	public finance	productivity	basic infrastructure
international trade	fiscal policy	labour market	technological infrastructure
international investment	institutional framework	finance	scientific infrastructure
employment	business legislation	management practices	health & environment
prices	societal framework	attitudes & values	education

With a total of 312 measures (a collection of hard and soft data), WYC aims to provide objective benchmarking and trends. It also realises that 'an economy's competitiveness cannot be reduced only to GDP and productivity because enterprises must also cope with political, social and cultural dimensions.

The methodology adopts a combination of hard data and survey data. The national economies are ranked according to their performance against each of these measures. 239 out of 312 measures are used to calculate the overall competitiveness ranking and the remaining 73 criteria are presented as background information only. The Standard Deviation Method (SDM) is used to standardise values for comparison.

The result shows that in 2006, the U.S.A, Hong Kong and Singapore respectively are ranked as the most competitive environments. For example in the US, air transportation, exports of commercial services, direct inward investment flows and gross domestic investment stand out, while Hong Kong and Singapore are catching up because their governments are synchronising with their economic performance.

Spatial quality still plays a role in terms of overall infrastructure, the criteria is to an extent compatible with the other two national competitiveness rankings (see table 8).

Table 8. Global CR's decisive economic factor, non-economic factor & implication for spatial quality

Decisive Economic Factor	**Decisive non-Economic Factor**
Economic performance	Government efficiency
Business efficiency	Infrastructure

Implications for spatial quality & characteristics: infratructure		
Basic infrastructure	**Technological**	**Health & environment**
land area	telephone lines	urban population
urbanisation	mobile use	ecological footprint
roads	computer use	pollution problem
railroads		quality of life
air transportation		
quality of air transportation		
distribution infrastructure		
water transportation		
energy infrastructure		

2.4 Limitation

The above three are focusing on *macroeconomic* performance, despite WEF trying to underpin the microeconomic (firm) level. For the OECD factbook, it is comprehensive as a pure statistical (hard data) reference. However, together with IMD, these two systems are more likely to highlight the *consequences* (i.e. GDP growth, export growth or influx of foreign direct investment etc.). IMD is using GDP per capita as an indicator for overall competitiveness, which can be misleading. GDP is not a measure of *progress* but merely a gross tally of products and services bought and sold (*Genuine Progress Indicator*, 1995), which means that social and environmental breakdowns will be added to economic gains. WEF is trying to exclude the variables of the outcomes. However, this is too sensitive in the business sphere and it is hard to evaluate "spatial unevenness" (*Fujita, Krugman, Venebles* 2001) and its impact on the human environment. *Krugman* even argues that the main source of growth in some Asian economies is just a massive mobilisation of resources (rapid supply in terms of labour and capital) other than the real growth of productivity (innovation & efficiency improvement), and thus, competitiveness, becomes a "dangerous obsession"(*Krugman* 1994).

3. REGIONAL TERRITORIAL RANKING

Of the work on regional competitiveness that is empirically driven, the studies often engage benchmarking exercises as well. The range of measures has been widened due to the diversity of regional structures. Unlike national competitiveness, the more detailed spatial issues regarding land, housing, social infrastructure and environment are extruded. In general, the case studies focus on analysing regional competitiveness as a cumulative outcome of factors. The case studies are:

- Randstadmonitor
- UK Department of Trade & Industry (DTI) - Regional Competitiveness Indicator
- ECORYS-NEI-regional investment climate
- Joint Venture (Silicon Valley Network)

3.1. Randstad Monitor

Starting in 2002, Nederlandse Organisatie voor Toegepast (TNO) was commissioned by the Regio Randstad organisation to research the economic position of the Randstad region in Europe. The biannual publication monitored Randstad Holland region's economic performance compared with 19 other major European metropolitan areas.

The determining competitive factors use 25 indicators, covering the spectrum from economic and sociological perspectives as table 9 shows.

Table 9. Randstadmonitor's 25 indicators to measure regional competitiveness

Determining Factors
GDP/ per capita
increase GDP/ cap
labour productivity
increased labour productivity
labour participation
attractiveness
increased attractiveness
increase in population
increase in population 0-14 years
higher education
increase in number of people in employment
increase in fulltime job
unemployment
foreign investment
office rent
high tech jobs
share of r&d in GDP
knowledge-based services
internet hub
motorway capacity
capacity of railways
increase in tourism
international conference
passenger airport
transshipment

The methodology uses a pure statistical data regressive comparison. And *the result* shows that Randstad Holland is still several steps away from being a Top 5 European metropolitan ambition. On the contrary there is evidence of it losing competitiveness compared to others (ranked 11 out of 20 in 2004). Among the top 5 indicators are labour participation, attractiveness for foreign enterprises, a young and growing population, low unemployment, knowledge services and external links through Rotterdam seaport, Schiphol airport and an Internet hub (Regio Randstad Fact sheet, 2004). However, the relatively poor performance in terms of labour productivity, high tech jobs, share of R&D in GDP, railway capacity and tourism will impede its ambition to catch up with London and Paris.

Spatial quality reveals an interesting interplay regarding the Randstad's barely satisfactory economic position and irrelevant spatial arrangement (see table 10). Firstly the scattered urban pattern of Randstad Holland means "business loses economies of scale in labour supply, markets and suppliers" (Regio Randstad Fact sheet, 2004). The concept of the *network-city* depends pretty much on the efficiency/innovation of the infrastructural network; however

with the relatively poor railway capacity and very limited public transport options, motorway congestion is inevitable and thus the fragmentation and inefficiency hinders the optimisation of the spatial economy. Secondly, trends can be observed that new business centres are established alongside the motorway nodes, and this reflects the lack of long term strategy for coherent business sites on the one hand, and on the other hand, having no adequate residential areas (i.e. insufficient supply in top segments in large cities, relatively small dwellings and high prices, lengthy process for starters to get a house, and etc) (Fact sheet 2004) can damage Randstad's attraction for high-ranking managers or knowledge migrates. As for tourism, the draw is attractive natural landscapes and culture for recreational and leisure purposes. For both, a large part are spatial-characteristic: a unique natural environment, a distinctive historical centre, well-equipped cultural amenities/facilities, well-functioning linkage patterns and hospitality industry. The boost to tourism brought about by budget airlines in the EU would seem to increase the importance of a regional airport. However Schiphol airport is well connected and the regional airports are generally less accessible by public transport.

Table 10. Randstadmonitor's decisive economic factor, non-economic factor & implication for spatial quality

Decisive Economic Factor	**Decisive non-Economic Factor**
GDP/ per capita	labour participation
increase GDP/ per capita	attractiveness
labour productivity	population
increase labour productivity	higher education
foreign investment	employment (increase in fulltime job, high-tech jobs)
	office rent
	share of R&D in GDP
	knowledge-based services
	internet hub
	capacity of basic infrastructure
	tourism
	international conference

Implications for spatial quality & characteristics		
Urban form	**infrastructure**	**tourism**
scattered urban form impedes efficiency and can harm the economies of scale	the capacity of railroad, motorway, and airport and seaport	the affiliating hospitality industry for tourism
	technological infrastructure such as internet hub	
	office rent	
	facilities for international conference	

3.2. UK Department of Trade & Industry (DTI)-Regional Competitiveness Indicator

Starting in 2002, the annual report of the Regional Competitiveness Indicators presented *statistical information* that illustrated the factors that contributed to regional competitiveness among 13 regions in the UK. Its aim is to create the conditions for *business success* and it is designed to assist those responsible for developing regional economic strategies. *The determining competitive factors* group together 5 main pillars with a total of 17 indicators as table 11 presents. The 17 indicators in this publication intend to give a balanced picture of all the statistical information relevant to regional competitiveness and the state of the regions.

Table 11. UK-DTI's competitive factor

Determining Factors
overall competitiveness
labour market
deprivation
business development
land & infrastructure

The result shows that the London region is outperforming other regions in the UK, especially with its more well-developed public transport system. The London region is the only region in the UK where public transport is topping the use of private means of transport while the rest of the country is highly dependent upon private transport. Extracting the causes for competitiveness from 17 indicators, it can be concluded that what is important are labour productivity, educational and vocational attainment, business registration, entrepreneurial activity, R & D, transport, industrial property/office rental cost, and the re-use of vacant and derelict land.

Spatial quality particularly stands out in terms of reuse of vacant and derelict land which demonstrates the potential for re-development. The need for land for further (re)development raises the issue of *monitoring* land use based on how much qualitative data a municipality can obtain (see table 12).

Table 12.UK-DTI's decisive economic factor, non-economic factor & implications for spatial quality

Decisive Economic Factor	**Decisive non-Economic Factor**
overall competitiveness	land & infrastructure
labour market	
deprivation	
business development	
Implications for spatial quality & characteristics	
Land	**Infrastructure**
Previously developed vacant land	Transport
Land previously developed and now vacant, which could be developed without work being carried out. Work includes: demolition, clearing of fixed structures, levelling foundations etc.	- Mode of transport used to travel to work - Road survey
Derelict land and buildings	Industrial property and office rental costs
Land so damaged by previous industrial or other development that it is incapable of beneficial use without work being carried out. This includes abandoned or unoccupied buildings in an advanced state of disrepair.	- Industrial / Warehouse units - Office accommodation
All land that is unused or may be available for redevelopment	
Comprises previously developed vacant and derelict land: vacant buildings; land or buildings currently in use, which are allocated on a local plan for any developed use, have planning permission for any use (including single residential dwellings with planning permission for at least one additional dwelling) or with known potential for redevelopment.	

3.3. ECORYS-NEI-Regional Investment Climate

ECORYS competitiveness programme establishes its own theoretical basis—a "competitiveness tree". It identifies four inputs as the reasons for a region being competitive: 'Human resources', 'innovation', 'connectivity' and 'industrial structure', being the root of all competition; productivity as the tree truck, and employment, income/profits, investment/taxes and contributions as the branches and competitiveness as the fruit. ECORYS-NEI has developed a benchmarking methodology that measures the quality of the *regional investment climate*. Over forty regions in North West Europe are benchmarked against the results of *surveys* of entrepreneurs located in the regions. *The determining competitive factors* are grouped into 4 main pillars with a total of 17 indicators as shown in table 13 below.

Table 13. ECORYS-NEI's competitive factor

Human Resources	Innovation	Connectivity	Industrial Structure
Knowledge intensive skills	Linkage between companies and R&D	Telecommunication information network	Cluster of activity
Educational facilities	Research institutes & universities	Transport infrastructure	Specialisation in high value added
Training & teaching institutes	Linkages in international R&D networks	Quality of place	Degree of internationalisation
Entrepreneurial talent	Intermediate institutions	Urban services	New products & services
Adaptability of labour force			

The methodology of measuring the regional investment climate is based upon the surveys of entrepreneurs. *The findings* show that it rules out the variables of econometric indicators (as the outcomes). To a great extent the *spatial quality* plays a significant role in contributing to regional competitiveness. For instance, the geographical clustering of specialisation, particularly, the "connectivity" contains many spatial interests. The physical and technological infrastructure, namely the "quality of place" gives a more ambiguous scope to be defined. Interestingly, a clearer picture can be seen in one of ECORYS' survey questionnaires "International Benchmark of the Regional Investment Climate", answering what "quality of place" should be: from a *firm's* viewpoint, it is mainly the availability of suitable office space, and availability/quality of industrial estates. For *employees*, the housing supply (availability of adequate housing at acceptable prices), cultural facilities, urban surroundings (presence of urban, historic, architectonic and cultural beauty), natural surroundings (presence of nature, space and relaxation) are critical.

3.4. Joint Venture (Silicon Valley Index)

Starting in 2000, the Silicon Valley Index benchmarks the area's competitiveness with ten other high-tech metropolitans in the U.S. It suggests that being a highly knowledge-based specialised region, the monitoring platform is built upon the prerequisites that technological and physical infrastructures are already well developed and living conditions are better (average wage $69,455 in Silicon Valley compared to an average wage of $42,000 in the USA). *The determining competitive factors* are grouped into 5 categories: people, economy, society, place and governance (see table 14).

Table 14. Silicon Valley Index's competitive factor

1. People	2. Economy	3. Society	4. Place	5. Governance
Population	Value added	Workforce training	Protected open space	Voter participation
Foreign immigration	Patents per capita	High school graduation	Vehicle fleet	Support for alternative funding
Science & Engineering education	Venture capital	Intermediate Algebra enrolment	Water quality	Property tax revenues
	Gazelles	3rd grade reading ability	Residential density	City revenue
	Industry cluster concentration and compensation	Kindergarten readiness	Development near transit	County revenue
	Silicon Valley jobs by industrial cluster & other industries	Art & culture	Transit use and availability	
	Silicon Valley employment	Immunisation of children	Building affordable housing	
	Real per capita income	Overweight youth	Rental affordability	
	Distribution of income	Health insurance	Home affordability	
	Bankruptcy	Child abuse	Commercial space	
	Average pay per employment, by cluster & other industries	Adult & Juvenile violent offences		

The methodology is a purely statistical approach, and *the findings* confirm that there is a strong correlation between patents, research institution expenditure, the availability of venture capital and the clustering of high tech firms (Silicon Valley, 2005). For Joint Ventures, an emphasis on scientific education, training, *quality of place* becomes relevant. The issues of open space, land use, housing and commercial space are contributing to the quality of life. *Spatial quality* is set out in table 15. For instance, ¼ of Silicon Valley is protected open space and continues to increase. Residential density increased from 13 units/acre in 2004 to 21 units/acre in 2005, raising the question of a compact and "walkable" city. It clearly states how affordable housing can influence regional productivity—"*The affordability, variety and location of housing affect a region's ability to maintain a viable economy and high quality of life. Lack of affordable housing in a region encourages longer commutes, which diminish productivity, curtail family time and increase traffic congestion. Lack of affordable housing also restricts the ability of crucial service providers—such as teachers, registered nurses and police officers—to live in the communities in which they work.-(Joint Venture, 2006).*

Table 15 . Silicon Valley Index's decisive economic factor, non-economic factor & implication for spatial quality

Economic factors	Non-economic factors
Economy	people
	society
	place
	governance
Implications for spatial quality & characteristics: place	
protected open space	
vehicle fleet	
water quality	
residential density	
development near transit	
transit use and availability	
building affordable housing	
rental affordability	
home affordability	
commercial space	

4. CITY TERRITORIAL RANKING

A bigger range of cases allocated to city rankings. In regional competitiveness, most of the cases are concentrated in Europe due to its long history in researching regional competition. At city level, it covers Europe to Asia, and from purely business benchmarking to ecological footprint. It encompasses two trends in city competitiveness. One is to analyse the outcome of competitiveness (i.e. Chinese City Competitiveness) and the other is to focus on a special driver for competitiveness (i.e. Sustainlane U.S. city ranking). Here the cases are:

- Chinese City Competitiveness Bluebook
- Cushman & Wakefield-European City Monitor
- Competitiveness European Cities: Where do the Core Cities Stand?
- Creativity index
- Mercer-quality of living
- Sustainlane US city ranking

4.1. Chinese City Competitiveness Bluebook (CCCB)

Starting with 2002, the annual report on Chinese urban competitiveness published by China Social Sciences Academic Press ranks the economic performance of over 200 cities in China, emphasising the critical causality between industrial clustering and city competitiveness. It concludes that two forms of organisation— transnational cooperation (TNC) and industrial clustering will dominate the global economy.

The determining competitive factors are based on the theory of a "Bow-Bowstring-Arrow model" to break city competitiveness down into "hard competitiveness" and "soft competitiveness". The sum of the two determines overall urban competitiveness (Urban Competitiveness (UC) = f ∑ (Hard competitiveness + Soft competitiveness)). Hard competitiveness (the bow) is comprised of 7 primary pillars: location, environment, infrastructure, human capital, capital, technology and structure. The soft competitiveness (the bowstring) consists of 5 primary pillars: culture, system, government management, enterprise and openness. The arrow is the urban industrial clustering. Shooting it releases overall urban competitiveness which can be translated into an overall resource saving, long term economic growth rate, quality of living, productivity and job opportunities (see fig.1). With a total of 230 indicators, including secondary and tertiary indicators, it tries to encompass the economic performance, including social and spatial dimensions.

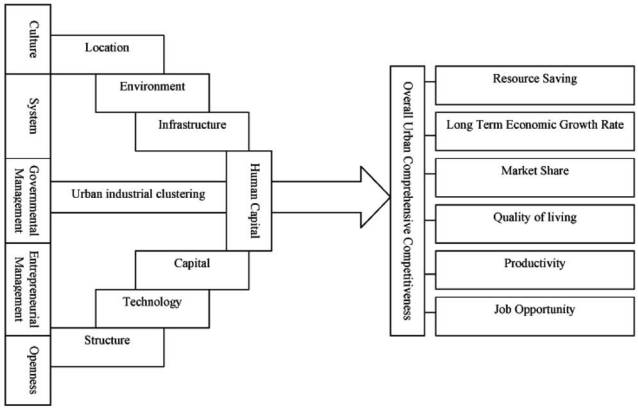

Figure 1. The Bow-Bowstring-Arrow model of city competitiveness

The methodology is using the "Fuzzy model analysis" from Los Alamos National Laboratory in USA. The fuzzy method is used to determine the most influential variant of output by compressing the input data. By doing so, it determines the weighting of indicators relating to statistical and survey data.

The findings show that the top 5 cities—Shanghai, Shenzhen, Guangzhou, Beijing and Hangzhou are identical to the booming cities in coastal areas (except Beijing) while the weakest cities are located in the "Big West". The industrial clustering within all Chinese cities is carefully defined by strong theoretical and empirical studies. It also explains the relationship between the outcomes (resource saving, long term growth rate, market occupation, living quality, productivity, job opportunities) and the reason. *Spatial quality* can be observed in terms of infrastructure, location and environment pillars. Despite the basic and scientific infrastructure, CCCB lends new focus to environmental competitiveness where factors such as the incidence of natural disasters, quantity of green spaces, the degree of natural and artificial landscapes is also taken into account.

Table 16 .CCCB's decisive economic factor, non-economic factor & implication for spatial quality

Decisive Economic Factor	**Decisive non-Economic Factor**
capital competitiveness	human resource
structure	scientific technology
	infrastructure
	location
	environment
	culture
	system
	entrepreneur management
	openness

Implications for spatial quality & characteristics		
infrastructure	**location**	**environment**
basic physical infrastructure	city location (given nature)	environmental quality
telecommunication	city location (economic position)	- air, water, noise
index for cost of infrastructure	natural resource	index of city comfort
transport cost	political & cultural position	- climate, incidence of natural disaster, cleanliness of street
telecommunication cost		natural environment
real estate cost		- natural scenery
		- city
		- green spaces
		artificial environment
		- relics
		- harmony of architecture layout
		- landmark, open space, shopping street, architectural style

4.2. Cushman & Wakefield-European City Monitor

Starting in 1990, the London-based real estate company Cushman & Wakefield developed a monitoring system for locating businesses. 501 companies are surveyed from 9 European countries where samples are selected from "Europe's 15000 largest companies".
The determining competitive factors fall within 6 broad categories:

Table 17. Cushman & Wakefield European City Monitor's competitive factor

- demographics
- labour force availability, quality and cost
- business costs including real estate issues such as costs, availability and lease flexibility
- access to market and/or existing corporate locations
- operating environment
- quality of life

The methodology for the scores is based on survey responses and is weighted by Taylor Nelson Sofres according to nominations for the best, second best, and third best. Each score provides a comparison with other cities' scores and over time for the same city.
The findings shows that London, Paris, Frankfurt, Brussels and Barcelona are the strongest performers amongst 30 cities. London enjoys the availability of qualified staff, international transport links, telecommunication factors and language spoken. From the point of view of a business location, the key factors in deciding where to locate lie in access to markets, communication, cost factors where quality of life for employees is the least significant from a business point of view.
The spatial quality here lies in transport links to other cities and internationally, value for money of office space, availability of office space, ease of travel within the city, quality of life and freedom from pollution. In the questionnaire, most CEOs believe that improving transport links with other cities, improving traffic circulation, and improving public transport can help to improve their current business locations.

4.3. Competitiveness European Cities: Where do the Core Cities Stand?

Published by the Office of the Deputy Prime Minister in 2004, the "Competitive European Cities: Where do Core Cities Stand?" has summarised various researchers' and policy makers' views toward city economic competitiveness. It is actually not a ranking but aims to examine how English Core Cities—Birmingham, Bristol, Leeds, Liverpool, Manchester, Newcastle, Nottingham and Sheffield are doing comparing with other European cities. A structured questionnaire was designed to clarify which are the most crucial factors for economic development. The *determining competitive factors* fall within 3 categories as table 18 shows:

Table 18. Competitive European Cities' competitive factor

Critical drivers (response rated 9-10)	innovation in firms and organizations
	skilled workforce
	internal and external connectivity
	economic diversity
	strategy decision-making capacity
Important drivers (response rated 5-6)	social cohesion
Ambiguous drivers (response rated 3-4)	exhibition facilities
	a distinctive city centre
	cultural facilities
	quality housing
	fiscal incentives to cities
	national policies
	a reputation for environmental excellence & responsibility
	a reputation for effective governance & efficient services

The findings indicate that the critical drivers for a city in this case are almost comparable to the ECORYS NEI regional competitiveness tree—human resources, connectivity, innovation, industrial structure.

The Spatial quality plays a critical role in connectivity. Increased concerns about social cohesion can be translated to a spatial dimension in terms of spatial (un)evenness. The conclusion from this paper shows that although quality of life—a city with a good environment, distinctive architecture, cultural facilities, diverse housing stock, access to nature—is not considered to be the most critical driver of competitiveness (see table 19). However, it is clear that soft location factors are becoming an increasingly important part of economic decision-making to maintain a managerial and skilled workforce.

Table 19. Competitive European Cities' spatial quality driver

Critical	**important**	**Ambiguous driver**
connectivity	social cohesion	exhibition facilities
	- degree of spatial unevenness	distinctive city centre
		cultural facilities
		quality of housing
		environmental excellence

4.4. Creativity Index

Developed by Richard Florida, the Creativity Index tries to gauge the ability of attracting a creative class into creative economic outcomes. The creative class is characterised by those whose work function is to "create meaningful new forms"— scientists, engineers, professors, poets & novelists, artists, entertainers, actors, designers, architects, non-fiction writers, editors, cultural figures, think-tank researchers, analysts and opinion-makers. There are 4 *Determining competitive factors:*

- proportion of the workforce comprised of members of the "creativity class"
- Miken Techpole index- a measure of high-tech industry growth based on the output of an area's high tech industry
- Innovation- patents per capita
- Diversity-Gay index, the measure of an area's open-mindedness

The methodology is based on statistical regression analysis.

The findings of the Creativity Index conclude that the creative class is attracted to a place with better resources, opportunities, a low entry barrier and high diversity. However, as Florida notes "future research is required to delineate the precise nature of the relationships

and direction of causality amongst these factors." Otherwise the Creativity Index remains only as phenomenology if the causality is not further scientifically proven. The spatial quality does not directly show its importance here. However, the relevant question is what spatial characteristics attract the "creative class" to reside here?

4.5. Mercer-Quality of Living

The Quality-of-living index is developed by Mercer human resource consulting. It aims to measure the quality of living in 270 cities worldwide. *The determining competitive factors* fall into 10 categories (see table 20) with a total of 39 indicators:

Table 20. Mercer-Quality of Living's competitive factor

Determining Factor
Consumer goods
Economic environment
Housing
Medical & health considerations
Natural environment
Political and social environment
Public services & transportation
Recreation
Schools and education
Socio-cultural environment

The methodology is based on a questionnaire cooperating with multinational corporations and then standardised into a quantitative calculation. The spatial quality can be ascertained in the following areas (see table 21)

Table 21. Mercer-Quality of Living's spatial quality driver

Public services & transportation
Electricity, water, public transportation, traffic congestion
Recreation
Restaurant, theatre, cinema, sports & leisure
Housing
Housing, housing appliance, maintenance service
Natural environment
Climate, record of natural disasters

4.6. Sustainlane US City Ranking

Starting in 2004, Sustainlane evaluated major cities in the US across 13 categories (12 categories in 2004) to measure their relative sustainable development. It has gathered information from cities, non-government organisations and peer reviews. Sustainlane focuses on how these major cities are doing when responding to local challenges such as clean air, water, local food, city regeneration, employing green building technologies, and global challenges such as climate change, loss of biodiversity and environmental toxins.
The determining factors fall into 13 categories (2006). The categories try to explain how people's quality of life and the economic and management factors in the city are likely to fare in the face of an uncertain future (see table 22).

Table 22. Sustainlane US City Ranking's competitive factor

Climate change policy
Economic development
Energy/ Energy efficiency
Food/ Agriculture
Forestry/ Street Greening
Green Building/ Development
Water/ Wastewater
Land use/ Planning
Parks/ Open space/ Environment
Purchasing/ Investment
Sustainability Management
Transportation/ Fleets
Water Management

The methodology is determined by averaging 13 individual category rankings into a cumulative average. Cumulative averages ranged from 5 for the highest-scoring city to 18.93 for the lowest-scoring city. The best possible score would be 1 (average of first place across all categories) and the worst possible score would be 25 (average of 25th place across all categories.) Cities were selected to be in the study based on:
a.) Population. The study was limited to cities with a population of 100,000+.
b.) Availability of sustainability or environmental programmes, current data and resources.
c.) Geographic diversity: control cities were included if they were in a geographic region which had no other cities that met the above criteria, such as the Southeast.
The findings show that major spatial quality concerns are in Green building, land use/planning, parks/open spaces and transportation (see table 23)

Table 23. Sustainlane US City Ranking's spatial quality driver

Green Building	Land Use/ Planning	Park/ Open space	Transportation/ Fleets
Built environment and related infrastructure including planning, design, construction, demolition, materials use and acquisition and landscaping. Government, industrial, commercial and residential sectors all apply.	Master planning, land use and transportation planning, as well as zoning. Includes brownfield redevelopment, Smart Growth, New Urbanism, pedestrian-oriented planning and development, as well as location-based programmes such as location-efficient mortgages and the US Green Building Council's leadership in Energy and Environment Neighbor Development (LEED ND).	This category includes planning, management and programmes related to parks, open space and wildlife habitat. Includes integrated pest management and exotic species management, in addition to biological/ wildlife inventories.	This category includes transportation planning, incentives and programmes as well as fleet and vehicle management. Alternative-fuelled and advanced technology vehicles are also included, as are mass transit systems and bicycle transportation.

5. SUMMARY OF FINDINGS ON SPATIAL QUALITY

From an overview of the ranking methods, *pure statistical* methods focus on economic growth (from macro economics to the business sphere). Sociological statistics, such as demographic changes and educational levels are added to complement the breadth of economic performance. The *pure survey* method done by interviewing the entrepreneurs and senior executives in a North-Western European base emphasise where to invest. For methods that *combine both statistics and surveys*, attention is paid to land issues and the ecological footprint of urban development on a city scale. However, briefly speaking, most rankings are still pinpointing how to benchmark in order to attract capital. Can these rankings account for "real" competitiveness—on the one hand to catch *outwards* mobile economic agents and on the other to invest in *inwards* "tangible assets"—assets of human, social, cultural, intellectual, environmental and natural clusters (Friedmann, 2007)? The tangible assets are closely tied in with the spatial dimension such as strategic spatial planning. Spatial planning surely cannot solve every problem, but at least it is an instrument to manage the interconnected economic-socio-ecological forces. The spatial dimension is not yet a comprehensive system and thus plays an ambiguous role in the realm of competitiveness. This can be observed on the one hand from the fragmentary spatial elements among all rankings and on the other, the contrasting weightings (i.e. transport infrastructure versus the distinctiveness of the city centre).

5.1. On a National Level

The most prominent role that spatial quality plays in national competitiveness is in the basic physical (i.e. external nodes such as ports & internal capacity of railway, motorway and water transport) and technological (internet, mobile, telephone and energy use) infrastructures. In these national rankings the infrastructure is the system that transports goods and

people in *quantitative* terms; however, there is no further elaboration on how the quality of the infrastructure impacts on land use, economic growth and quality of life. Overlooking the macro-framework, the most important factors are macro-economic drivers, the efficiency of the institution, level of education, level of health care, level of innovation, with a view to how the national policy should be enhanced when facing global challenges.

5.2. On a Regional Level

In terms of regional competitiveness, the quintessential factors are human resources, innovation, efficiency of the institution, and land & infrastructure. Here two trends can be outlined. On the one hand, regions are trying to create conditions for investment; on the other, the regions are beginning to create the conditions for attracting skilled human resources. Therefore, the spatial quality begins to play a role on many levels. Issues of land & infrastructure in particular have been elaborated greatly at a regional level. The preconditions are land requirements for urban (re)development to attract investment and the need for efficient/innovative infrastructural provisions to reduce travelling time and transport costs. For a firm, the availability/quality of industrial estates, the affordability/quality/value of offices and access to the labour market become a priority. For people, quality of life, including the housing (i.e. varieties of housing, housing affordability/rent/quality, accessibility from house to work) and social infrastructure (i.e. child care, access to cultural amenities, access to leisure activities, and access to nature) become critical.

5.3. On a City Level

The spatial quality at city level elaborates on those on a regional level. Within the spectrum of locating a business through to its ecological footprint, there are findings in several fields which always correlate with one another:

Transportation

Transportation should be seen as a policy instrument to guide city growth and social justice, not merely for transporting goods and people. Transport plays an essential role in stimulating economic growth by lowering production and distribution costs, attracting private investment, improving productivity, and even enhancing a city‘s image.

Planning instrument

Relates to the attitude of planning institutions. How to catch the urban trends influenced by “globalisation” forces and then react in time in order to maintain the balance of economic growth, social cohesion and ecological footprint. This raises the issue of the decision-making capacity in the planning instrument—the challenge becomes how to incorporate the private sectors, how to manage socio-spatial disparity in a polarised urban development and how to reduce the risks of an ecological crisis.

Housing infrastructure & Social infrastructure

Following on from the regional level, the quality and variety of the housing stock and the maintenance of the housing will affect the city's productivity. The social infrastructure, including the quality of cultural amenities, quality of public space, and quality of recreational facilities will dominate the willingness of a knowledge-based workforce to stay.

Environmental quality & incidence of natural disaster

In addition to known environmental quality such as levels of clean water, air quality and noise pollution, growing attention is being paid to the incidence of natural disasters. How to monitor and reduce their impact are becoming urgent city issues, which bridge various professions.

Social cohesion

The connection between social cohesion and economic growth has been theoretically (EU Commission) and empirically (Rusk) proven. Social cohesion in a city is now becoming an important factor for businesses when choosing where to locate themselves.

City landscape & natural landscape

A distinctive city landscape and its surrounding natural landscape create a local identity and are an attraction for tourism. The psychological recognition of the built environment can enhance communal consciousness and improve local empowerment.

In 1996, the United Nations Human Development Program argued that it was time to examine the quality of economic growth rather than the quantity of growth, where it defined "Five damaging forms of growth"—*Jobless*, *Voiceless*, *Rootless*, *Futureless* and *Ruthless*. From this perspective, hardly any of the existing rankings could identify what kind of quality of economic growth one territory had. Being fully subjective to market forces can be very misleading and the consequences can be seen in numerous imbalanced urban developments all over the world. A city-region should, conversely, make market forces bend to suit its needs, and this will change the spatial planning attitude to work towards better spatial quality, not only in terms of physical qualities but also "spatial justice"—a fair and democratic distribution of societal benefits and burdens across spaces of various scales (Critical Planning, UCLA, 2007).

From the findings, there is evidently a strong need to evaluate spatial elements and their qualities systematically (see table 24) in terms of the uneven distribution of spatial quality among the rankings. Viewing competitiveness only from an economic and sociological point of view is not enough since much spatial relation has been both explicitly and implicitly involved. There is no single successful nation that did not have successful city regions and

no single successful city-region that did not have successful cities within it. This means that spatial quality should be treated as *a monitoring instrument* helping to monitor within a framework of broad competitiveness. A systematic analysis can help us better understand what is the best spatial practice or solution for urban management. Certainly it is not naïve to say that spatial quality should replace the importance of economic drivers. On the contrary, spatial quality can complement economic importance by monitoring and understanding the causality of socio-economic contradictions/problems and contribute to the decision-making level with a more transparent and strategic way for future planning. By doing so, this integrated system can eventually help to enhance the contemporary territorial rankings.

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Peat polder structures, Source: Karel Tomeii

DRS. F.L. HOOIMEIJER

THE RELATION BETWEEN DESIGN AND TECHNOLOGY OF POLDER CITIES

Ph.D. research: The New Poldercity
Chair: Urban Compositions
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ABSTRACT

The design of Dutch polder cities has been a combination of technological prosperity and an understanding of the rules of water management: the 'fine tradition'. But, the more civil engineers could solve, the less water management became a spatial task. This cumulative development can be divided into six phases that are characterised by a specific relationship between the design and technology of polder cities: acceptance (-1000), defensive (1000-1579), offensive (1579-1814), early manipulative (1814-1886), manipulative (1886-1990) and adaptive manipulation (1990-). In the current situation where climate change causes flooding in polder cities, the technical approach alone is insufficient. Reintroducing the fine tradition, a spatial approach and larger acceptance is required. Our heritage shows the Dutch talent for design and construction with water. This research must give a representative idea of the historical, current and future relationships between urbanisation and water management in polder cities. The main hypothesis of this research states that 'the fine tradition' was based on a self-evident relation between water management and urban design. Innovative design of the new Dutch polder city is only possible when this aspect of the fine tradition is reinstated.

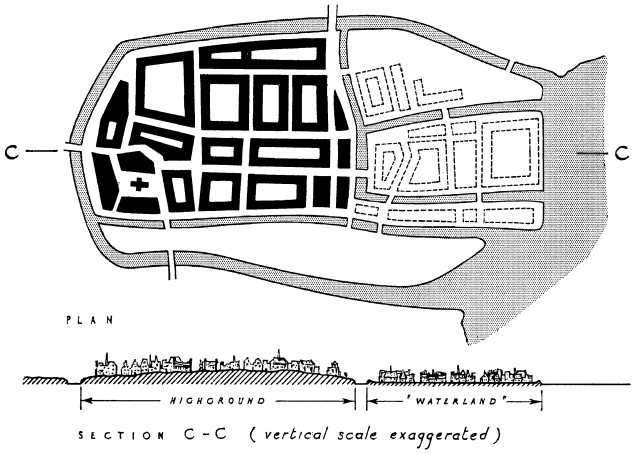
Keywords: polder, civil engineering, urban design, history, future, climate change

INTRODUCTION

The Dutch have a rich and internationally renowned 'fine tradition' when it comes to the intense relationship between urban development and civil engineering. Their expertise and knowledge of hydraulic laws and ingenuous technology have helped them successfully to make land out of water: polders.
In order to tackle current and future problems with water, a greater understanding of the 'fine tradition' will offer an important layer of knowledge. This research must give a representative idea of historical, current and future relationships between urbanisation and water management in the polder cities. The main hypothesis that structures this research states that 'the fine tradition' was based on a self-evident relationship between water management and urban design. Innovative design of the new Dutch polder city is only possible when this aspect of the fine tradition is reinstated.
A comprehensive systematic overview of the relationship between technology and urban design, this 'fine tradition', and even an overview of the methods of preparing building sites for building, has (surprisingly) never been carried out. The aim of the research is to identify opportunities, bottlenecks and possible joint assignments, and to redefine (reacquaint oneself with) the relationship between technology and design in the field of water management. The verification of the hypothesis must explain how technical conditions, cultural meaning and beauty can be integrated into the design of cities and how the 'fine tradition' can be put to use tackling new problems arising from climate change.

Polder cities

The peat polder city, the oldest polder city, is based on higher river ground, coast, burcht, geest (sandy soil between dunes and polder), dike, hill and dam cities. This is the first important characteristic of the peat polder city: the higher levelled 'dry core' on which the settlement started. Prosperity and growth led to the expansion of the surrounding wet and weak soil, derived from peat or already prepared for cultivation, but not yet prepared to be built upon.
To be able to expand, there was a need for 'strict control', the result of the cautiousness required for the polder city to expand. First, the size of the expansion was determined, which did not only need to comply with the requirements of the time, but for centuries to come as well. Secondly, a technical plan was required to ensure that water could be discharged and controlled, and the water in the city canals were maintained at a constant level. In most cases the start was initiated by building an encircling canal which was connected through the expansion area by means of a sequence of parallel canals (Burke 1956). The water level of the canal system was regulated and the excess water discharged by means of sluices and windmills. Subsequently the reclaimed land needed to be raised in order to obtain the required protection level, and it had to be consolidated and prepared for building. Mud excavated from the canals was used to raise the level, and it was supplemented with earth. To stabilise the hous-



Polder city, Source: G.L. Burke, The making of Dutch towns, 1956

ing, long foundation piles were driven into the ground in the deep-set stratum (of sand).
It is superfluous to observe that in the case of polder cities, random development is absolutely out of the question when land has been reclaimed, raised, drained and protected with so much effort. In polder cities, one cannot speak of so-called 'chance growth' and due to the costs and efforts of building on the reclaimed land, optimum use was demanded of it (Burke 1956).
Dutch polder cities are a combination of what Kevin Lynch calls the practical and the organic model. (Lynch 1981) The practical model, or the city as a machine, is factual, functional and cool, not in the least bit magical. The organic model, or the biological city, considers the city as a living organism. The magical combination of these two models - the practical model adapts all hydraulic rules and the organic model is the blueprint of the social order - is in the design of the polder city Amsterdam. The practical issues of hydraulics and the social engagement of the organic model represent the work of the people (engineers and surveyors) who understood both – then emerging – worlds. The making of Dutch polder cities is, as Burke emphasises, not only a matter of architectural meddling, but foremost a visionary way of dealing with the hydraulic demands of wet land (Burke 1956).
In the 20th century, the world of urban design and engineering were segregated, also mirrored by the design and construction of polder cities. Climate change puts pressure on these cities, as the water system is not flexible to adapt to these changes. The question is how to have these worlds come back together and build the urban hydraulic constructions of the future.

THE SIX PHASES OF WATER MANAGEMENT

The discipline with the knowledge to build polder cities, the civil engineer, has a crucial part in the design, because he is responsible for preparing the building site. The relation-

ship between the civil engineer and the urban designer (a discipline that only arose in the 20th century) is highly significant. Different attitudes towards dealing with the water can be seen here (Van der Ham 2002). The following phases are used to put into order the state of technology in building site preparation (source of power, soil mechanics, hydraulics) and the effect on the design of cities: I. acceptance (until 1000), II. defensive (1000-1579), III. offensive (1579-1814), IV. early manipulative (1814-1886), V. manipulative (1886-1990) and VI. adaptive manipulation (1990-today)

I. Acceptance (until 1000)

The dynamics of the regional water system, which include groundwater and rainwater, combined with surface water, is crucial for the process of development and urbanisation of the Dutch polders. Until the 8th century, the Dutch lowlands were an uninhabitable marshland where the forces of water and wind had free reign. The first developments in the lowlands were built on higher ground levels, such as dunes and riverbed sedimentation. The Frisians in Friesland, in the north of the Netherlands, built moulds for the water to escape to. These moulds were the first method of 'building site preparation', the subject of the research behind this paper.

The way people dealt with water can be described as accepting the situation as it is, and adopting ways to live with it. There were small initiatives aimed at controlling the wild landscape by digging ditches to drain the field in order to be able to grow crops. Around the year zero, the Romans stabilised their bridges on the wet and weak ground by using wood. They also introduced the wooden sluice that came into more common use around the year 900.

Still the highest mould in the Netherlands, Hegebeintum, Source: Fransje Hooimeijer

II. Defensive (1000-1579)

The period starting around 1000 and ending with the birth of the 'Republic of seven united Netherlands' in 1579, is also referred to as the 'great reclamation' of agricultural grounds, sometimes accompanied by state supervision and bills, producing regular patterns and standard measures. The ditches dug around the separately owned lots discharged their water into peat river streams. In the 12th century this discharge became difficult partly due to the silting up of the main river, the Rhine. They intervened by digging new discharge canals and by building dams and sluices to control the water. The cooperation and organisation of these kinds of state projects lead to the oldest known government, the 'water boards'.
The most important condition for creating cities in the polders is the construction of dikes, which can protect ever-growing areas that have become vulnerable due to settlement and subsidence, against flooding. The dikes replaced the moulds in Friesland as protection from the water. The first generation of large-scale dike rings was built in the 13th and 14th century. Where a dike crossed the watercourse - usually a peat bog flowing out into a larger river or estuary - a dam was built. Apart from this dam function, the dam ensured discharge of the river water into open water by means of a drainage sluice. Together with tidal movements, drain water was used in a practical way in order to ensure the depth of the harbour as well as city access for sea-going vessels. The drainage sluice could only support smaller ships, goods from larger vessels had to be hauled or sold on the dam. The dam turned into a trading market, and the estuary outside the dikes of the peat river became a sheltered harbour. The dam city and polder became hydraulically, as well as economically connected. Besides the dikes, raising the ground to drain and strengthen the wet and weak soil and foundations under buildings were essential if urbanism was to take place. The earliest technology employed for the foundations of buildings on wet and weak soils was used by fishermen who founded Amsterdam in the 13th century, by building their houses on wooden rafts. The technology of dikes and dams at that time was not institutionalised but a craft organised by the guilds: the water boards. The profession of surveyor – one of the ancestors of the urban designer - becomes distinct around 1300.

III. Offensive (1579-1814)

The period begins with the birth of the 'Republic of seven united Netherlands' in 1579 and ends at the beginning of the Netherlands as a monarchy after the French occupation in 1814. The Republic flourished in the 17th century, the so called 'Golden Century'. Cities grew and more valuable assets had to be protected from the water. The 18th century, by contrast, was a century of decay and war. The Dutch lost their leading position in Europe and city development stopped completely.
Urban and economic growth also affected the scientific revolution in the 16th and 17th century (in Western Europe). One of the results was the increased independence of scientific research compared to the 'old sciences' of theology and philosophy. This scientific research

was carried out by using experiments as a source to test hypotheses and theories. (Musson and Robinson 1969)

In the 16th century, water management was perfected with the help of sluices and mills and damming methods also increased greatly. The availability of new technology in hydraulic instruments changed the approach towards the water from defensive to offensive.

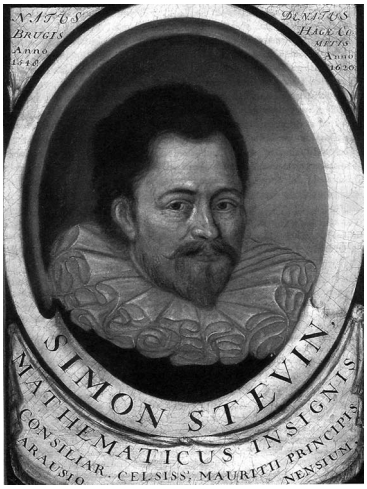
The mill was deployed to drain water from the settled polders and to make the ground ready for building. Drainage on a greater scale increased subsidence, which resulted in more drainage. Also whole lakes could be drained and cultivated for agriculture by using windmills. Due to the subsidence of the moors, the water had to be raised to greater heights, which took place with the help of stepped drainage through a series of three or four mills. The draining of the lakes was also partly due to the invention of the Archimedes' screw, which replaced the water wheel as a water raising machine, so that the height of the water more than doubled (approx. 1634).

The birth of the 'Republic of seven united Netherlands' meant that an organised army was created. The military engineers were the first with the expertise, building fortifications, canals, bridges, surveying etc. all based on knowledge through experience. They therefore became quite experienced in dealing with building fortifications and building on the wet and weak ground of the Dutch territory. The transition from wood to stone houses in the 16th century meant that most houses now needed foundations due to the weight of those houses placed on the weak soil. Besides the use of piles, more knowledge on the characteristics of soil was requested.

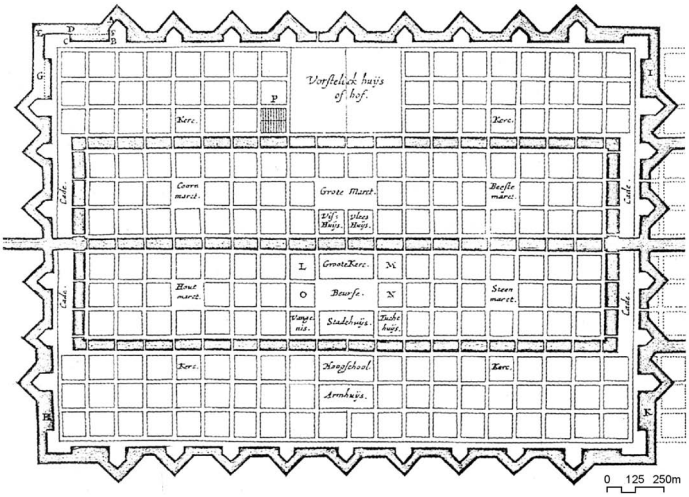
At the end of the 18th century the military engineers were educated in mathematics and physics. The scientific approach based on mathematics and the laws and theories of physics became dominant within the discipline, the result of craftsmen using knowledge through experience. (Lintsen 1980)

The 17th century was a Golden Age for the Republic, cities flourished from the economic growth, the period where polder expansion took place. The way these cities did 'building site preparation' was described above. The cities stepped off their 'dry core' and under 'strict control' raised and drained their expansions. The characteristic of modern civil society is that the future is consciously planned based on rationality, mutual consultation and decision-making. The political independence was accompanied by a flourishing of science, technology and art: the Dutch Renaissance.

The large-scale application of grid-shaped street plans took place during the Dutch Renaissance. The expression in terms of urban design was attributable to the military engineer Simon Stevin's (1548-1620) 'Ideal City', as described in 'Designing cities' (1649, published posthumously). His design was based on the existing size and structure principles of agricultural engineering and urban design. The perspectives of water management, derived from the pattern of the polders, were applied directly in his city. In the centre of the grid there was a square around which the public buildings were situated and canals with houses along-



Simon Stevin (1548-1620),
C. van den Heuvel, De Huysbou, 2005



Ideal City by Simon Stevin,
C. van den Heuvel, De Huysbou, 2005

side them for the wealthier citizens. Simon Stevin is the first example *par excellence* of the possibility of integrating hydraulics and urban vision: the urban engineer, technically trained and autodidact urban creative thinker.

Around 1620 it was decided to build an entirely new urban structure over the existing polder structure in Amsterdam. The world famous *grachtengordel* (ring of canals) is an integral design of a street plan and a new water system and shows that the relationship between land restructuring, surveying and water management is the basis of urban development in the Netherlands. The design of the *grachtengordel* must have been the result of cooperation between the representatives of the merchants for whom the city expansion was built, the city carpenter Hendrik Jackobzn Staets and the surveyor Lucas Jansz. Sinck drew up the plans. A further study of the dimensions of the project indicates that they either used the Ideal City of Simon Stevin as an example, or that the dimensions belonging to a hydraulic sensible system was common knowledge, available to carpenters (the early architects) as well. The construction of the hydraulic city was a *gesamtkunstwerk*, with shared knowledge and without professional boundaries.

The *grachtengordel* is constructed as described in the introduction. The three canals are dug to drain the area, therefore with a certain distance between them. The soil that came out of the canals (together with added rubbish, sand etc.) was used to raise the islands and stabilise the weak ground. The buildings were placed on wooden piles. An excellent example of the combination between water management and city building: urban engineering.

IV. Early manipulative (1814-1886)

The period starting in the beginning of the 19th century, after the French occupation, is characterised by exploding population growth and industrialisation and by the move from hand to machine labour, made possible by the introduction of the steam engine. This strongly altered the forces that shaped the urban landscape. (Van der Ham 2002). In addition to the shift from hand to machine power, the hydraulic technology also changed. It became easier to control the water, making it do things it would not naturally do: manipulate it. The civil engineer became a more defined discipline (clear tasks, education and a discourse) at the end of the 18th century.

The building of cities on wet and unstable soil arose from three fields of knowledge that began to develop in the previous period. When considering the history of building site preparation these areas need to be studied. The first is the general hydraulics of water management, including larger water systems like rivers, lakes and the sea. The second is the science of soil mechanics that studies the characteristics of soil to determine its carrying-capacity and understand ground water flows and soil. Parallel to soil mechanics is the development of pile foundations and of drain systems. The third field is crucial to both previously mentioned fields and includes the development of engine power, important for the movement of soil and water.

In general, water management was the prime interest of the military and civil engineer. The discipline of the civil engineer was institutionalised due to the French occupation (1795-1813). The French bureaucratic and centrally organised government structures were super-

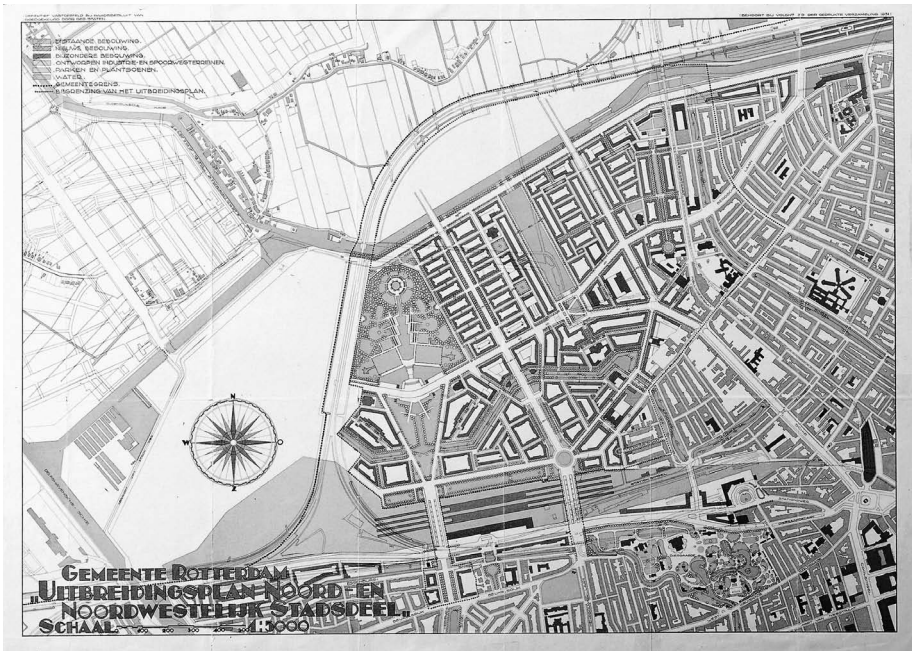
Water Project 1854, Rotterdam,
Source: Municipal Archives Rotterdam

Willem Nicolaas Rose (1801-1877),
Source: Municipal Archives Rotterdam

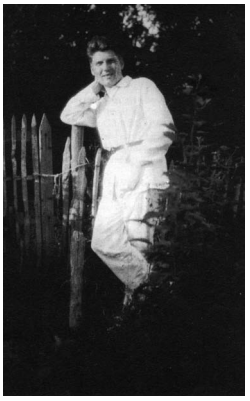
imposed on the Dutch administration. Water management became a national concern and the government body of civil engineers was structured according to the French 'Corps des Ponts et Chaussées'. The schooling of engineers in the 19th century took place at the Royal Military Academy (started 1805) and the Royal Academy in Delft (started 1842). In addition to their formal education they were also organised into the Royal Engineers Society (1847) and the Society of Civil Engineers (1853) (Lintsen 1980).
The main projects of the civil engineers in the 19th century were the building of channels and the draining of the Haarlemmermeer (1848-1852). The first great draining project with the use of (experimental) steam engines (and 30 windmills) was the Zuidplaspolder (1836-1839). After the windmill, the steam engine was the most significant change in technology: the start of the phase of early manipulation.
The development of methods of building site preparation relied heavily on soil mechanics, a science that matured in the 20th century (Verruijt 2001). At the end of the 19th century, industrialisation caved in and engines were used to build foundations faster and cheaper, the method of piles however stayed the same (until today).
The spatial organisation of cities in the 19th century was characterised by the separation of conflicting functions and the bundling together of functions which belong together (Van der Woud 1987). In this period, the city architect was the director of Public Works. Rather than an architect he was a technician and manager of a government service. His task was so complex and extensive that he operated fairly independently of the city council. The city architect of Rotterdam, the military engineer W.N. Rose (1801-1877), was the designer of the first expansion of the city of Rotterdam, the Water Project, with the crucial use of steam engines to be able to manipulate the water. The plan served four objectives: flushing the city centre water to improve water quality, lowering the ground water level for the required urban expansion, creating a pleasant living environment for wealthier citizens and a walk-in landscape for the poorer inner city dwellers.
Rose is the second excellent example of an urban engineer. The way he combined hydraulic knowledge with city design is still a great example. He also marks the end of a tradition of spatial design of hydraulic constructions. Rose used the characteristics of the landscape, the pattern of ditches and dikes for his city design. The water structure is therefore also the main structure of the expansion. The logic is still visible and hydraulically important today, providing the (bombed) city with a historical sense and providing the water surface to discharge tropical rainstorms. Rose's use of the steam engine to control water and the lowering of the ground water table as a mean of building site preparation marks the start of the manipulative era.

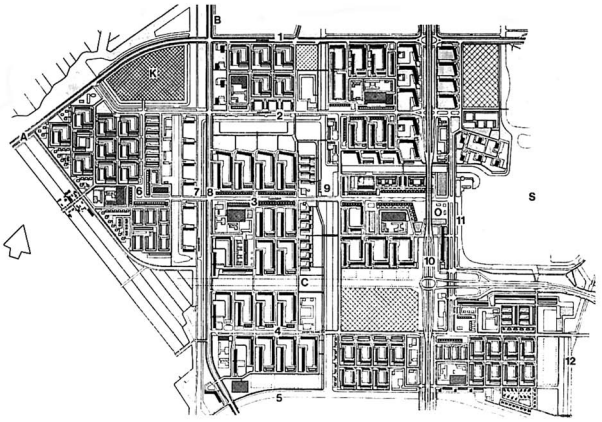
V. Manipulative (1886-1990)

The fields of knowledge (defined in the previous phase), important to the construction of polder cities, create the changing force of the manipulative era: people taking an increasingly vulnerable position in the game between water and land .



Blijdorp 1931 Rotterdam, Source: Municipal Archives Rotterdam





Left: Cornelis van Eesteren (1897-1988), source: C. van Eesteren, Urbanismus zwischen de Stijl und C.I.A.M. , Herausgegeben und kommentiert von Franziska Bollerey, 1999

Right: Osdorp 1950s, Amsterdam, Source: Municipal Archives Amsterdam

When preparing the building sites, the shifting sources of power (from steam to diesel, oil, gas, electricity) provided greater possibilities when constructing a large layer of sand to build on. This power shift once again also increased the scale of water management. Land could be made out of water: closing the Zuiderzee and building new polders in the IJsselmeer. The scientific research into soil mechanics was developed during this century and added to the development of better and more refined ways of preparing building sites.

Calculations were combined with the new methods of draining, more balanced pile foundations were used and all the restrictions of building polder cities on weak and wet soil were employed on an even larger scale. All fields of knowledge together made it easy to control the water, making it do things it would not naturally do: manipulate it.
The use of steam-driven pumping stations for the city expansion of Rotterdam is one of the first examples of a technological approach to urban water, which would become common property a hundred years later. The most important input for this development was technological progress combined with an explosive growth in urbanisation. Health problems, caused by the city's water, were slowly but surely an influence on the spatial effect of water management, due in part to the progressive development of the steam engine and later of the internal combustion engine.
Whilst the functional meaning of water was increasingly devalued, 'nature' in the city gained proportional interest. Besides traffic, buildings, and water, a new element was introduced to the city structure: public space. At the same time, structures of buildings, traffic and the combination of water and green spaces were separated. These structures coincided in traditional cities, such as in the Amsterdam *grachtengordel*, which had one single main structure containing all the elements. In the beginning of the 20th century it appeared as if water and green spaces could only guarantee their right to space when they were combined.
The breaking up of the various structures illustrates the separation between civil engineering and urban design. The designers of the *grachtengordel* and the Water Project were military engineers, and autodidactic visionary urban designers. At the beginning of the 20th century, urban design became an autonomous discipline and the tasks were divided. Civil engineers solved the water problem and offered the urban designer the possibility of designing a plan based on this. This was graciously accepted, especially during late post-war building. Technological progress, such as improved pumps and calculation methods made the preparation of a larger site possible by raising it with sand. This meant that, combined with an underground drainage system, significantly less surface water was needed.
Water became a waste product, and was located alongside the outskirts of districts, integrated into the infrastructure or the green space system. The water system as designed by civil engineers cannot be recognised as such, since underground pipelines alternate with the surface water. Moreover, the sand package provides the urban designers with a *tabula rasa* on which each required urban design can be realised without any concern for the water system. Whereas up to 1940 the total surface of the city contained 12%-15% of water, in post-war city expansions, this percentage was often reduced to less than 5%.

VI. Adaptive manipulation (1990-today)

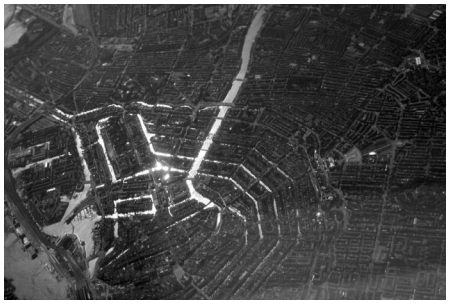
Improvements in technology in the last decades of the 20th century made it possible not only to maintain what was under threat, but also to opt for an increasingly vulnerable place in the game between water and land. The fact this advanced technology made us lose sight

of what was vulnerable, marked a cultural change at the end of the 1970s towards a greater concern for the environment and ecology. The notion of integral water management was raised. It is assumed that ground and surface water must be managed in a physical sense as well-founded systems (physically, chemically and biologically). Integral water management meant a shift for civil engineering. It lead to new objectives that required new designs and working methods. It also meant a strategic regrouping as biologists and ecologists also became players in the field, alongside the civil engineers.

In many countries of the world there are similar institutes and consulting companies that specialise in soil mechanics. Usually they also deal with foundation engineering, which is concerned with the application of the soil mechanics principle to the design and the construction of foundations in engineering practice. Soil mechanics and foundation engineering together are often denoted as Geotechnics.

Many different piles and techniques to drive them in were developed, and new techniques for building preparation came into use. The use of lightweight materials, such as polystyrene foam and granules, has the advantage that building can start immediately and that little subsidence occurs afterwards.

Webber and Rittel marked the change, the end of the idea of efficiency, at the end of the 1970s when the context of urbanism was reintroduced. In response to the technocratic approach towards urban design in the 1950s, it was in the 1970s that water ecology returned to the attention of the urban designer.



Left: Too much water, source: Volkskrant 14 august 2006

Right: Grachtengordel Amsterdam, Source: Fransje Hooimeijer

This phase started in the 1970s but from the 1990s on, with problems related to climate change came an increased awareness of the fact that the Netherlands is a water machine that needs to be spatially, and not only technically, approached. Urban designers became very interested in working with water as the basis for their urban design. On the other hand the civil engineers had to let go of their strict control and also started to adapt to the natural rules of water.

CONCLUSION

Surveying the historical relationship between technology and the design of polder cities one can only conclude that there has been a tight bond dominated by technological prosperity. The more the civil engineers could solve, the less water management became a spatial task. The urban designers were also happy to work on a layer of sand, offering them the *tabula rasa* where they could draw any ideal urban plan.
This technical approach to management has led to the current situation where climate change (with more extreme storm water) has led to flooding in the polder cities. The days of pipes and pumps (the work of the civil engineers) are over. Water needs to be reintroduced into the urban design of cities. The water system of the future should be flexible and self-cleaning. This requires a spatial approach where fluctuations in water supply and ecological water systems have to be taken into account. Greater acceptance is required with regard to the rules and regulations governing water: return to the first phase of acceptance. We shall need to adapt to even wetter surroundings and use this to our advantage. The Netherlands is a water machine where all the cogs are interconnected.

Projects like the *grachtengordel* and the Water Project illustrate that the Dutch talent with regard to the integration of design and construction of water cities finds its basis in a combination of urban vision and civil engineering. There is a need for strengthening coherence between urban design and civil engineering and to be able to go on living with water.

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Allan Wexler, Coffee seeks its own level (1990)

IR. C. REDEKER

URBAN FLOOD INTEGRATION = SPATIAL STRATEGIES

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ABSTRACT

The post-productive Central European city is challenged by its industrial legacy, while facing competition from other, often more privileged, cities in terms of topography, climate and thus life style. In this context, Central European river cities along the Rhine have an advantage, as the interaction between city and river may catalyse developments capable of responding to these challenges. The pressure of the value of sites along urban river fronts versus the potential for damage due to seasonal flooding demands a provision for varying water levels within the urban fabric. Left with the modernist legacy of separated functions and a tendency towards enshrining urban water fronts, the integration of river dynamics within urban planning strategies may have the potential of reintroducing programmatic complexity by combining flood management within urban functions.
Regarding anthropogenic manipulations of the river, there have been two major paradigm changes beyond the scale of local intervention. The channelling of the Upper Rhine in the 19th and 20th century could be considered to be the true industrialisation of the Rhine basin. It has led to multi-faceted impacts of unknown severity not only on site, but also downriver. Today, river expansion strategies are demonstrating spatial considerations in flood management. Expanding the riverbed is not only a rural strategy towards flood mitigation linked to the predicted increase of extreme floods. It is also related to the demand for a cultural landscape capable of accommodating river dynamics in a less exclusive way. Adapting the built environment to varying water levels is also occasionally being tested as a strategy for urban riverside regeneration and flood management. Morphological transformations of the urban water front and/or object-related adaptations to the buildings it is hosting

may offer the chance of adding new qualities to the post-industrial condition, while lessening the potential for economic damage. What potential do post-industrial Rhine cities offer for adapting to varying water levels in terms of flood alleviation, and what urban potential do varying water levels offer to post-industrial Rhine cities? The challenge, as well as the potential, lies in the synergetic approach.

RELATED RESEARCH

This study is supported by TU Delft Water Research Centre. It is organised as an interdisciplinary project involving two other PhD researchers: Bianca Stalenberg, Hydraulic Structures supervised by Prof. Han Vrijling and Miriam Cuppen, Technical Management, supervised by Prof. Wil Thissen.
Apart from studying the related literature and previous research and cooperation that have dealt with the issue of flood management in the Rhine basin projects on a European scale, expert interviews with specialists of other disciplines related to specific projects will inform the research.
The topic of this research is based on my Master's thesis *K2O-Urban Retention* at the Berlage-Institute in 2003. By extending a derelict harbour basin to create a new side arm on the Central East Bank of Cologne, the water front would be elongated and made more accessible, while flood levels for the historical city up river on the opposite bank might be decreased.
There has been a further exchange with other related PhD research at the chair and faculty with Fransje Hooimeijers' study on Polder Cities, and at the chair of Urban Compositions with Ties Rijckens' research on floating houses.
Ongoing projects, such as UFM Dordrecht, will inform the research regarding interdisciplinary design strategies and offer sites for conceptual design studies.

RESULTS

Flood related design strategies based on water as a qualitative urban element have been developed, but have never been systematically evaluated according to a specific set of criteria. This research sets out to develop a catalogue of conceptual design strategies for river expansion within cities and the parameters required by looking at the specific conditions of the city in question and its potential sites.
This urban planning tool will provide the basis for a more systematic discussion between the architect and other players involved by analysing what parameters give shape to the original vision or idea. The architect switches between the spatial design by creating this first image and the moderation process with the other stakeholders. What tactics for the involve-

ment of architecture and urban design can therefore be deduced?
The format of the research will be a book with maps and graphical representations of conceptual design strategies.

SUPERVISION

The research is supervised by Prof. Han Meyer, Urban Compositions, TU Delft Faculty of Architecture and Robbert de Koning, landscape architect. The changing relations between urbanisation and water is a long-term research-topic at the chair of Urban Compositions, beginning with Han Meyers' dissertation 'City and Port'(1997), then the PhD-research of Fransje Hooimeijer and finally, the 'Atlas of Dutch Watercities'. Robbert de Koning, landscape architect and external supervisor to the project, is involved in a number of river-related research and implementation projects in the Netherlands and provides professional expertise on present-day questions regarding the relation between landscape-/urban design and river-management.

INTRODUCTION

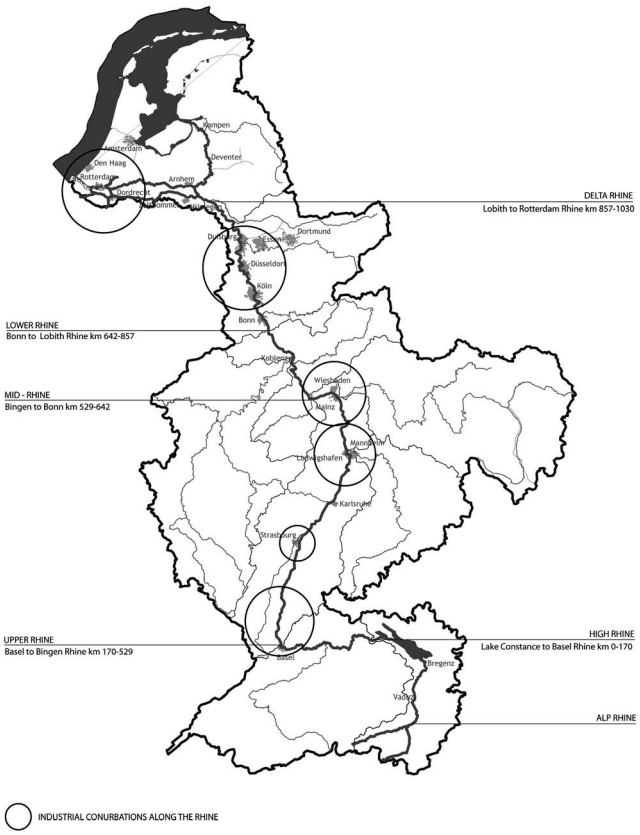
The apparent contradiction between the eternal desire to live and work in the direct vicinity of rivers, which is evidenced by the land prices achieved along urban river fronts vs. the increasing risk of their flooding demands synergetic spatial strategies. As water levels are predicted to rise, the current methods of defence applied in urban areas call for a paradigm change capable of offering new solutions that incorporate the qualities of waterfront urbanisation with a necessary degree of protection against adversity.

PROBLEM DEFINITION AND APPROACH

The aim of this research is to explore the potential of interweaving city and river. For obvious reasons, the majority of river expanding projects are being planned or implemented in rural areas. Very few examples are currently being planned within cities.[1] As a result of very recent changes in flood management, these projects have been modelled, but none have yet been implemented or exposed to a flood. Based on the presupposition that this approach is viable, this research investigates how it may inform new urban typologies.

1. UFM Dordrecht as an exemplary project for developing planning strategies outside the dikes and Nijmegen Plan Brokx for the installation of a bypass.

How can river expansion within cities respond to the challenges of Rhine Cities today?
What potential is there for expansion in the specific city typologies with regards to the river segment in question?
As a consequence of the pressure for development on urban river fronts: What urban typology does this produce?



This also assumes a new definition of the architectural role in the development of such projects, as they are more interdisciplinary, assume higher public acceptance and depend on the strategy chosen, demanding a much longer time frame.

The research encompasses three scales:
• the Rhine River
• the Rhine River city
• the urban water front

An analysis and categorisation of Rhine City typologies in accordance to the river segment which they are framing and a study of ongoing projects will serve as a basis. The aim will be the development of urban typologies on water with minimised flood vulnerability according to site specific criteria from ongoing projects or from project sites defined by research into selected Rhine cities.

RHINE URBANISATION

Urbanisation along the Rhine in the past

The river as a topographical and political boundary, the channelling of the Upper Rhine by Tulla and its consequences down river and the Sandoz accident in 1986 are only some examples which show the historical multitude of influences on the scale of the river. Their spatial effects on Rhine urbanisation in its direct relationship with its water front as a palimpsest of larger scale political, infrastructural, industrial and cultural developments, raises the question of how we define the city and its boundaries in this context and what players are operating when we look at urban flood management projects today.

After the decline of the Roman Empire and phases of migration, medieval city states began to rise, expanding on the plan of Roman left bank cities. Cologne, the oldest Roman city along the Rhine, was built at a distance to the river on a left bank terrace high enough to be flood protected. The city followed as a medieval commercial centre, and a toll and transhipment point from sea to river barges as part of the Hanse. Urban development expanded towards the river, filling the gap between the former Roman fortification and river front and expanding the fortification lines perpendicular to the river. While the city states began to develop as a civic society based on economic developments strongly linked to trade on the river, the area outside the cities had hardly developed.[2]

During industrialisation, the river became a transport route and the city faded to mirror its commercial activities. The channelling of the Upper Rhine had made the centres of commerce located close to the water front volatile, and these in turn had been vacated. The public rise of leisure, introduced by the unions‘ demand for 8 hours work - 8 hours sleep

2. Febvre , op.cit.

- 8 hours free time,[3] let the riverside become both a place of leisure and of labour. Floating public swimming pools were installed on the waterfront within the city, for example in Basel and Cologne, while industrial plants began to expand. Ferry stops for excursions on steamboats to the castles of the Mid-Rhine were installed. Leisure became a public good on different scales along the river.

However, the increasing industrial activity and the inherent pollution as well as the increased velocity and current due to the channelling of the river eventually led to an alienation process. The river was no longer capable of combining work and leisure activities along its waterfronts. Not until the rise of ecological activism in the 1970s, profiting from the beginning of the Western European decline in industrial production in the 1980s, had the conflict between technical progress and environmental damage become an issue. Since the 1980s the river front has been reintroduced as a site for leisure activities, combined with an increasing appearance of events.

European Rhine cities today

Cities along the Rhine River today are confronted with two seemingly contradictory challenges - the pressure of the value of sites along their waterfronts vs. the seasonal challenges of flooding.
From a historical point of view, urban rivers have continuously been adapted to socio-economic and cultural agendas alongside technical innovation.

Before looking at the specific urban typology and the related river segment, an evaluation of the socio-economic and cultural agenda within cities today is necessary to define the potential role that rivers may play and in what way design strategies can accommodate and orchestrate these additional values/functions for the city in question. Rhine cities today are challenged by

- an increasing lack of public funding
- the dependence on market performance
- the competition with other cities for locations
- an increasing flood threat due to the predicted increase in water levels
- a local demand for a hedonistic environment
- the transformation towards service-oriented industries leading to the development of large scale water-related programmes such as harbours, industrial plants, etc.
- reliance on the public sector for protection
- very slow paradigmatic changes regarding the general attitude towards flood alleviation
- discrepancies between European/national agendas/local interests/risk awareness

3. P. Decaix and C. Redeker, Isotopia, in Research By Research, Berlage-Institute Publication, 2001

The decrease in local industrial production, often located on the water, and the relocation of transshipment activities to the edges of the cities has led to large scale urban changes along river fronts. At the same time, the societal transformation towards service-oriented industries is increasing competition between the cities that are affected, as they often lack suitable topographical and climatic conditions. The event culture that this competition produces is comparable to the current method of dealing with floods within cities. Flooding is also treated as a seasonal event, managed by employing ephemeral structures and attracting a crowd of spectators. One of the main traits of such events is the lack of traces left on the urban fabric, as there is no effect on existing architectural structures. The flood is different in this respect, as it is capable of producing severe material damage.

The boundaries of the city today have been blurring with its surrounding landscape. The rise of the regions, triggered by their dependency on the hinterland and the sprawl caused by collective individualisation may demand measures on a larger scale. Multiple river fronts vs. one historical waterfront frame the rivers today. Water is one of the few spatial elements capable of preventing sprawl, thus preventing additional sealing of the ground. At the same time it may incorporate a possible strategy of managing shrinking processes. Water may be more than just a panorama for the iconographic quality of historical river fronts.

The river can be considered as one of the few elements capable of developing regional coherence and identity.[4] The need to create meaningful structures on a regional scale, to provide for greater identification of the population with the region and to promote policies at a regional level are some of the tasks of spatial planning and design today.[5]

THE RHINE AS A EUROPEAN DEVELOPMENT CORRIDOR

The Rhine basin

The Rhine not only connects the Alps with the North Sea, but has also functioned as a physical border in the past. It can be considered to be one of the most important European economic development corridors. As a consequence, it has also been subject to severe anthropogenic manipulation, which has influenced the direct vicinity of the respective site of intervention.

The Rhine basin today has a population of 58 million (almost 12% of the European Union with 493 million), and hosts five major industrial conurbations, including the Rhine-Ruhr Region and the Randstad. With two main European harbours, the sea port of Rotterdam,

4. see Meyer, Han, Ontwerpen voor een monumentaal stadslandschap-De opgave van de stedebouwkundige discipline in de 21e eeuw
5. see Engelsdorp Gastelaars, Rob and Hamers, David. De Nieuwe Stad, Ruimtelijk Planbureau, Nai, 2006

the inland port of Duisburg and through the Main-Danube canal directly connecting it to the Black Sea, the Rhine connects the European hinterland to the rest of the world.

However, apart from being a body of cultural heritage since Roman times, the Rhine is something else – a threat. Not only does it play host to industrial plants along its waterfront with their related emissions and risks including their disappearance, but it is also a river liable to extreme flooding.

Flood risk is increasing in two ways: the probability of extreme floods is rising as a result of climate change. Levels of investment in areas at risk (parallel to mean economic growth) double every three decades, while the room for rivers is decreasing due to urbanisation, also leading to an increase in the cost of future investments.6 Within the past 150 years, urbanisation processes and river channelling have reduced the flood plain surfaces of the Rhine branches by 65%.

There are three forms of flood damage: from extreme rainfall, from the rupture of a primary dam, from the rupture of an antechamber or another regional dam and also by exceeding the height of current defence systems.

In terms of risk, the Rhine segments differ greatly. While the Upper Rhine has a much larger surface area at risk, the number of people affected is much lower. The Mid-Rhine settlements at risk are the highest with 34% (average 9-16%) as its cities were built on the narrow banks of the Rhine during the Middle Ages. These medieval cities are being abandoned at basement level due to the risk of floods.[7] The Lower Rhine surfaces at high risk (flood depth above 2m) are mainly those protected by dikes, but the height and maintenance of dikes and the alleged security of the inhabitants of the hinterland is currently being questioned. Most threatened is the Delta Rhine Basin - 79% of this area (flood depth above 2m) is at risk and large areas lie below sea level. The intensive use of the valleys at risk are highest along the Lower Rhine and the Delta. 90% of the total area is endangered compared to only 74% of the surface areas along the Upper and Middle Rhine. While 75% of the surface areas affected today is used for agricultural purposes, 83% of all damage hits settlement areas occupying only 11% of the surface area.[8]

Paradigm changes

Since the management and manipulation of the river has reached a larger scale than local

6. see A. van Os, A. Hooijer, F. Klijn, J.Kwadijk, B. Pedroli, Towards sustainable Flood Risk Management in the Rhine and Meuse River Basins, Proceedings Final Working Conference, 2002
7. Interview Prof. Koetter, Bonn University, June 1, 2006
8. 6 ICPR Rhine Atlas, 2001

intervention, there have been two major paradigm changes: The channelling of the Upper Rhine in the 19th and 20th century, with major consequences on site and down river, and the expansive strategy of Room for the River, originated and consequently most often applied in the Netherlands today.

The Channelling – Industrialising the river

The first paradigmatic shift which implied a manipulation of the river on a larger scale was introduced by Gottfried Tulla between 1817 and 1865. This new approach to channelling can be considered to be the true industrialisation of the Rhine. Previously a bifurcating river between Basel and Karlsruhe and from there on meandering until Mannheim, the wild river became a deeper and narrower stream, held partly in its new bed by dikes on both sides. The main aim of this intervention was the protection of land and property.[9]

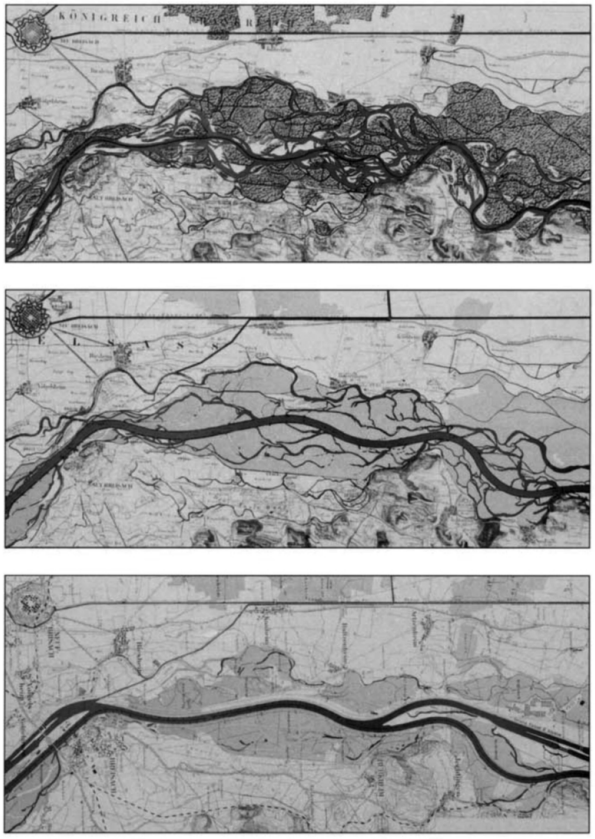


Image 2. Channelling of the Upper Rhine - 1828-1872-1963

9. Blackbourn, David. The Conquest of Nature- Water, Landscape and the Making of Modern Germany

The channelling of the river itself changed the morphological and hydrological state of the basin from Basel onwards downstream. This affected all areas of life. Gold sifting, one of the oldest activities on the Rhine, as well as fishing and fowling disappeared, so did the fish markets and fishing boats from the urban waterfronts. Instead, arable land and industrial production, and thus urbanisation, continued to increase. The developments in straightening the Rhine produced a relationship between the occupants which correlated to a lesser extent with natural circumstances.[10]

While the first rectification phase of the Upper Rhine provided flood protection and permitted side channels, the second phase of rectification, which lasted until the 1970s, also led to side channels being cut off to improve the navigation capacity of the main river. This was not in line with Tullas' original plans and led to an increase in floods down river. Cities also stopped serving as toll and transition points for sea and river barges.

Previous floods, but also political changes and technical innovation, led to the channelling of the Upper Rhine. At the beginning of the 19th century, on the right bank of the Upper Rhine, Germany was fragmented into countless micro-states. The French Occupation led to a unification of these states, in favour of a clear boundary between the French and the German states. This development can be seen as the beginning of modern nation building.[11]

The Expansion – increasing the number of stakeholders

The second major paradigm change was evoked from such visions as the Plan Ooievaar in 1987 and Stromenland Nederland 2030 and from the floods of 1993 and 1995. 6 Social protests, especially from residents and organisations in the river-area, were rising against the plans of Rijkswaterstaat to enlarge and broaden the dikes in the river-areas, which would destroy the typical river-landscape. The government set up a commission to investigate the complaints and to offer advice on the possibilities of alternative approaches. The 'Plan Ooievaar' was a professional expression of this resistance against the ongoing destruction of the ecological and cultural characteristics of the river-landscape. The Dutch strategy, entitled *Room For the River,* was set up and water management became a political topic not only involving engineers, but also ecologists, spatial planners, sociologists, artists and the broader public, promoting a more natural approach to river management. Retaining, storing and discharging have become the Dutch national strategy for action since 2001. By increasing lateral space, rivers gain additional room for storage and discharge in the alluvial plains currently protected by dikes.[12]

10. Hooimeijer, Meyer, Nienhuis. Atlas of Dutch Water Cities
11. Febvre, Lucien. Der Rhein und seine Geschichte
12. see A. van Os et al, op.cit.

The ecological movement developed in the 1970s, made the Rhine river, as with other habitats, a self-organised public concern. In 2000, the European Water Framework Directive (WFD), which mainly addresses ecological aspects of water protection was legislated, but this is being supplemented by the current formulation of the EU Flood Directive. It is informed by ongoing research and cooperation projects such as the Urban Flood Management cooperation project between Dordrecht, London and Hamburg, just to name one of the few dealing with the urban sphere. The directive will focus on the coherent flood approach of member states. Its aim is to reduce and manage the risks that floods pose to human health, the environment, infrastructure and property. Member states will need to carry out a preliminary assessment to identify the river basins and associated coastal areas at risk of flooding. For such zones, flood risk maps and then flood risk management plans focused on prevention, protection and preparedness have to be developed.[13]

The knowledge that upstream flood prevention measures can reduce extreme floods only on a local scale leads to the recommendation that along the Lower Rhine and Meuse, decision makers should not look far upstream for solutions. Instead, a focus on measures in or near downstream areas, possibly via detention ponds, is recommended. As space is limited in the Rhine-Meuse basins, the aim should be to enable more than one function in areas at risk of flooding. [14]

More room for the river, as a flood mitigation strategy, is already being applied and funded on a European level for many rural areas in the Rhine catchment region. Within urbanised areas, local river expansion strategies towards flood mitigation are still not very common due to the lack of space, higher land prices and existing building structures.

Refined forecasting technologies enabling flood prediction for the Rhine four days ahead of the actual occurrence on the Dutch-German border leads to a time-space detachment. This gives the affected stakeholders up to 96 hours to prepare for the event. Apart from eliminating the threat to lives, this may reduce economic damage when flooding inhabited areas, presuming that architecture and technical infrastructure can be protected by previous measures. This would, however, demand large scale transformations of existing building structures. Based on this, studies like the Rampenbe-heersingsstrategie Overstromingen Rijn en Maas propose the improved compartmentalisation of the existing dike rings (53 in NL) for more strategic flooding via a system of cascades flooding areas in order of damage potential.[15]

13. Proceedings Flood Conference Vienna, May 17 2006
14. Also according to Dirk Sijmons, CEO of HNS and Rijksadviseur voor het landschap, 30,000 ha of land should be reserved for water in the West of the Netherlands. An absolute prerequisite for the availability of land on such a scale being the incorporation of multifunctional land use.
15. see Rampenbeheersingsstrategie Overstromingen Rijn en Maas by Rijkswaterstaat and Robbert de Kooning

Preserving room for rivers on 11 sites in North-Rhine Westphalia via detention ponds or setting back the dikes can lower water levels during an extreme flood (1/1250) of the river by up to a maximum of 10 cm. Using dike relocations and cyclic rejuvenation measures, other studies initiated by Room for the Rhine have calculated flood water reductions of 30 cm.[16]

The criticism to this approach is the time scale (decades) before this strategy would become feasible and the necessity to transform existing settlements. Bucolic landscapes - the idyll of river expansion failing to consider the hydraulic and economic problems within given time spans are some of the arguments brought forth by experts in the field who have little confidence in the inherent interdisciplinary approach of the *Ruimte voor de Rivier* project. A shallower navigation channel which would demand gigantic adaptations for shipping as well as contaminated dike foreland needing to be dug off are further concerns.[17]

Science vs. Politics

The flood regime defined by probability, depth, velocity, duration and timing[18] offers a number of parameters with a high degree of uncertainty. Studies as well as actions always rely on models based on previous experience. Also, the differences in planning culture play an important role when looking at varying safety standards and the way of organising players and stakeholders, information flows, etc. The difference between the actual threat and politically evoked boundary conditions is not always transparent. A legal norm for boundary conditions in the Netherlands for a river dike breach is 1:1250 while for sea dikes it is 1:1000.[19] The boundary conditions in Germany vary between 1:200 and 1:500.[20]

SPATIAL FLOOD MANAGEMENT STRATEGIES WITHIN URBAN AREAS

Urban Flood Management

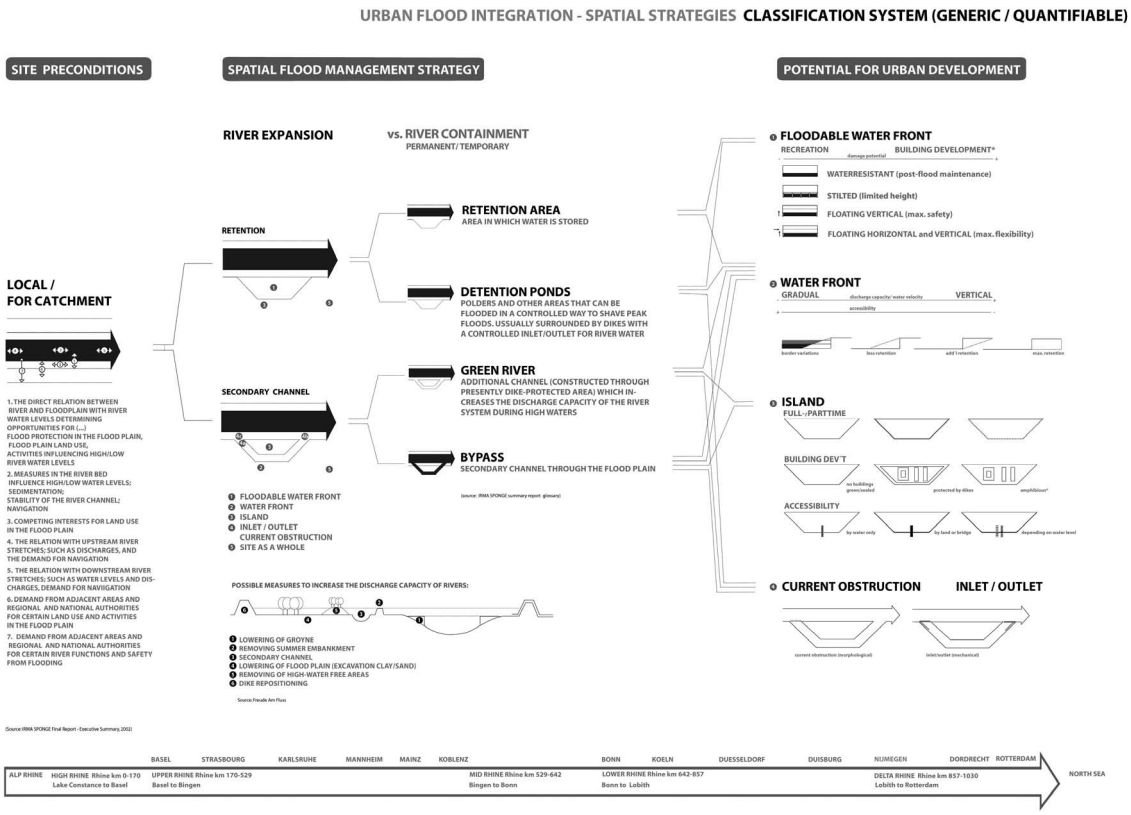
The limited capacities of cities demand local flood alleviation measures. By widening the river within urban areas, the waterfront can be expanded, while producing retention capacities on site as a possibility of incorporating more resilient techniques of flood management and possibly flood reduction on a local scale. However, building a defence line is, due to its scale, land scarcity and the value of a specific site, often the only possible intervention

16. Interactive Flood Management and Landscape planning in River Systems IRMA SPONGE project 4, Jan 2002
17. Han Vrijling and Enne de Boer in van der Hulst, Alex. Watergevecht: dijkenbrekers versus dijkenbouwers Groene Amsterdammer # 33 / 2004
18 A. van Os, et al. op. cit.
19 van der Hulst, Alex. Watergevecht: dijkenbrekers versus dijkenbouwers Groene Amsterdammer # 33 / 2004
20 Hochwasserschutzkonzept Köln

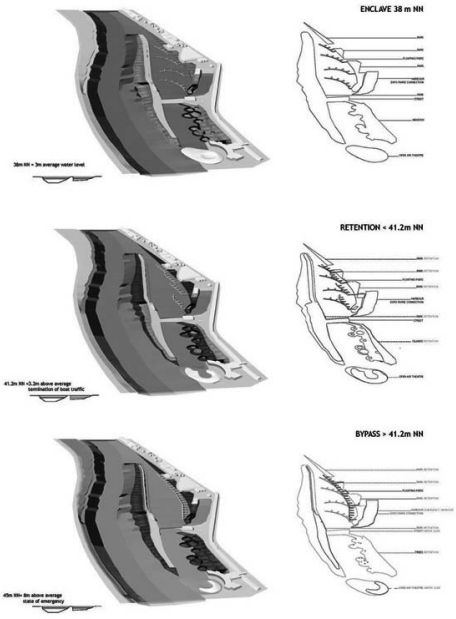
in order to protect the endangered area. Between these two extremes lies a third option, adapting the endangered areas, for example when planning outside the dikes.

Minimising damage potential is the most cost-effective flood risk management measure. With awareness of the risk of extreme floods rising, total control is economically not feasible. This leads to the need to accept more risk and to develop more resilience and adaptability in the future.

These three spatial strategies of flood management must be orchestrated according to the sites‘ potential and demands and their economic feasibility not only regarding flood protection, but also in relation to the urban potential they are capable of producing.



There are recommended measures and strategies which anticipate higher peak discharges, while room should be preserved for future measures.[21] Translating these recommendations to the situation of the cities along the Rhine today would imply efficiently protected or well adapted high density conurbations reserving the spaces in between urbanised areas as possible flood plains- possibly a return to the traditional European city structure- however, in many cases with a heightened defence line. All variations of that concept imply an additional set of parameters defined by their capacity to synergise the qualitative enhancement of urban river fronts with the constraints of flood management and alleviation.



THE ROLE OF ARCHITECTURE AND URBAN DESIGN - VISION VS. STRATEGY

The analysis of the Rhine Cities and designs for selected sites will culminate in the question of what role architecture and urban design have played in project development. In the past, the modernist approach of architecture and urban design in the involvement of flood related projects has implied a separation of the urban space and its protective elements. This is slowly changing.

There are different approaches to the relation between water and the urban landscape. It can trigger a new organisation of a specific urban area when looking at landscape and water on a regional scale. New elements, types and inventions in the field of civil engineering may provoke a new cultural meaning to the waterfront, such as the introduction of specific building typologies (i.e. floating houses or structures on pillars, etc.) and a combination of two or more of these approaches.[22]

21. A. van Os, et al. op. cit.
22. Meyer, Han introduction to the Atlas of Dutch Water Cities

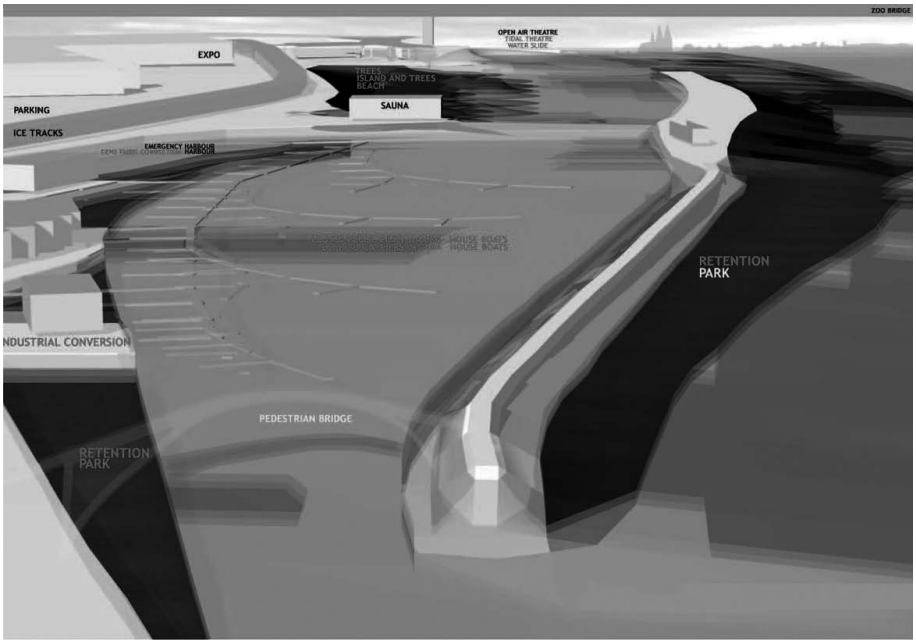


Image 4. K20 Urban Bypass, Cologne

By creating a design for a specific site, all stakeholders can relate to a common vision. Although the created image may trigger differences in interpretation, it may serve as the least common denominator capable of being related to by experts/non-experts alike and may be a model informed by the demands of other disciplines. The design also serves the purpose of attracting investment. Adapting cities to anticipated extreme floods will demand a change of attitude also in the Nimby public. This demands correspondent market mechanisms[23] reliant on image.

Where do architecture and urban design enter this interdisciplinary process and how do they operate as a moderator between the involved players and the dynamics of a project, without losing essential content? Increasingly, large scale urban design projects are also delivering a project development strategy.[24] How can the uncertainty of future developments become part of the design strategy when looking at spatial flood management projects?

23. *Toine Smits in van der Hulst, Alex. Watergevecht: dijkenbrekers versus dijkenbouwers Groene Amsterdammer # 33 / 2004*
24. *i.e. Harbour development Rotterdam by MaxWan, 2007*

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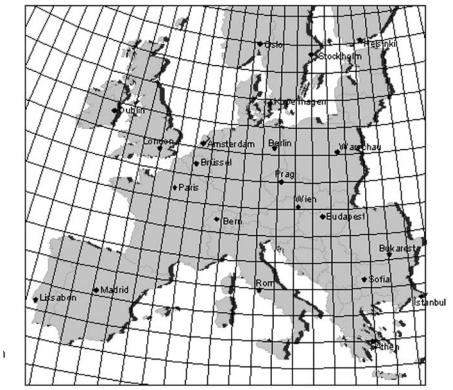
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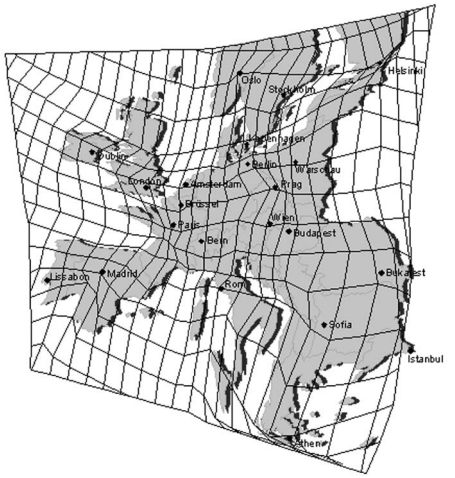
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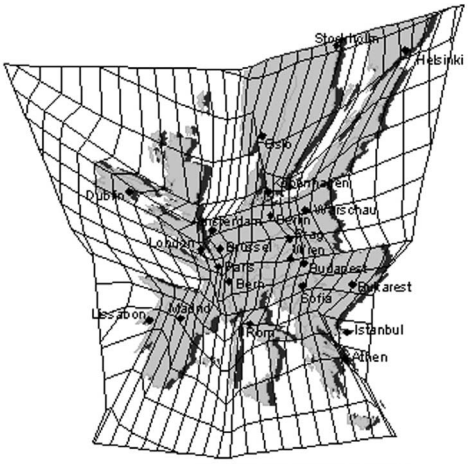
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IR. J. VAN SCHAICK

DEVELOPING A COMPLEX OF TIME DEFINITIONS IN THE CONTEXT OF URBANISM: TOWARDS REPRESENTING TIME IN RELATION TO SPACE

Ph.D. research: Space meets time – Integrating time-space use in urban design and planning
Chair: Spatial Planning
Promotor: Prof.dr. P. Drewe
Supervisor: Dr. I.T. Klaasen
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"I...insist...that we recognise the multiplicity of the objective qualities which space and time can express, and the role of human practices in their construction" - David Harvey, The Condition of Postmodernity. p.203

1. INTRODUCING DAILY DYNAMICS IN THINKING ABOUT URBAN SYSTEMS

There is no single concept of time. In spoken languages we use the word *time* – or its equivalent(s) – for different phenomena, such as moments, distances, rhythms and of course in relation to clocks and the natural cycles of the sun, moon and earth. With regard to the use of the concept of time in relation to space, a number of different concepts of time together can be distinguished as constituting urban processes. "A process is said to exist in the case of a prolonged, regular action or succession of actions that take place or are carried out in a certain manner" (Klaasen 2005). A vast variety of processes is strongly intertwined within the system one understands as a city. The contemporary dynamics of urban systems are such that they undermine the image of the city as a spatial entity or unity and such that new types of urbanisation have developed in recent decades[1]. Cities should be

1. For more on contemporary urban dynamics see Schaick (2007)

understood and dealt with by urban designers as a social *and* physical spatial system. "The *urban* is both a concentrated complex and a process of diverse relational webs." (Amin & Graham 1997)

This means that having an eye for *daily* dynamics – common in geographical or sociological analysis – becomes important for the urban designer and planner. The urban and regional design or plan itself should incorporate the *time* factor directly and thus focus on the processes of and within the city. (Drewe 2004; Klaasen 2004; Klaasen, 2005) A number of questions arise from this standpoint. *How does one incorporate temporal aspects directly in urbanism? What urban problems need to be addressed in particular?* And: *how does one achieve a consistent approach towards time in urbanism?* Since these questions address a range of topics that are too broad for this paper, the question tackled here is how to deal with the diversity of time conceptions in representations of the urban system within the context of urbanism. To do this, the first part of the paper develops a number of simple definitions or concepts of time in relation to possible representations. Next, more complex concepts of time are examined by distinguishing between pattern-oriented representations and process-oriented representations, followed by an exploration of possible complexes of time concepts. The last part of the paper focuses on the consequences for the field of urbanism, in terms of both urban problems and a research agenda.

2. BASIC REPRESENTATIONS OF TIME

Representations of time are closely related to definitions of and associations with regard to the concept of *time*, which are in fact a representation of time in words – verbal, conceptual models (see de Jong & van der Voordt, Part D, 2002). Visual representations of time often discard the dynamics of processes by *freezing* time in a two-dimensional drawing (see also Klaasen 2005), although options are limited in representing time directly in another way, in particular in a meaningful way for urbanism. Still, there are possibilities for representing time in different ways in both two-dimensional drawings and with other means[2]. However, without defining time, the problem remains of what process or processes to visualise. To set the scene, this section explores definitions of time used commonly in relation to their representation.

Experience of time is governed by a number of time mechanisms. Parkes and Thrift (1980) distinguish three main mechanisms: universe time, life times and social times. Measurement of time in years, months and days finds its origin in universe time through the observation of the cycles of the sun, moon and earth. From these cycles, clock time has developed,

2 For an explorative study on visualisations of time in relation to space see Schaick (2006)

which has replaced universe time as the main reference for the temporal grains of daily life since the industrial era. In this clock-based view of time everything happens *in a time* as it happens *in a space*.

The human body governs life times according to biorhythm (e.g. causing jetlag), the limited life span of a human being and man's sense of time (psychological time) which is time as one experiences it. Life times thus give limited *packages* of time which people use as a reference for understanding and experiencing time. Moreover, life times structure these packages in a scale system according to the structures of human knowledge. Similar structures are related to social times. Social times are governed by interaction between individuals, groups and society through systems of measuring, scheduling and allocating time, and by the way societies deal with the relation between past, present, and future[3]. (Parkes & Thrift 1980: 36-105)

Since neither universe time, life-times and social times can be represented directly in a relevant or applicable way for urbanism, to represent time we have to think of time in a complex of concepts of *time* through a number of more simple definitions and associations to the world around. A major problem with time in the context of urbanism is its invisibility (Klaasen 2005) - or rather indirect visibility - in real life. Two general views on time *can* be distinguished. One defines time as linear, the other as cyclic. (Parkes, Thrift & Carlstein 1978; compare Klaasen 2004) These two views are not mutually exclusive. Two possible relations can be simply represented, one depending on a shift in scale regarding the temporal grain of an observed phenomenon (figure 1-A), the other depending on repetitive, accumulative principles as cyclical-linear phenomena (figure 1-B).

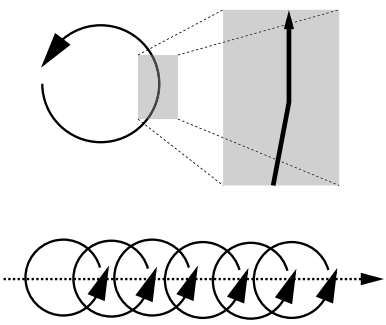

Figure 1
Relations between cyclical and linear temporal phenomena, based on the principle that in cyclical processes with a linear component the grain of perception determines the perception of a process as linear or cyclical:

A. Shifting down in scale from a cyclical to a linear perception. Source: Schaick (2004).

B. Shifting up in scale from a cyclical to a linear perception. Source: Klaasen (2004). Compare B with the realisation of place (Parkes, Thrift & Carlstein 1978) and the principles of structuration over time and space (visualised in Rose & Scheepers 2001).

3 For further reading on social times most literature (e.g. Parkes & Thrift 1980; Harvey 1990) refer to Gurvitch' work The Spectrum of Social Time (1964).

Before subsequent sections go into more complex definitions of time and a complex of time definitions with relevance for urbanism, the following paragraphs elaborate on relatively simple definitions which are widely used *and* which can be represented in relatively simple representations: *moment*, *change*, *flow* and *amount*.

Seemingly the most simple definition of time is *moment*. Time as moment refers to either points or positions *in time* or to a *time marker* around which processes take place. "Now", "then", "at 8 o'clock", "when school starts", etc. are day-to-day expressions of *time as moment*. As such, *time as moment* plays an important role in defining what is *present*, *future* and *past* or in defining *beginnings*, *endings* and *pivotal points* in processes. In the context of urbanism and representations, one can view for example snapshots of urban situations (either in maps or other media such as photographs) as visual expressions of *time as moment*. A specific example is the historical map of an urban fabric. Time as moment can be spatially represented either by representing it in the form of its spatial equivalent – a *dot* as the visualisation of a point – or by *freezing* time in two or three spatial dimensions in a spatial model or indirectly a point *in-between* by representing only the difference between situations.

For the definition of time as *change* – i.e. the process of construction, as well as of manifestation, of realisation, etc. – one must compare it to *duration*, the absence of change (Jong 1992). Change can either be continuous, non-continuous or final, limited (e.g. demolition, or a finalised transformation), depending on the nature of the process and the scale of the temporal grain regarded. Normal representation types would be sequences or series, in urban design, typically a series of maps, through which not only a historical perspective, but also possible futures can be explored.

For the definition of time as *flow* or movement, one will need to envision a directed path, a beginning and a (projected, possible) end. A respectable way to this is through graphs, vectors or lines. A representation of time however loses its specific quality when mapped. Specifically the experiential character of time seemingly defies a mapping that gives an overview in a glance of something that in reality is lived and thus can never be seen as a whole or an entity. Time and space coincide largely in this definition. Now is here and then is there, giving still good possibilities to represent time in a spatial manner.

To regard time as *amount* means conceptually to demarcate and fragment time. An amount can be a sample of time to study, for example, behaviour, such as to study the organisation of activities in a *day,* a *week,* a *year* or a *decade*. An amount can also be delimited by the start and end of a specific action or event. This method of demarcation is what can be called projects, actions with a specific goal. The amount of time in those cases is deter-

mined not by quantitative criteria, but by qualitative ones (e.g. how far have I gone towards reaching my goal? How did I start to realise my goal?). Another distinction for time as amount can be made with regard to the relative character of a temporal amount (e.g. this event takes *less time*, or is experienced to last *longer than the other*). This relativity, dependent on experiential criteria, is an important aspect of the human perception of temporal amounts. Last, time as amount refers to a temporal measurement of distance. Travel times are often used both in daily life and transportation sciences to indicate distances instead of a spatial distance.

These four *times* are all present simultaneously in the urban system, but the knowledge regarding these *times* remains fragmented in different sciences, different types of representations and different scales of observation. The next step in understanding time in a relevant manner to spatial plans is to combine these singular definitions into complex representations, combining time and space. In urban studies, this can be done through pattern-oriented approaches[4] or process-oriented approaches (Klaasen 2004). The first focuses on the composition of either time or space, limiting itself considerably as to the understanding of the dynamics of the urban system. The latter incorporates both time and space as equal notions, offering new possibilities to incorporate the complex notion of *time* in urban and regional design and planning. These new possibilities are explored below, first analysing pattern-oriented representational concepts, and second elaborating on process-oriented representational concepts using two examples: the *time-space cube* and *time-space cartograms*.

3. COMPLEX REPRESENTATIONS OF TIME IN RELATION TO SPACE

3.1. Pattern-oriented representations

Composition of time: interaction of rhythms of everyday life and the analogy of music

An important aspect of time is the fact that it is 'lived directly', which is elusive in terms of representation, scale and the relation of time to spaces and places. Observing everyday life in cities one can think of a complex, "polyrhythmic" piece of music (Lefebvre 2004). The analogy of the urban system and music reminds one of the differences between representations on paper and direct experience. Repetition, both in music and in cities, is an important cyclical-linear characteristic of rhythm. It is mediated by a *metric* constraint and can have two effects. On the one hand it can bore us, irritating, frustrating and tiring us in

4. Although the distinction between pattern-oriented and process-oriented approaches is developed with regard to urban design (Klaasen 2004), the distinction is used here in a wider sense with regard to urban studies in general. Pattern-oriented approaches regarding time thus come into the picture in addition to a spatial, pattern-oriented approach.

the process. On the other hand, it can give one a feeling of security and well-being through predictability, which can lead to the "structuration of space" (see Giddens 1984) and/or the "realisation of place" (Parkes, Thrift & Carlstein, 1978, Vol I: 21). The complex, harmonic interaction of multiple rhythms is what makes a piece of music interesting, as it does with the city. However, a musical analogy does not fully grasp the spatiality of a city, misses out on the valuable, simultaneous co-existence of *disharmonic* realities, and on the openness of the urban system, because of the clear temporal and spatial demarcations in which a musical piece exists.

Composition of space: a fixation on transformation in urban design

The transformation of the urban ground plan has been promoted as the "core of urbanism" (translated from *kern van de stedebouw*, Heeling, Meyer & Westrik 2002). This approach can be regarded as a "pattern-oriented" approach, focussing "on final processes with a relatively large temporal grain" (Klaasen 2004: 80). This approach favours space over time, revealing two attitudes towards time. On the one hand it limits itself to the definition of *time as change* (see above). On the other hand it has the tendency to *record* or *freeze* this change through symbolic spatial expressions in the design of the urban fabric. Its static legend constitutes configurations of the city through functionally distinct categories, such as housing, work and facilities. In focussing on the *becoming* of the city, it neglects the *being* in and of the city. Just as with a temporal pattern-oriented approach, a spatial pattern-oriented approach misses out on the complex problem of co-existing urban processes, especially processes with a small time grain (see also Klaasen 2005) and on the openness of the urban system.

3.2. Process-oriented representations

Time-space cubes

The time-space cube (figure 2) has been a vital instrument to relate time and space directly in urban studies, and specifically geography, during the last decades. The principles of time-space behaviour are studied in time-space cubes through the allocation in time and space of human activities, social interactions and movement. The concept is strongly related to the concept of the *time-space budget*, bringing together the definition of time as *movement* and time as *amount* (see above). The time-space cube can be regarded as the legacy of Torsten Hägerstrand (1970). The importance of the concept is confirmed by Parkes and Thrift (Parkes et al 1978, Parkes et al 1980), Anthony Giddens (Giddens 1984) and David Harvey (Harvey 1990), although criticised as well by the same authors. The development of the time-space cube as an instrument in Geographic Information Systems (GIS) in view of new visualisation and analytical possibilities, due to the development of specialised computer software (see e.g. Kwan 2003, Kraak 2003, Ferschin 2002), gives the concept a new lease on life.

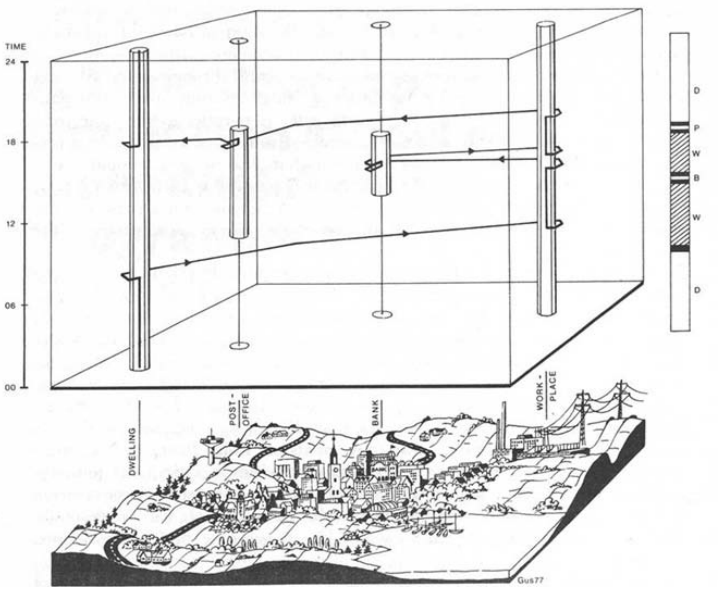

Figure 2
The time-space cube: "Example of an individual's path in a time-space coordination system. The three dimensions of geographical space have been collapsed into two in order to make room for a time axis. The movements of the individual in space and time are depicted in a continuous and invisible path. In the example, the individual starts from home and visits his work place, a bank, his work place, and, finally, a post office, before returning home." Source: Parkes, Thrift & Carlstein (1978) Vol. 2: 64; image by B.Lenntorp.

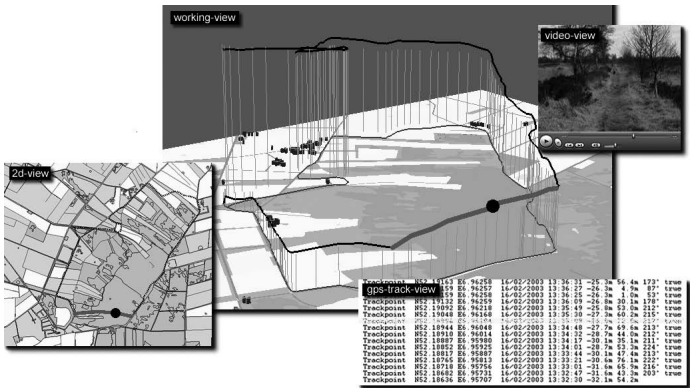

Figure 3
New possibilities regarding the time-space cube as GIS-instrument: "A run in the Aamsveen, Enschede displayed in the Space-Time-Cube viewing environment. Next the 2D view and the cube's working view a video view and a GPStrack view are linked. Both the video view (the visible frame) and GPS track history (the highlighted coordinate) show the location of the runner at the black dot's in both map views". Source: Kraak (2003).

A space-time cube combines a sample of space with a specific space-time-path, most often that of an individual. It is "a useful descriptor of how the daily life of individuals unfolds in space and time" (Harvey 1990: 211). Although a crucial starting point for understanding the relations between space and time, the concept has its limitations. First of all, the time-space cube is limited with regard to scale, addressing one spatial scale and one temporal scale at a time. At the moment no means exist to integrate different temporal and spatial scales in a single cube environment, although computer technology can overcome parts of this problem (see Kraak 2003, figure 3, see Kwan (2000) for an interesting attempt to overcome this problem).

Another problem is the focus on one time-space path for one time-space cube. To provide clarity in terms of visualisation, the instrument is inadequately equipped to deal with complex interactions of multiple time-space paths, as the complexity of the urban system would command. Furthermore, the *space* within the time-space cube is generally regarded as a static, sampled given, while in urban and regional design and planning one is also interested in the dynamics of this space and its relations with other spaces and places. Lastly, it is mostly an analytical - descriptive - tool, based on and delivering representations of empirical data. With an eye on wider application possibilities, one should think of developing the possibilities of this concept with more regard to design and planning. David Harvey might point in the right direction, stating that in the time-space cube concept the following issues are not addressed sufficiently: the production of place(s), variations in the "friction of distance", the dominance of specific "social projects" (e.g. the factory system), the dominance of certain "social relations", and the way "meaning gets assigned to places, spaces, history and time". (Harvey 1990: 211-212)

Time-space cartograms

Another visualisation tool that incorporates a large degree of complexity in representations of time is the cartogram. A cartogram is a distortion of a geographic map using data. Cartograms and series of cartograms that use travel time distances as the data source for distortion can incorporate multiple concepts of time in one map and relate it to space. Three dimensional distortions are possible (see Mathis 2003 & 2007 for an example), but most cartograms limit themselves to two-dimensions. The principle of map distortions of travel times go back to the mid 19th century (e.g. the work of the French engineer Emile Cheysson) and are based on the same principles as isochronic maps, dating back to the same period (e.g. in the work of the explorer Francis Galton). Series of cartograms are particularly interesting. These can show the changes over time in travel time distances and in accessibility profiles of an area as an effect of interventions in infrastructure systems. As such, it simultaneously shows two concepts of time in direct relation to space (see figure 4).

However, cartograms based on travel times suffer from a number of problems, much the same as isochronic maps. With regard to the latter, Janelle (1996) states: "[...] such maps [...] suffer significant limitations. (a) They document the situation for only one of an infinite number of locations within urban regions; (b) it cannot be assumed that travel time from the central point of an isochrone map will equal movement in the reverse direction, to the central point; (c) an exceptionally large number of isochrone maps would be required to depict even the most general changes in the travel environment of a city." Some of these problems can be tackled by using grid distortions (see figure 4) or the distortion of the graphs by which an infrastructure network can be depicted. However, additional problems arise in the context of urbanism. For example, this type of map is usually based on the travel times

within one transportation system, such as the car or public transport, while mobility in cities is multimodal. Another problem is that this type of visualisation is hardly applicable on lower, urban scale levels, let alone simultaneously applicable to multiple related scale levels, which is most relevant in the context of urbanism.

3.3. From complex representations to complexes of representation

In light of the range of problems regarding complex representations of time-space, it seems necessary to look for representational concepts that address the complexity of time in relation to space in urban systems to grasp time in the context of urbanism. Although complex representations of time in relation to space are very good at showing specific urban problems or elements of urban systems, they fail to grasp the coherence between multiple urban processes. They integrate time and space and multiple concepts of time in one representation. However, the legibility of images reduces significantly with an increase in complexity of interrelated times and spaces.

Therefore, the next step to take in representing time in relation to space in the context of urbanism is to think about the coherence and interrelation of different urban processes. Rather than complex representations, the following section examines complexes of representation. This suggests that solutions for representing time in relation to space can be found not only in maps, but also on the level of conceptual models of urban systems.

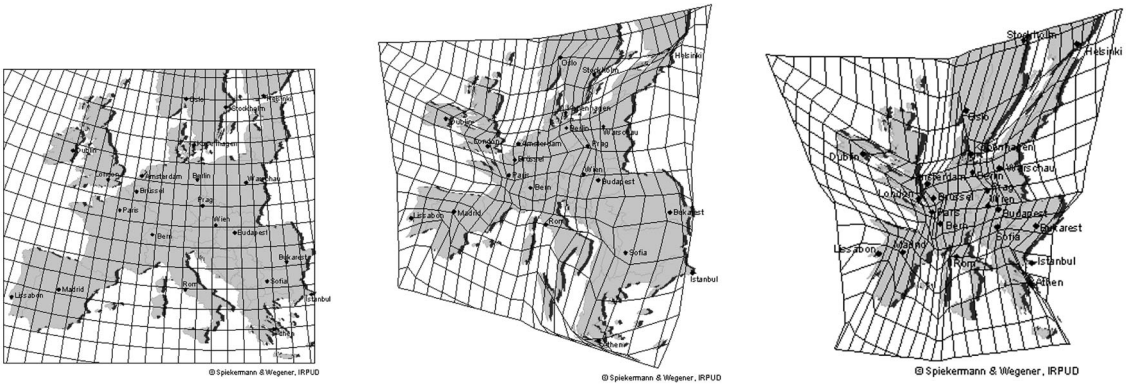

Figure 4. The distortion of Europe from geographical space (1st map) to travel times over the High Speed Rail Network showing the time-space convergence in the period from 1993 (2nd map) and in 2020 (3rd map). Source: Spiekermann and Wegener (1994).

4. COMPLEXES OF TIME REPRESENTATIONS

4.1. Networks and graphs: multilevel modelling

Dupuy (1991) provides a framework for thinking about a complex of several urban networks in the context of urban planning. It is based on a combination of network theory with historical research on the interaction between technical system development and urban development. It distinguishes between the logics of spatial processes in physical networks, in functional networks and in individual networks (see figure 5, Dupuy 1991). Previous work (Schaick 2006a) shows that this framework theoretically incorporates different concepts of time because networks can be regarded to be inherently dynamic. The basis for complexes of time in a network approach are the three criteria for networks, developed by Dupuy (1991): the topological criterion, the kinetic criterion and the adaptive criterion (see also Dupuy 2000). As such, the concept network offers a good starting point for looking at complexes of time representations, in particular from the perspective of spatial structures.

Graphs and Networks (Mathis 2003, 2007) is one applied example that uses the *network* concept in such a way that it represents a complex of processes rather than a complex representation of a process. This model tends to draw primarily on transportation science, but does address and incorporate wider issues regarding integrally social and physical aspects of the urban system. This approach brings together different models into one framework. It uses traditional transportation models to simulate multimodal connexions between cities or polycentric cities. Simultaneously individual behaviour is simulated with a multi agent system, while a cellular model connects these different levels:

I The first level: connection between cities
II The second level: connection inside the town
III The third level: simulation of human behaviour
IV The fourth level: cellular model

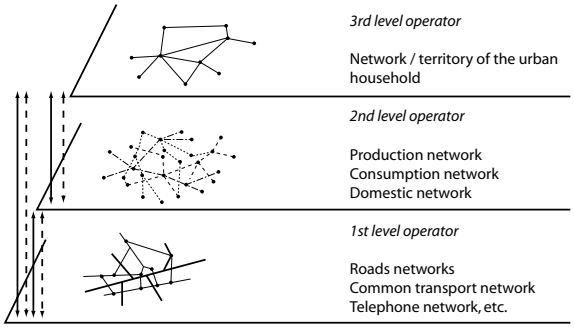

Figure 5
The three levels of operators of networks who (re)organize urban space and time. Source: Dupuy 1991: 119

Through this complex model, the representation of a dynamic urban system combines the concept of graphs and the concept of networks. The networks are multimodal, multi-scale and multi-time (Mathis 2003). An important difference with the time-space cube concept is that the graphs-and-network-model goes beyond description and is deliberately developed to operate on the urban system. Still, this model deals primarily with physical networks of transportation. Although the graphs-and-network-model claims to simulate human behaviour, it cannot be substantiated from the literature that it accounts sufficiently for the logics of all different types of networks.

4.2. Chronotopes

In contrast to network-based complexes of representations, the concept of the *chronotope* offers a primarily time-based perspective. A *chronotope* is a physical time configuration consisting of (according to a combination of the definitions by Bonfiglioli 2004 and Guez 2002):

- a place (or physical space), urbanised and transformed through history
- a place inhabited by residential or temporary populations with characteristic, cyclical time-architectures or structures
- a mixed and layered presence of populations distributed over specific amounts of time (such as 24hrs, week, season), determined by complex logics of time-structures, reflected in time-tables, calendars and presence cycles
- a place attracting populations to execute specific activities within the hours when the facilities and other conditions for these activities are available
- enclosing mobility-phenotypes (i.e. the combination of mobility style and mobility environment) of people and goods, e.g. the promenade, the transit, the traverse, the pause
- a place embedded into new multi-scalar nets of mobility of people, goods and information

In relation to this concept, a chronographic system of visualisation tools has been developed, of which the following prototypes exist (state of affairs as indicated by SURE[5]):

1) Chronographic Maps System developed at the *Politecnico di Milano* for Chronotope Maps, On/Off Maps, Calendar Maps and Attractor Maps
2) Time Diagnostic Maps developed at the *Maison du Temps et de la Mobilité* at Belfort
3) Chronographic GIS-instrumentation being developed at the *Politecnico di Milano*.
4) Mobilis in Mobile chronographic model of asystematic mobility being developed at the *Bologna University*.

Ferschin (2002) seems to have adopted a comparable approach in the Chronopolis project. His project used a data-oriented approach, combining three main time-space dimensions: time geography for a one day period, time-slices of locations and urban parameters for a

5 www.sure-project.com [accessed 26 April 2006]

one-year period (thematic parameters (e.g. homelessness), area-parameters (e.g. wind, light & shadow), line-parameters (traffic, etc.), and point-parameters (e.g. cinemas).

Combining urban temporo-spatial configurations and use dynamics on more than one scale, simultaneously and from different viewpoints, the chronotopic approach is based on a holistic attitude towards the urban system. Further research will be needed to explore the opportunities offered by this approach, although the internal coherence of these chronotopic models seems to be an inherently weak point.

4.3. Social production of time: social-geographic structure

The last example of the exploration of complexes of time representations is the conceptual model of social-geographical structure by Parkes and Thrift (1980). Time in the context of spatial structure can be understood through the complete set of temporal components of functional social-geographic structure:

- Circadian rhythms (biological and psychological time)
- Time scale (e.g. hour, day, year, life; see below for elaboration on scale)
- Duration (compare Jong 1992)
- Sequence (compare with time as change, section 2 above)
- Time surplus or deficit (compare with the time-space budget, section 3.2 above)
- Elasticity of time (relating different activities within a time or a space, pressured e.g. by obligatory activities)
- Time perspectives / images (mediated by individual experience and culture, creating particular life spaces) (Parkes & Thrift 1980: 65)
- Monochronic or polychronic times (referring to the degree of synchronisation of rhythms). (Parkes & Thrift 1980: 361, see figure 6).

This extensive list gives a comprehensive overview of time concepts relevant to a complex of representations of time. In contrast to the chronotopic approach, **figure 6** shows the internal coherence of a social-geographical approach through the interweaving of *space, time, place* and *location* in social-geographic structure, bringing together formal structures and functional structures. “Physical space, social space, and time together act in concert as structural factors in the ecology of the city” (Parkes & Thrift 1980: 359). Time in this view should be regarded as a relative and relational concept as a product of social interactions. This opens up interesting possibilities with regard to a new view on urban and regional design and planning, including both the dynamics of and the dynamics within the urban system. The problems of this conceptual model arise when looking at the gap between the conceptual model and its application in urbanism. The problematic application is effected by the complexity of the model itself and the absence of an operational approach to urban systems, such as developed in network-based complexes of representation.

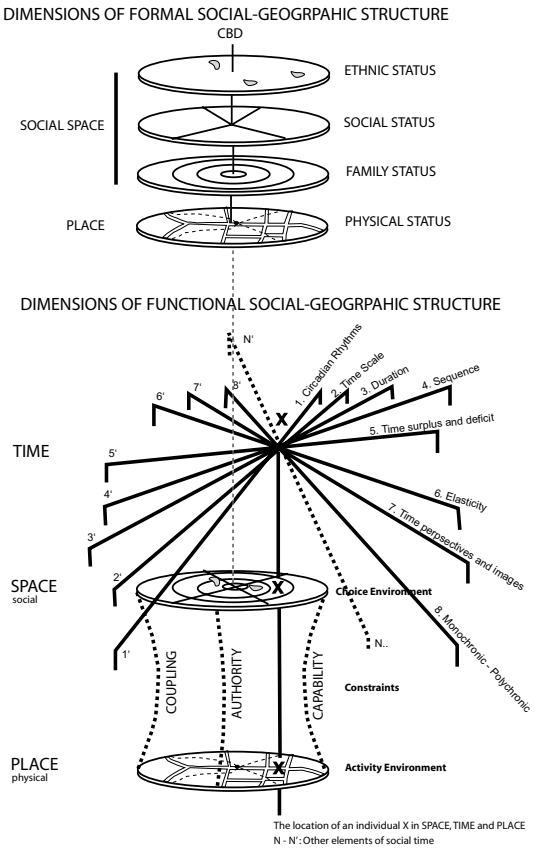

Figure 6 "Social space, physical space and time in the ecology of the city". Source: Parkes & Thrift 1980: 361

5. TOWARDS A GRASP OF TIME IN URBANISM

The problems raised by all conceptual complexes of time require a search for new ways to represent time with relevance to urban designs and plans. The relevance of different types of representation will depend on the audience to which it is aimed – e.g. professionals, politicians or inhabitants of a city – and the goal it is developed for – e.g. temptation, discussion, realisation. Representation types to be developed further, with this in mind, can be found in:

- new temporo-spatial models that combine multi scalar, multi systemic and multi level approaches with concrete, virtual and/or conceptual representations of time
- new types of representational symbols (legends)

- new methods of mapping traces of time
- new conceptual frameworks to place different time representations in relation to one other.

A major problem encountered in virtually all explored models of the urban system, is the way in which the models deal with the multiplicity of temporal and spatial scales relevant to urban and regional design and planning. This means that it is important to develop scale-concepts parallel with time-concepts. Another crucial theme to develop is the multiplicity of perspectives on time and space, either in terms of the range of possible *individual worlds* of different groups or different people within urban systems (see e.g. Sociaal en Cultureel Planbureau 2003), or the *multiplicity of time-space configurations* of physical urban systems (see e.g. Harvey 1990; Boelens 2000; Graham & Marvin 2001).

What does this mean for the urban design itself? New approaches for process-oriented urban design and planning can be found on two levels. On the one hand we can look at the application of time-knowledge in urban designs and plans *as they are*. On the other hand we can look for new ways to approach the issue of time altogether in *other ways* of planning. Both deliver a process-oriented type of urban design and plan for which we can list the following characteristics:

- They use a process-oriented language and/or legends
- They use dynamic representations and/or representations of dynamics
- They relate and time space of the city
- They relate different time-space realities of the city
- They are possibly interactive.

6. CONCLUDING REMARKS

This paper started as an exploration of the *concept of time*, trying to extract relevant starting points to develop time-oriented approaches for urban designs and plans. A number of problems need to be tackled to do this. First, there is a lack in coherent definitions of time for urban systems that do justice to the complex nature of the concept. Second, the conceptual frameworks from other scientific domains than urbanism lack the ability to represent a conceptual complex of time in a meaningful way for urbanism. Meanwhile, the conceptual frameworks used in urbanism are for the large part not sufficient to grasp a conceptual complex of time. Third, the visual language of maps as used in urbanism does not use symbols and legends in a way that time can be incorporated. This visual language can for some part be borrowed from other disciplines.

This problem description leads to the following possible goals to develop in future research:

(1) a new legend for urban and regional designs and plans, (2) dynamic representations that do justice to problems of temporal-spatial scale, and (3) internally coherent complexes of representations doing justice to co-existing multiple perspectives and/or time-space realities. Each of these options delivers specific problems to the task ahead. The exploration of complexes of representations in previous sections suggests a focus on a primarily network-oriented approach, incorporating elements from chronotopic approaches and social-geographic approaches.

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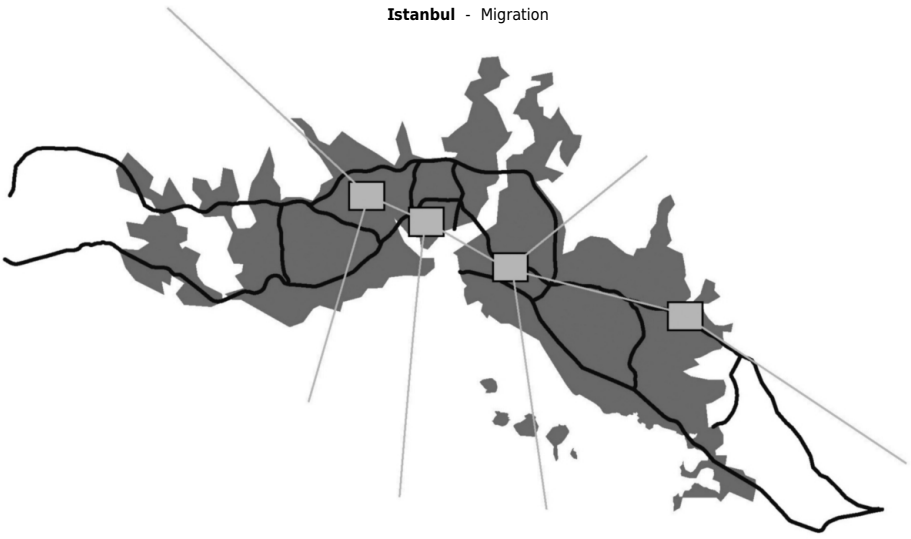
Amsterdam - Immigration

Istanbul - Migration



IR. C. SEZER

CAN PUBLIC VISIBILITY BE AN OPERATIONAL CONCEPT TO INVESTIGATE INTEGRATION PROCESSES OF MIGRANT GROUPS?

THE INVESTIGATION INTO PUBLIC VISIBILITY OF THE ANATOLIA-TURKEY ORIGIN IMMIGRANT GROUP IN AMSTERDAM AND ISTANBUL

Ph.D. research: A Framework for Mapping the Ecologies of Urban Groups:
Analysis of the public visibility of Anatolian origin immigrants in Amsterdam and Istanbul
Chair: Urban Renewal and Management
Promotor: Prof.dipl.-ing. H.J. Rosemann
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ABSTRACT

This paper describes ongoing PhD research named 'Analysis of public visibility of Anatolian Immigrants in Istanbul and Amsterdam'. The objective of the research is to investigate the way the public space in the city makes different social groups present and 'visible' to one another. What we mean by public visibility is public space configurations which allow different levels of encounters between inhabitants of a neighbourhood (Anatolian immigrants in our case) and outsiders, who represent the public of the city on a larger scale. Our focus will, in particular, be on the ways that urban immigrants of Anatolian-Turkish origin become variably present and 'visible' in a public space, in Amsterdam and Istanbul.

Keywords: urban public space, public visibility, urban ecology, configurational approach.

1. INTRODUCTION

Recently, immigrants have been highly debated in formal and informal platforms in West European countries. These debates have mostly concerned the negative aspects of immigrant related issues, such as illegal immigration, urban poverty, urban criminality, social / spatial segregation, extremist religious tendencies and so on (Tisdall; 2005, Philips; 2005).

The main problem emerging in these debates is the presupposition of a fixed immigrant identity that can be defined through ethnicity, race, and religion. This approach reinforces the 'us versus them' distinction, and prioritises some groups while excluding others. This results in unease resulting from the presence of strangers and promotes assimilative approaches against immigrant groups (Mouffe; 2002).

However, urban space accommodates many different social groups, and many commentators believe that a well functioning public space involves the co-presence of social differences (by being present and 'visible' to one another), and allows one to express and learn to accept diverse life-styles and choices, and deviate from an ostensible 'norm' (Sennet; 1970). This approach embraces heterogeneity as a positive feature of the 'public', and argues against the 'assimilation' of 'differences' (Young; 1990, 173, Mouffe; 2002, 15). This is, according to some, a necessity condition for a modern metropolitan 'body politic', in a globalising and mobile world, where, rather than focusing on fixing or assimilating identities, we see how *new* identities and alliances may begin to be formed in complex overlapping configurations which cross traditional lines of ethnicity, class, gender etc. (Urry; 2000, 49-77). But first, as Sennett argues, in a public of differences, we need to learn an 'adult' acceptance of others through the way they present themselves in urban public space and confront us with visibly different urban lives. (Sennett; 1970, 1976, 1990, Young; 1990)

In this context, our study shows a way of ordering public space as an interface of daily involvements with different scales of movement networks (Hillier & Hanson; 1984, Read; 2004). The forms of public space, which is urban ecology itself (but different to what The Chicago School proposes), might be understood from the configurational concept of urban space that deals with relations between patterns of street networks (Hillier, Hanson 1984). Accordingly, the idea of visibility is a factor of *topological depth* that conceives different degrees of visible 'publicness' in urban space and an urban 'structure of visibility'. Given that, we would suggest that visibility structure is topological and based on this concept we can 'operationalise' Sennett's public space visibility idea.

The first part of the paper reviews the role of the public space in a city of social differences. This argument will be constructed through the work of Sennett and Young which argues for

social justice and qualities of democratic public space in the city. The second part is a configurational understanding of urban space which stems from the work of Hillier and Hanson (1984) who propose an operational approach to investigate relations between social and spatial processes. Later, we describe a research process that aims to investigate the everyday use of streets, markets, parks or specific gathering places (such as mosques, tea houses) by Anatolian immigrants, and the public space configurations by which these activities become 'visible' to a broader urban public of the city in Istanbul and Amsterdam. This paper ends with a conclusion in which we will make suggestions for further steps to the research.

2. THE ROLE OF A WELL FUNCTIONING PUBLIC SPACE IN A CITY OF SOCIAL DIFFERENCES

The city accommodates different urban groups. Immigrant groups are seen as differentiated, distinguished by differences in their music, food, way of living, clothing, language and daily practices. However, 'being different' has placed them in a disadvantaged position (in terms of living conditions) which they might overcome by assimilating the customs of the host country. In some West European countries, for example in the Netherlands, this approach became part of government policy, aiming to 'integrate' some immigrant groups (the policy only applies to non-Western immigrants) to the customs of Dutch society[1] by assimilating them. We want to address this sort of approach towards differences in the urban population, particularly immigrants, as being problematic for the vitality of urban life, and we aim to understand the role of the public space in generating tolerances between urban groups in a heterogeneous urban population.

According to Young (2000;172), who argues conditions for representation of different urban groups in democratic public space, different social groups are not constituted through objective attributes such as ethnic, racial, religious or gender differences, but *sharing assumptions*, *active bounding* and *networking* that recognisably differentiates one group from another. Furthermore she claims that group identity, is a flowing process and it shifts with changes in social processes. Therefore, all group differences cut across one another, and different groups have similarities in some aspects and potentially share the same networks. An Anatolian immigrant in Amsterdam, for example, may be rich, homeless or old, or a worker in a factory or an academician in a university and all these differences produce different identifications and locate him/her in different urban groups. Therefore, his/her identity doesn't require satisfying some general criteria (such as originating from Anatolian Turkey) but his/her subjective affirmation of affinity with a particular urban group. This relational understanding of group difference rejects exclusion.

1 http://www.justitie.nl

Young further argues that the identification of one group by another creates borders between different groups and favours some groups, while disadvantaging others. This condition triggers an *oppressive* meaning of group difference she claims, which locates / marks some groups, as a categorical opposition, 'the Other'. Moreover, this approach generates fear of contact between urban groups and results in inequality in the urban population in terms of access to some opportunities to improve life conditions.

Many scholars argue that to overcome exclusive aspects among urban groups, there is a need for the recognition of differences by experiencing visibly different urban lives. The city gives opportunities for the recognition of differences (Sennet; 1976, 48- 63, Zukin; 1995,19-27, Ibid., 236-241). In material forms of public spaces, such as streets, parks, we encounter with 'strangers' from different social and physical networks, different urban groups. As Sennet claims, through such relations, people might have the experience of living with the diverse groups, who are still 'strangers' in a way, but not in the sense of 'the other'. Visual contact with people from different social groups does not necessarily lead to 'order' or 'violence', but to some 'mutual patterns of compatibility' (1970, 146-157).

In a well functioning public space, different urban groups are not included and excluded, but overlap and intermingle without becoming homogenous. Streets with a variety of activities where people walking, talking, shopping, sitting, standing, going to or from work will attract all the differences of age, taste, background and belief that are concentrated in a city and give rise to diversity. This is the essence of vital urban public life and democratic public space.

Taking these approaches as a basis, we will first analyse the distribution of public visibility in the city, and secondly, the accommodation of Anatolian immigrants in this visibility struc-

Image 1. From left to right, Amsterdam Central Station, a street in De Pijp - Amsterdam, a square in Amsterdam West-Geuzenveld. Source: Author.

ture in Amsterdam and Istanbul. Indicators of their presence (the visible signs) that we are going to work with are immigrant owned shops, markets, some specific gathering places, and daily practices through individual case studies. But first, we aim to investigate the distribution of public visibility in the city (the structures of public space) which offers different levels of encounters between urban groups (from high visibility: public-ness to low visibility: private-ness). In other words, we aim to analyse the spatial mechanisms of what makes the central station of Amsterdam more visible than a street in De Pijp – Amsterdam, or a square in the Geuzenveld - West Amsterdam. We aim to make this investigation through an ecological approach which seeks ways to investigate the relations between humans and their active connection with the environment.

3. FORMS OF URBAN PUBLIC SPACE FROM AN ECOLOGICAL APPROACH

The ecological approach calls for relational thinking between social and spatial means by seeking ways to investigate humans and their active engagement with the environment**.** This synthesis started from a conception that human beings and the environment are not separate but complementary parts (Ingold; 2000, 173-188)**.**

We will present two different approaches of ecological thinking in urban studies: The Chicago School Urban Model and Space Syntax Urban Model. Both models investigate the city through patterns of movement. However, while the Chicago school's urban model describes the city as a flat surface, divided through territorial zones, the Space Syntax model developed by the Space Syntax Laboratory at University College London investigates the city as vertical layers of movement scales.

The Chicago School of Sociology in the 1920s was the leading figure of ecological thinking in Western urban studies. They studied the movement of the city population; changes in physical structures, social and spatial segregation / integration and the setting-up of distinctive urban groups through the investigation of the city as an 'urban ecology' (Mellor; 1977, 204-210). They defined urban ecology as zones of different land uses and community settlements**.** Accordingly, the city is territorially organized on a horizontal plane, a bounded environment. *Natural areas,* perhaps the most distinctive feature of the city, are recognisable clusterings of neighbourhoods, distinguishable not only by their appearance, but also by the composition of their population. Each natural area is a product of control over a locality by an urban group and public space is a competition for space between different urban groups, which entails the co-presence of heterogeneous lifestyles, each founded in a bounded territory. (Ibid, 212-213).

The Chicago School's approach was very innovative in many aspects: they introduced ecological thinking into urban studies; they aimed to understand relations between social and spatial processes in the city by analysing movement in the city. However, the territorially bound concept of urban space limits the understanding of the dynamics of contemporary cities which are generated by increased movement and accessibility and developments in communication technologies.

One of the important contemporary contributors to ecological thinking in urban studies is Hillier and Hanson's work 'The Social Logic of Space' (1984). In this study, they defined the city through a configurational approach which deals with relations between different scales of street networks. In this perspective they propose an operational tool / spatial model of the city (Space Syntax Urban Model) built on research in the Space Syntax Laboratory at University College London[2]. Accordingly, urban space is a space of 'vertical ecologies' constructed through everyday flows of different urban populations between movements of different scales (Hillier; 1998, Read 2005). In this model, the idea of public visibility is a factor of topological distance from one network to another. Examples are the formation of the 'place of presence', which is ecology itself, but clearly different to the Chicago School's one because of the way the dynamism of the city breaks down any bordering structure. (see Fig1)

In our investigation, we will use Hillier's and Hanson's approach because of its operationality and high falsifiability. The spatial configuration of vertical ecologies shapes / forms the urban space for the conditions of public-ness (high visibility) and / private-ness (low visibility). For example Central Station is more present and visible than a street in De Pijp Amsterdam, and De Pijp is more present and visible to the general public than Geuzenveld-Amsterdam (See Image 2). In other words, it is the structure of the city which is capable of articulating the difference in the public visibility of Central Station from De Pijp and De Pijp from the Geuzenveld.

4. RESEARCH PROCESS: INVESTIGATION OF DISTRIBUTION OF PUBLIC VISIBILITY

The essence of the research process is to investigate the way the public space itself in the city makes different social groups present and 'visible' to one other. This analysis will provide an understanding of the relations between different spatial configurations of the city and the conditions of various levels of visibilities (public-ness/ private-ness) for a particular urban group. By making the public visibility issue mappable / analysable / visible we aim to

2 www.spacesyntax.org;

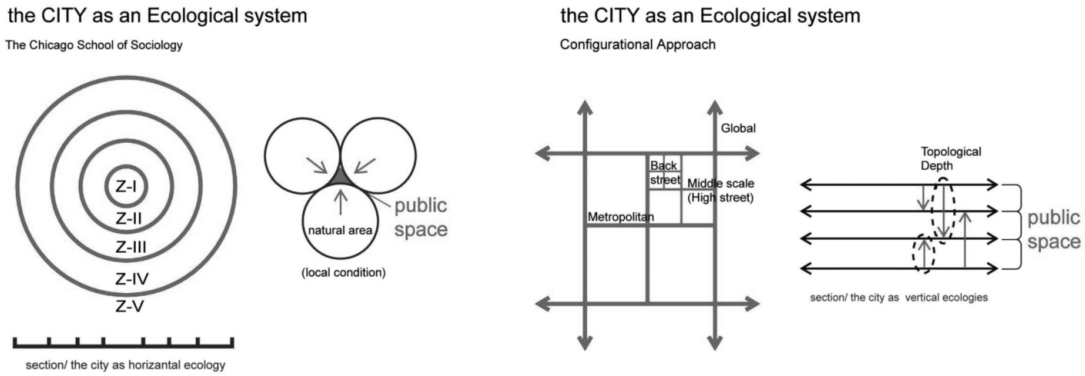


Figure 2. Two models of the city as an ecological system:
(1) The Chicago School of Ecology, (2) Configurational approach from Hillier and Hanson.

make recommendations to urban planners, designers, policy makers to improve conditions in the urban public space.

Our focus particularly will be on the ways that urban immigrants of Anatolian-Turkish origin become variably present and 'visible' in a public space, in Amsterdam and Istanbul. We will then investigate the everyday use of streets, markets, parks or specific gathering places (such as mosques, tea houses) by Anatolian immigrants, and the public space configurations by which these activities become 'visible' to a broader urban public. The research process will be carried out in two steps: the first is an investigation of the public visibility of Anatolian immigrants in a residential neighbourhood and the second is the investigation of public visibility of the case group in non-neighbourhood fields of relationships. The following steps are formulated:

1. Selection of case studies;
2. Analysis of structure of public visibility of Anatolian immigrants on a neighbourhood scale;
3. Analysis of structure of public visibility of Anatolian immigrants on non-neighbourhood scales of relations;
4. Discussion of findings;
5. Expected results.

4.1. Selection of case studies: Anatolian immigrants in Istanbul and Amsterdam

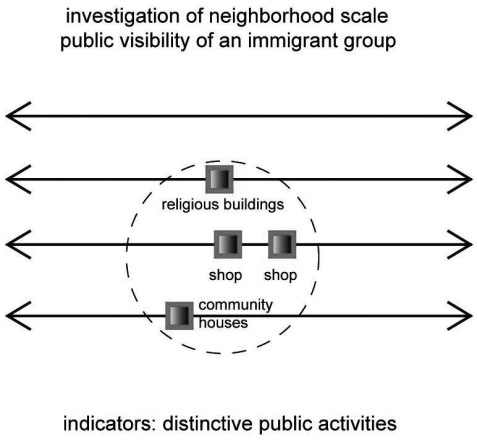
The proposed cities are Amsterdam in the Netherlands, and Istanbul in Turkey. The selection is based on being representative within the characteristic of urban lifestyles. Both of the cit-

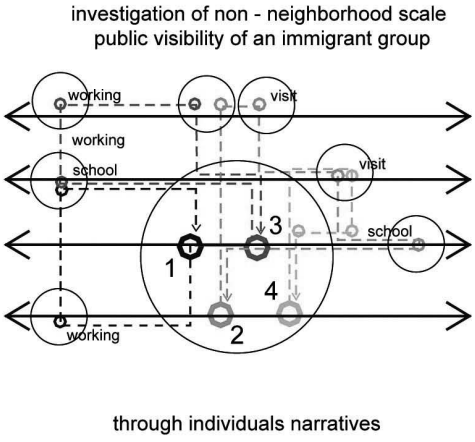
ies have an immigrant population from Anatolian Turkey, mostly with a rural background. In the Amsterdam case, Anatolian immigrants came to the city in the beginning of the 1960s as part of a recruitment agreement between the Netherlands and Turkey (Vermeulen, Penninx [eds]; 2000). In the Istanbul case, mass immigration from Anatolia started in the 1960s as a consequence of industrial developments in the city. (Keyder [ed]; 2000, 10)

Within these cities we propose to investigate two neighbourhoods per city with a high Anatolian immigrant population. Selection is based on the location of the area in relation to the whole city (Inner city / periphery /semi periphery). Each empirical case will be represented through geographical maps, a spatial configurational analysis and mapping functions and facilities such as types of economic activities: what types of consumers they attract (immigrant shops, workshops and their consumers from local, middle, city scale/ types of social activities / what types of participants they are operated by (distinctive gathering places: tea houses, mosques, community house).

4.2. Analysis of structure of public visibility of Anatolian immigrants on a neighbourhood scale

In this step, we will investigate the distribution of public visibility in the chosen neighbourhood through spatial analysis. This analysis consist of (1) registering street flows – counting pedestrians, (2) registering scales of pedestrians (interview through random selection: where are they coming from: the neighbourhood, the city, a regional or global scale?) (3) registering the use of the street through a static snapshot analysis. This empirical study will be repeated in each case study. Based on outcomes of field work, we will produce maps





which illustrate different public space configurations. This locational analysis will be projected into the city scale to understand the distribution of public visibility in the city.

The following step will be to locate places in which Anatolian immigrants are visible to the public in chosen neighbourhoods. As indicators for public visibility, we will map where Turkish shops, community houses, mosques are in the configurational analysis of the public visibility structure.

4.3. Analysis of public visibility of Anatolian immigrants in non-neighbourhood scales of relations

In this step, we will analyse the daily involvement of Anatolian immigrants in the public visibility structure of non-neighbourhood scales of relations. We will investigate the public visibility structure of places in which Anatolian immigrants are visible to the public in their work, studies and social activities. This step will be based on individual interviews with the inhabitants of Anatolian origin in the case neighbourhood. Interviews will be carried out with 60 individuals (15 families per case study). Interviews aim to obtain information to produce a database about the daily movements of the inhabitants.

4.4. Discussion

In the Discussion part, we will examine relations between (1) various spatial configurations of public space; (2) different levels of public visibility (from private-ness to the public-ness) (3) of the position of the Anatolian immigrants in this public visibility structure. Descriptions will be in an urban atlas, including the assembly of previous results, maps, analysis and the identification of parameters of Anatolian immigrants in this structure.

4.5. Expected Results

The final products of this research are diagrammatic recommendations which explain spatial configurations of public space and provide levels of visibility from public-ness to private-ness. These recommendations can assist urban planners, designers who aim to improve the conditions in the public space by generating spatial conditions that might offer encounters / co-presence to different social groups.

CONCLUDING REMARKS

In this paper, we presented a theoretical and methodological outline of ongoing PhD research which aims to investigate parameters of public visibility in different urban contexts, by investigating the presence of an immigrant group through their daily activities. To summarise we discuss: (1) The notion of social differences and approaches towards immigrant groups as 'excluded others' (2) The role of the public space as a space for co-existing and

generating tolerance between urban groups (3) The approach to understanding the form of public space as an urban ecology, and a configurational approach as an operative tool for our research (4) The research methodology that we propose to investigate the public visibility of Anatolian immigrants, in Istanbul and Amsterdam.

The discussions in this paper are still preliminary and further elaboration is clearly needed. We have tried to elaborate on growing assimilative approaches towards immigrants which are strengthened by identifying the immigrant as the 'excluded other'. This situation has placed them in a disadvantaged position in terms of developing their life conditions, and triggers unease regarding the presence of immigrants. As Sennett argues, the co-presence of different urban groups generates tolerance towards differences and public space and has a role in these encounters. We want to test how different public space configurations generate daily encounters between visibly different urban lives and how an urban group, such as Anatolian immigrants, fit into this visibility structure. Through this approach, we will be able to produce spatial recommendations to improve conditions in urban public space where visibly different urban lives can freely be represented.

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IR. Q. SHENG

CHANGING CENTRALITIES UNDER AN URBAN CONFIGURATIONAL "SCALE-STRUCTURE"

Ph.D. research: Changing centralities under urban configurational 'scale-structure': investigating the spatial conditions for emerging shopping areas in Beijing
Chair: Urban renewal and management
Promotor: Prof.dipl.-ing. H.J. Rosemann
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ABSTRACT

This PhD thesis - *"Changing Centralities under an Urban Configurational 'scale-structure' – Pondering the spatial conditions for emerging shopping areas in Beijing"* - is a work of urban morphological research. Focusing on the rapid economic, social, and spatial changes that have taken place in recent decades, and using configuration analysis as a research method, this thesis aims to establish how changes in movement patterns affect the location of shops, particularly in relation to food shops and markets in Beijing.

1. CRISIS OF THE 'LOCAL'

The current rapid development of some large Asian cities has had two important consequences: on the one hand, the globalising economy as the driving force of urban development has greatly changed the mobility patterns and life styles of urban inhabitants, with rapidly growing cities attracting village migrants who are lured by the dual promises of modern living and higher incomes. On the other hand, inner-city redevelopment has been stimulated in many neighbourhoods. Development in Beijing, for instance, is not only changing the physical form of its traditional architecture, but it is also affecting the quality, and perhaps the vitality, of everyday life, damaging the delicate socio-economic relationships

of street life in particular. This problem is reflected in the diminishing number of local shops, and the lack of functional diversity in public spaces within neighbourhoods. It brings with it not only a reduction in convenience for its inhabitants, but it also removes both an important finer-grained link in the 'urban economical ecology' and the niches normally occupied by small shop-keepers and traders, which are factors that can be important in the livelihoods of immigrants, and in alleviating poverty. However, this 'crisis of the local' should not necessarily be regarded as a failure by architects and developers to include such local facilities in their projects. These local (and in many cases, informal) economies are tied to an emergent logic of land use that arises out of complex conditions, which are - to some extent - outside the localised control of designers and planners. Many scholars in China have criticised the destructive role played by some 'revitalisation' or 'redevelopment' projects, which have actually destroyed the identity (cultural) and functional specificity (economic) of certain areas. Some of these criticisms focus on street profiles or architectural design, addressing the problem on an architectural scale. However, in other places where building projects have been completed, the power of regeneration has been significant even when buildings or street level constructions have not been completed on a human scale (Fig. 1 & Fig. 2). Obviously, there is still a lack of understanding about the power of a city to regenerate itself, which is at least to some extent an effect dependent on the positioning of movement networks and urban spaces. It is therefore necessary to explore the spatial conditions of these 'spontaneous' developments, and to understand how different levels of movement networks in urban spaces (Hillier, 1996) can affect or stimulate commercial activities.

Figure 1

(Left) Wangfujing High Street in Beijing. Following redevelopment in 1993, the new architectural style and street scale destroyed the original atmosphere. However, it is still an economically successful project.

(Right) Longfusi High Street used to be a high street at city level, but it began to decline following renovation in 1994. However, this has not prevented it from functioning as an early morning (7:00-9:00) local food market.

The changing centralities and functional patterns of Beijing, as well as of other rapidly developing cities in Asia, offer wonderful opportunities for research as such a rapidity of change stimulates similarly rapid conditional changes across many different locations. The superimposition of modern and traditional lifestyles means that the demand for both new and old types of centrality remains high.

2. AIMS

This research started in 2005 with the recording of the locations of shops of all scales. Maps from the last 50 years were also collected to illustrate the changing configuration of available space in Beijing. The research then focused on specific cases in more detail. Based on these data and employing configurational space analysis techniques[1], the research explores the spatial conditions that allow shops to emerge, focusing in particular on how they locate themselves in relation to different scales of movement.[2] The results of this research could be used in the future: 1. as suggestions and spatial principles for planners and designers in revitalising or redeveloping projects to offer conditions which stimulate emerging spatial micro-economies; 2. to further understand the issue of economic vitality ('live centrality'[3]), based on certain configurations of urban space and associated public-space effects; 3, to explore the factors and logic that determine the relationship that exists between transportation and land use.

3. RESEARCH QUESTIONS AND METHOD

Based on the above-mentioned problem, the main research question is:

- How does the configuration of urban space affect the emergence of the 'live centrality' that is associated with shops and functional diversity in public spaces in Beijing?

A subsidiary research question is:

- What is the effect of multiple scalar conditions - a layering of movement networks on different scales - on urban environments, and can this effect contribute to economic vitality?[4]

1. Including space syntax analysis developed by Bill Hillier and Julienne Hanson (Hillier, B. & Hanson, J., 1984), based on the 'topological' connection of streets, and the development of these ideas at TU Delft. (Read, S. 2005, Bruyns, G. and Read, S., 2005, Mulders-Kusumo, C. and Read, S. 2003).
2 Configurational analysis has proved to be effective in describing how 'scale-free' network effects are structured into movement infrastructures to produce a 'scale-structure' (Hillier, B., 1993, Hillier, B., 1996).
3 Hillier (1999), 'Live centrality' means the element of centrality which is led by retail, markets, catering and entertainment, and other activities which benefit from movement.
4 This question relates to suggestions from previous research, both in Hillier's group and in Delft, which indicate a strong

To answer these questions, the empirical research was divided into two parts: 1. research on large-scale shopping activities (metropolitan scale clustering) over a time-span of 50 years, with the aim of identifying the logic behind the positioning of shops and their relationship with movement networks in terms of stability and change; 2. detailed research on food shopping activities through the interviewing of different players (customers, vendors, suppliers), and by mapping the results in order to identify how space can act as one of the major factors in inter-connected complex networks, and providing an explanation of the pattern that is revealed. In summary, this research attempts to examine how a configuration pattern can define the way in which urban space is used, and to demonstrate trends in development. Since research is still ongoing, the preliminary conclusions based on the available data therefore remain highly hypothetical.

4. CHANGING CENTRALITIES: HOW CAN SPACE MAKE A DIFFERENCE?

As outlined in earlier papers (Sheng, 2005), Beijing's spatial structure, particularly in inner-city Beijing, can be understood as being a serial layering of different scaled streets sorted by compass-point orientations (north-south or east-west, see Fig. 1). There are two 'combinatory rules', based on traditional housing typology, which contribute to this spatial order. Firstly, courtyard houses tend to have entrances facing north, forming ordered structures. Secondly, bigger 'tree-like' spatial structures are inserted into this arrangement, breaking up the uniformity in a chaotic manner. One extreme example is the Forbidden City in the middle of Beijing, which was a major barrier to the latitudinal development of the city. Later development solved this problem by superimposing an extra large-scale over the existing framework.

The most important outcome of the analysis of the urban structure is the effect on history itself. In the old urban structure, because large-scale streets were topologically better integrated than smaller streets, most traditional high streets were longitudinally oriented. Relatively independently of specific movement technology (travel by foot, bike, car, etc.), there is a general tendency for individuals who are on the move to bypass the large-scale network, and to focus their movements more intensely in the medium and small scale networks. This tendency, despite the effects of other inducements, is called 'natural movement' by the Space Syntax group (Hillier, 1996). Therefore, urban space itself becomes a sorting device for natural movement, meaning that there should be a correlation between movement intensity and the integration value of space. A space, through its physical/metrical dimensions and the transportation patterns that it supports, actually changes its

influence of 'scalar layering' on 'live centrality'. Read (2006) working paper and Urban Life (forthcoming), Bruyns (current PhD work), Kusumo-Mulders (current PhD work).

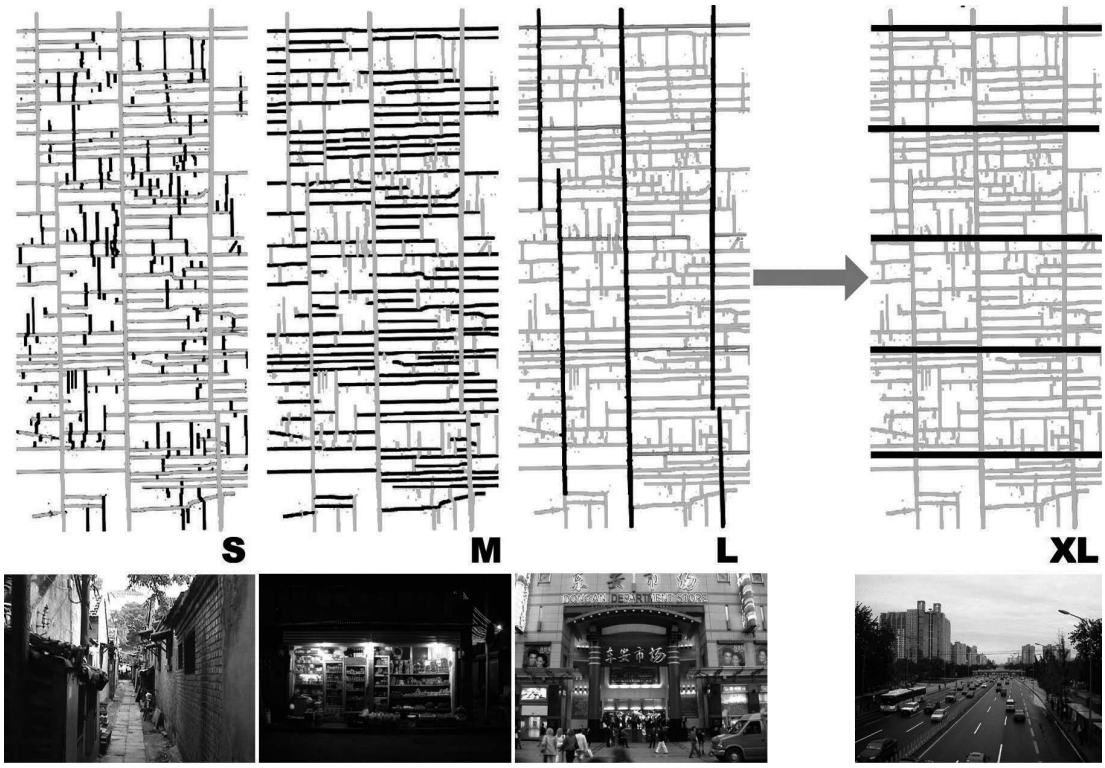

Figure 2. the spatial structure of Beijing's inner-city on different scales.

own initial configuration. Higher-level movement networks, such as highways or regional roads, are usually constructed so that they are either directly linked into, or superimposed on to, existing busy streets. They also form large-scale interconnected network structures of their own. It is easy to understand that higher scale networks (called 'super grids' in Spacelab) attract high scale urban functions, such as offices, banks, large hotels, malls, etc. (see lower part of Fig. 1); while lower scale networks (local grids) tend to attract low scale urban functions, such as grocery shops, food markets, etc. (see lower part of Fig. 1), as part of a 'self-sorting mechanism'. To illustrate this pattern, research was completed from two observation points. Firstly, from a global level (Fig. 2), by mapping out all metropolitan scale shopping clustering (in black), and all city-scale clustering (in dark grey), making it possible to observe that most clustering is located not only near to exits or junctions, but also (which is more interesting and relates to the issue of stability which will be addressed later on) to where two or more scales of movement meet one another. Secondly, on a local level, by mapping out all 'local' scale functions where food markets and local shopping streets are located, making it possible to observe that in most cases these tend to be located in well-

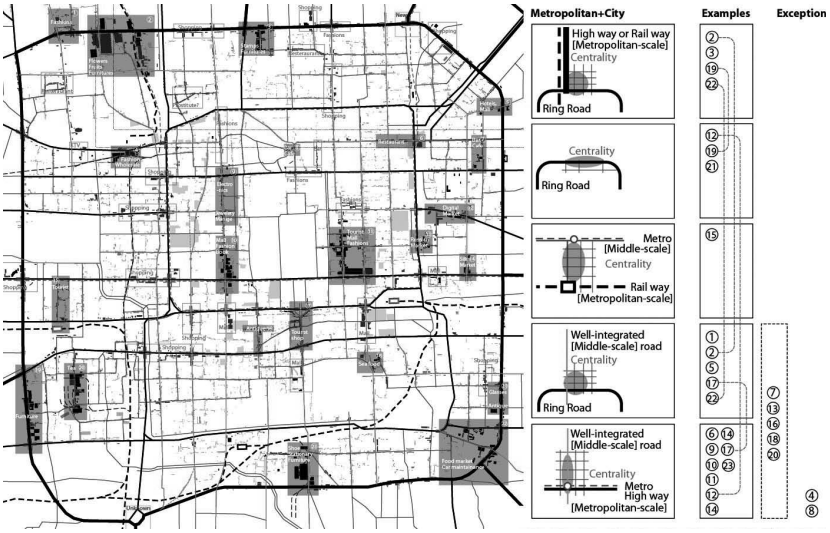

Figure 3
Beijing's high scale shopping clustering (metropolitan scale in black, city-scale in dark grey) with movement networks (regional network in black, city network in grey, and the well-integrated city-scale network in orange)

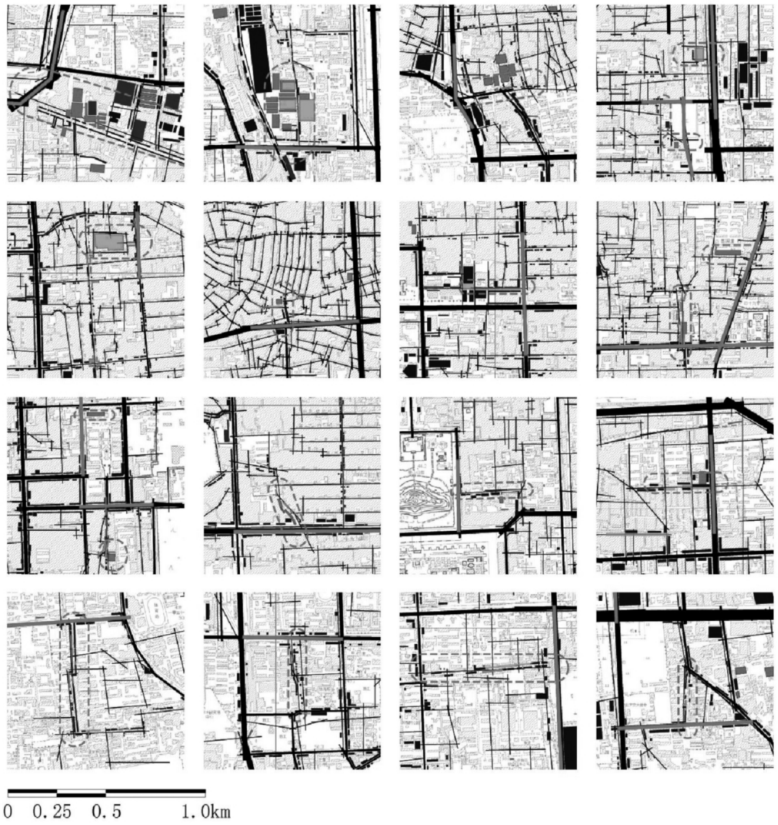

Figure 4
Beijing's local scale shopping clustering (the orange dash indicates where local functions are situated, and the solid orange line identifies the area where the majority of customers come from)

integrated spaces that have easy access to high scale networks, normally no more then one topological step from the highway. (See Fig. 3)

Based on the empirical study discussed so far, especially in relation to the second part of the research about local scale functions, there are still some issues to be addressed: 1. food markets were initially chosen as indicators of local scale functions, but in being location dependant they are far from homogeneous; 2. not all local scale functions are located one step away from city-scale networks, meaning that there are some interesting exceptions. The second issue will be addressed first of all.

One of the most interesting cases is the Dashilan area, where local centralities are located in the middle of a super block that is topologically deep (two steps) in relation to city-scale movement (Fig. 4). However, in this case, the local centralities are located on a street that

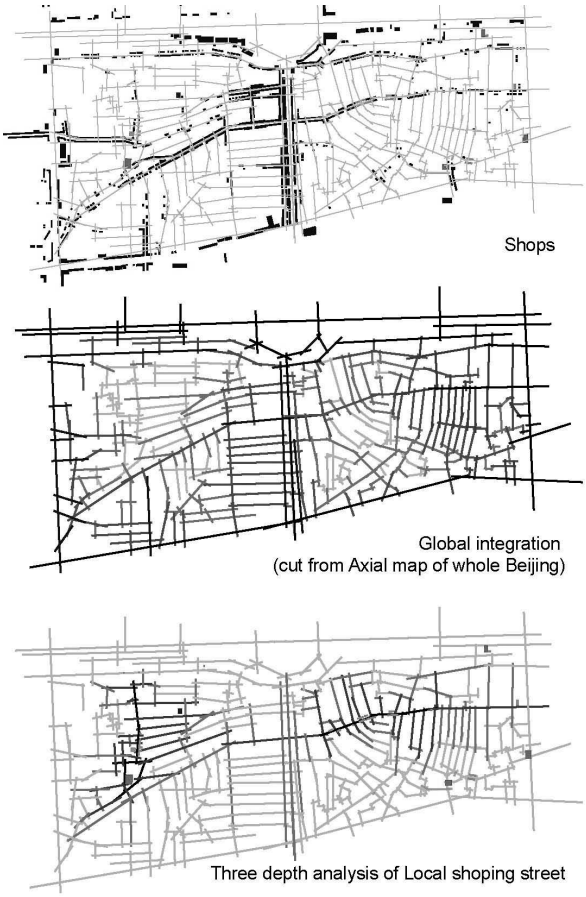

Figure 5
Dashilan area in 2005. (Red and orange indicates food shops, blue indicates other types of shop.)

is integrated into the local neighbourhood itself, especially because the best location, Lylichang Street, is already occupied by tourist shops, and so the local shops cannot find better positions than their current locations. This leads to some important points. Firstly, most shops are in a 'conflict' between being visible by more people and being closer to potential customers. The word 'conflict' was especially used to describe those local shops that are located deep within the structure, because Beijing's deep and complex local structure makes such 'conflict' more apparent, especially in comparison with European cities which are topologically shallow. Secondly, the location of these shops dictates what they can sell, or what scale of business they can operate. This point will be clarified by dealing with the first issue.

Unsurprisingly, depending on their location, food markets are not equal to each other. Some, such as wholesale centres, supply other markets located near the ring road with goods, forming part of the regional network incorporating Dazhongsi, Xinfadi, Dayanglu, etc. Furthermore, it is important to point out that in addition to these significant and self-evident cases, there are more subtle differences which provide an insight into the logic of location. This was the original intention of interviewing customers and vendors for the detailed research.

So far, data from six inner-city food markets have been collected, and the following two cases will be used in comparison to show how space affects how they are used: Case A is a small market near to the second ring in terms of metrical distance, not topologically speaking. Case B is a bigger market, deep inside a block which is itself deep inside the inner-city. It has an initial advantage in that it is built on a large brownfield site (originally used for coal storage), and is therefore bigger and better in terms of space and amenities than case A. However, whilst case A has a slightly larger number of customers and a bigger service

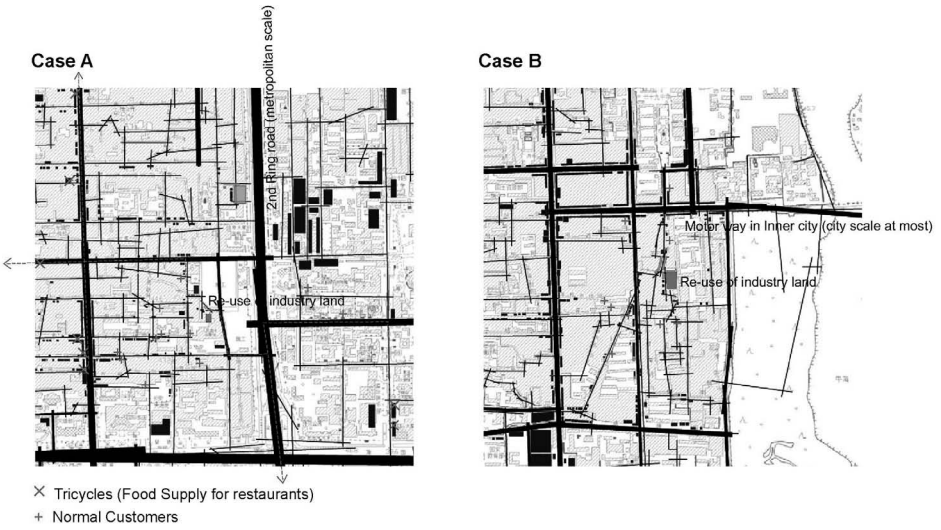

Figure 6
A comparison between customers in two food markets in Beijing.

range than is normal, it also functions as a supply centre for other restaurants nearby. All day, numerous tricycles visit the market to buy goods, making its second level service range substantially larger than case B. Just by looking at these small cases, we can immediately see how 'local places' are shaped by the networks that they are located in.

5. STABILISATION AND DE-STABILISATION: HOW DOES THE LAYERING OF DIFFERENT SCALES OF NETWORK MOVEMENT AFFECT THE IDENTITY OF A PLACE?

These days, it is very difficult to talk about stability - rather than changes -, since we live in a rapidly changing environment. However, this research is looking at 'stability' as a process, rather than as a result. To be more precise, the research seeks to identify how the function and use of city spaces can be stabilised or de-stabilised by changes in movement networks. Two cases will be used to address the issue of stability.

The first case, Dazhongsi area, a wholesale centre serving many small food markets and shops in Beijing, was previously an industrial area. Recently, other functions, such as big malls selling furniture and interior furnishing materials, began to emerge by re-using the industrial buildings. Last year, a train station was opened on the north side of the site, with the aim of promoting further development in the immediate area, and acting as a catalyst for additional city-scale development. Apart from embracing the explanation of land use morphology, network based development is also emphasised. After all, as a former industrial area, the site was already well connected to the city's transport network via the old train system (exactly where the new train line is today) and the regional roads (located

Figure 7
Dazhongsi area

on the third ring road). Therefore, the development of the Dazhongsi area serves as a good example of the continuous consolidation process of city-scale centrality based on the construction of high scale networks. However, despite the whole area being regarded as a city-scale centre upgrade, other layers of use have not disappeared from the process. It is still being used as a normal food market by local inhabitants. Also, deep inside the block, you can still find relatively local services, such as a bathhouse and barber shops (prostitutes also work in the area).

Another case is Longfusi High Street, which was mentioned earlier. Its decline has to be understood in a broader context. It is not a coincidence that the 1993 renovation of Wangfujing High Street was so successful, and that Longfusi High Street started its decline around the same time. In any sense, Wangfujing High Street occupies a far more strategic location with a combination of multiple layers of networks: thanks to the metro system Wangfujing High Street is just one topological step from Chang'an Street; the *extra large* highway cuts though its centre; and Wangfujing High Street itself is a main integrator on the axial map. Based on all these factors, Longfusi High Street's niche as a city-scale centre had already been eliminated by the reconfiguration of the networks. However, this does not prevent Longfusi High Street from functioning as a good local centre. As mentioned earlier, it is used in the early mornings as a food market for local inhabitants.

Figure 8
Longfusi High Street

7. PRELIMINARY CONCLUSIONS, LIMITATIONS AND FURTHER STEPS

Based on data collected so far and the empirical studies, it is possible to see how the functions of an urban space act as a sorting device for the activities that happen in it. 'Sorting' is not only a simple matter of putting the right scale of activities into the corresponding

movement scale network, but also about the fact that things are more likely to emerge in a place where there is an interface for multiple scales of movements to meet. Far from being inert, space can play an active and definitive role in the emergence of shopping areas. It seems it is 'where it happens' that defines 'what it is', rather than the other way around.

Secondly, stabilisation and de-stabilisation processes should be understood through the way that movement networks are constructed, and the space-time structure correspondingly needs to be re-configured. Places that are well integrated in a multiple scale of movement networks can show high resilience to external factors - such as in the Longfusi High Street case - since such places have numerous opportunities to adapt to prevailing conditions.

However, there are still some limitations and further steps that require additional study. First, historical factors affecting the evolutionary process of the movement network in the last 50 years, and the effect that different transportation modes have on the classification of different levels of networks needs to be addressed. Second, the change of centralities over time needs to be researched. Data for high scale shopping are partly accessible, but local scale data are impossible to obtain. Third, citywide food market case studies reveal 'subtle differences' depending on the configuration of the networks. Fourth, detailed analysis of supply patterns and other non-movement related factors is needed in order to explore the limitations of, or provide explanations for, how and why some customer based movement networks maintain certain initiatives.

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IR. E.H. STOLK

SPATIAL QUALITY IN THE POLICY OF THE PROVINCE OF NORTH-HOLLAND: SOME RECOMMENDATIONS FOR BETTER IMPLEMENTATION WITH REGARD TO DESIGN REVIEW AND DESIGN PROCESS

Ph.D. research: Spatial quality in the policy of the province of North-Holland: recommendations for a better implementation with regard to design review and design process
Chair: Technical Ecology and Methodology
Promotor: Prof.dr.ir. T.M. de Jong
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ABSTRACT

This article gives an overview of ongoing research into improving the implementation of the 'spatial quality' concept in policy documents in the province of North-Holland, focusing in particular on visual quality plans, from a design-point of view. Spatial policy aims to have an impact on the human environment, through spatial design, with some sort of visual impact as one of the outcomes. Linking the (inter)related disciplines involved, like planning and design, would therefore seem to be a relevant undertaking. This article does *not* propose a holistic model for the concept of spatial quality, but outlines a possible strategy, offering some (conceptual) mechanisms and tools, which can support a better relation between policy and design. It begins with a short introduction on the situation at national level; the context of the provincial policy. In order to relate policy to design, a conceptual cognitive model of design/analysis is set out which can be used as a possible link between policy and design. Finally, a (computational) framework for measuring some performances that are often used in spatial quality frameworks is proposed, using 'isovist'-based visibility analysis (IBVA).

Keywords: Spatial quality, planning policy, province of North-Holland, visual quality plans, form-operation-performance (design process), affordances, measuring (quantifying) quality, space syntax, isovist-based visibility analysis.

SPATIAL QUALITY IN THE NETHERLANDS – NATIONAL LEVEL

Since the 1970s and 80s there has been an increasing interest in *quality* in a variety of sectors, ranging from management, healthcare, education, emancipation and living conditions[1]. There has been a shift from competing on pricing alone, towards more explicit quality driven competition (Reijndorp, Truijens et al. 1998). Ever since the 4th National planning act, 'spatial quality' has been part of national policy, it has been a controversial, but widely supported concept. It is often split into three values: future-value, usability-value and experiential value derived from the tripartite: firmitas (strong or durable), utilitas (useful), venustas (beautiful) (Vitruvius 1914). There is no consensus about its specific content, according to the Ministry of Housing, Spatial Planning and the Environment it is a very wide description. The uses of this concept vary from being a starting point for finding measurable indicators related to spatial quality towards merely being a communication device for streamlining planning processes. On a national level, increasing the spatial quality is largely seen as strengthening *diversity* and supporting *coherence*.

A lot of Dutch institutions have done research, which attempts to make this concept operational. A literature survey covering 60 publications on this subject shows some lacunae (Bulkens 2006). Although most of the reports start ambitiously, by using terms like 'measurable quality', only a few move past the formation of abstract frameworks of classifications of several sub-criteria (for example Hooimeijer, Kroon et al 2001). On the other side of the spectrum, we find GIS-based frameworks, mostly based on two-dimensional data (for example Hoogeveen and Vreke 2000). Here, the availability of GIS-data seems to be the 'leitmotiv' for constructing a theoretical framework. Although there are some serious attempts to incorporate experiential values into GIS-based frameworks (for example Roos-Klein Lankhorst, Vries et al. 2005), there is still a lack of detailed data-sets on the level of the lived-in human environment and relevant categorisations, making it difficult to use these frameworks as a useful interface between different stakeholders in the planning process. Other remarkable issues are the lack of reference images, context-insensitivity, incomprehensibility to non-experts, and the lack of design-thinking.

1. One could say that before there was a more implicit understanding of the concept of quality. In places where there are, for example, a few building types, few options in materials, few construction methods and a coherent society with shared values and interpretations of the "meaning" of building forms, there is less of a need for a formal policy on 'spatial quality'. Radford, A. D. (1994). Local Architectural Languge and Contextualism. Design review : challenging urban aesthetic control. B. C. Scheer and W. F. E. Preiser. New York, Chapman & Hall: 165-174.

THE PROVINCE OF NORTH-HOLLAND - VISUAL QUALITY PLANS

The current changing relations between national government and the provinces (because of the *nWRO*[2]) move parts of National responsibility concerning spatial quality to a lower, provincial level. At the same time, municipalities will have more freedom under the nWRO, not being bound to traditional provincial plans. The development vision for the northern part of North-Holland (Provincie Noord-Holland 2004) has already anticipated this shift by making it less strict and more directed towards development and freedom for the municipalities. Here, the province introduced the visual quality plans (*beeldkwaliteitsplan* in Dutch) as an instrument to safeguard spatial quality, especially focusing on the landscape to be transformed, with the intention of this complementing the work of the aesthetic committees of the municipalities, focusing more on built up areas. As a visual quality plan is obliged when setting up a zoning plan (*bestemmingsplan* in Dutch), the province has the possibility to reject the zoning plan when its relations with the visual quality plan are unsatisfactory.

In the context of the nWRO, the role of the province of North-Holland will change from a more evaluative task at the end to a more stimulating role at the beginning of planning processes. The province of North-Holland is setting up a new provincial structural vision (building upon the development vision mentioned above), which aims at incorporating a meaningful and useful concept for spatial quality in relation to this changing, more stimulating role. So the question of dealing with this concept is raised once again, even more apparently. Now, it must be closely related to the tasks of municipalities, which are faced with immediate problems to handle and decisions to be made. The province should be supportive and steering, not unnecessarily blocking developments because of slow decision making processes or a lack of clarity in relation to the interpretation of the policy itself, and possible overlaps with the criteria used by aesthetic committees at municipal level. This demands a re-evaluation of the current instruments, amongst others the visual quality plans, which are regarded as a crucial instrument in maintaining the visual/spatial quality. Until now its new legislative position is unclear.

In the last five years, the province of North-Holland has completed studies to overcome some of the above mentioned operational problems with the research on spatial quality at national level and its changing role in planning processes. This has resulted in a policy framework regarding the landscape and cultural heritage (Provincie Noord-Holland 2006). The province obliges the municipalities to underpin their intended developments at transforming the landscape to an urban area/extension based on several criteria, fitting within several context-sensitive constraints. Besides an overview on the relevant current policies

2. nWRO, new Spatial Planning Act (*nieuwe Wet op de Ruimtelijke Ordening* in Dutch), which will take effect in 2008.

on different scales, it describes the intended strategy for each type of landscape; ranging from preserving to strengthening and developing the area. In order to underpin these descriptions, some reference projects are studies that are carried out and which provide some clues on dealing with these descriptions (Provincie Noord-Holland 2003; Provincie Noord-Holland 2004).

Although municipalities are generally positive about the initiative to use these visual quality plans as a means of maintaining the visual/spatial quality (van Laar, Stolk et al. 2006), there are some serious issues. (1) The province needs to execute some sort of design-review on the visual quality plans; (2) designers should be able to use the guidelines and constraints in the creative design process; (3) the tendency to use the planning process merely as a consensus-seeking instrument, not focusing on the outcome quality (Carmona 2003); (4) the possible conflicts with other legitimate instruments which influence the visual characteristics of the built environment. The third and fourth issue have been elaborated on in a recent essay (Buijs, Stolk et al. 2007). The main focus will be on some aspects of the first two issues at hand.

DESIGN-REVIEW ON PROVINCIAL VISUAL QUALITY PLANS

Design review[3] on the visual quality plans should attempt to control/improve the visual character of the (built) environment. Hence, one of the problems of a visual quality plan is that it is somehow holistic, in a sense that the intention to control the visual quality encompasses many legislative, public/private, and territorial borders. It is therefore inevitable to link the visual quality plans with regulations that have an indirect impact on the outcome quality, like construction permits, the rules attached to development plans or environmental impact analyses. When reviewing a zoning plan, one can check legislations and rules and give an unambiguous judgement because of the well-defined nature of the problem at hand. By judging visual quality plans several other issues arise.
The provinces‘ design review is conducted by some experts, on the basis of the policy framework for landscape and cultural heritage. Their informed opinion and different backgrounds within the expert-panel give a judgement on an intended plan or development. In order to give their judgement they must use five criteria set out by the province:
1. Attention to the historic development

3. Design-review in general aims at a wide variety of goals: improving the quality of life; preserving and enhancing a unique place; maintaining or upgrading the ’vitality‘ of a place; improving/protecting property values; making change more acceptable; making new development compatible or unified; offering community input to development decisions; and improving the design. Scheer, B. C. (1994). Introduction: The Debate on Design Review. Design review: challenging urban aesthetic control. B. C. Scheer and W. F. E. Preiser. New York, Chapman & Hall.

2. Fitting with the ordering principles of the landscape
3. Fitting with the characteristics of the built environment
4. Fitting in the area in a wider context (of a larger landscape unity)
5. Attention to the existing qualities of the area; suggesting measures to counterbalance negative impacts.

I will leave questions of justice[4], power[5], freedom[6] (Scheer 1994), and legitimacy[7] aside, and focus on the representation of the criteria, like the ones mentioned above. The use of words like 'fitting with/in' and 'attention for' alone are rather ill-defined in the policy documents of the province of North-Holland. Although some effort is put into clarifying their meaning by using a few pictures and descriptions, their intention and boundaries remain vague. One could argue this is done on purpose; it focuses some attention on the specific subjects, making them a more central issue of concern. Problems arise with municipalities who do not have the competencies to produce good visual quality plans, and the instrument risks being misused by municipalities focusing on short-term political and/or economic profit. So, besides using the visual quality plan as a consensus seeking instrument, a thorough substantive approach should remain at its core; safeguarding the quality of the outcome quality and using clear and consistent arguments based on the intended visual impact of the plan.

Hence, the problem with design review comes down to the question of clarifying the relation between descriptions from policy documents (focused on language-like representations) and descriptions from designers (focused on image-like representations) to the minimum extent necessary. The lack of clarity in argumentation undermines the intentions of design review, and is partly responsible for the sentiments surrounding design-review, as is the arbitrariness that is felt. The question arises of how to describe criteria in a sense that invokes creativity and at the same time can assist designer in remaining within the intended boundaries of the policy.

SPATIAL POLICY GUIDELINES IN RELATION TO THE DESIGN PROCESS

In general, there is a well known lack of design theory or design principles in planning policy (Punter and Carmona 1997 p. 142), this also accounts for the province of North-Holland. This is not only due to the background of those writing policy but also due to the fact that there is no single, widely accepted concept of design to provide a framework for policy

4. Is design review arbitrary and vague? Is it possible to protest on aesthetic grounds?
5. To what extent can lay people overrule professionals? How is the public interest taken into account?
6. Is design review some sort of violation of the First Amendment to free speech?
7. Does it just reflect the current trends in design? Or do they really stimulate towards better designs?

development (Punter and Carmona 1997 p. 143). In order to be effective, the intended provincial spatial policy, focussing more on an inspirational role at the beginning of planning processes, should include a meaningful description on the design process, which it tries to influence.

Policy guidelines and constraints can affect a wide variety of design-professions, like architects, landscape architects and urban designers. In order to be effective, they must speak to these disciplines. Besides their domain knowledge, designers, in no matter what discipline, *design*. Design as an activity is difficult to define because of the omnipresence of design as a natural human activity (Braha and Maimon 1998, p. 19). Nevertheless we need some kind of model in order to deal with *design* in policy making.

"Although there is no single model that can furnish a perfect definition of the design process, models provide us with powerful tools to explain and understand the design process" (Braha and Maimon 1998).

ANALYSIS [F(M)-O-P] AND DESIGN/SYNTHESIS [P-O-F(M)

Such a model is proposed by Guney (2007), which is a clarified and refined version of the one proposed earlier by Tzonis (1992). It will be used because it is a clear and consistent conceptual cognitive model of the design/synthetic and analytic process. A more detailed description of the proposed model can be found in Guney (2007). I will limit the paper here to only some of the relevant insights of those studies.

Design begins with the recognition of needs, along with the realisation that some action must take place in order to bridge the gap between the existing situation and the desired outcome. First, a programme of requirements needs to be set up based on needs or dissatisfaction with a current situation. Within a program of requirements, we can broadly distinguish two categories: well-defined requirements and ill-defined ones. A design will generally consist of both of these types of requirements. In order to show that the design meets the objectives, the requirements need to be transformed into well-defined ones. To have a successful spatial policy, it is evident that all relevant stakeholders should be involved in the process of developing this programme of requirements. These design specifications may initially not be precise or complete, but may be developed and fine-tuned during the design process.

Second, design should be recognised as a creative, recursive and iterative thought process, in which the designer acts under conditions of bounded rationality because of the limitations on

the cognitive and information processing capability of the designers' decision making. Designers look for satisfying solutions, not for pure functional optimal ones. In this process, designers use analogies from precedents (in their widest sense) to create spatial compositions.

Third, the acknowledgement that relying solely on intuitive methods of trial and error is not as fruitful as using as much relevant knowledge as is available, including knowledge of the design process itself. Guney cites Hearn, stressing the importance of both theoretical and practical knowledge to overcome very complicated design problems: "... architectural theory is not narrowly prescriptive; its purpose is to establish the range of liberty, even when that freedom is subordinated to a regulatory system. Rather than constricting with narrow dictates, theory enables and inspires" (Hearn 2003).

Design can be seen as a translation/interpretation between descriptions; so the designer needs to 'translate' the programme of requirements to a composition that fits best with the design specifications. By using F(M)-O-P, relevant relations can be described explicitly, opening up ways to clarify and discuss design decisions. In order to do so, the representation of the designed artefact is crucial; Guney proposes frame-semantic networks[8], as they are powerful examples of well-definedness.

When we intend to analyse an object (a Dutch polder, building (ensemble), chair, etc.), some sort of morphological analysis[9] (F(M)) is needed in order to represent the object in a clear and consistent way. One can think of analysing spatial relations, organisations, topological representations of spaces, geometrical properties, etc; including analysis of the morphogenesis (how the form emerged/evolved over time). If we represent the analysed artefact well enough, we can start relating the form(morphology) of the object to how it can be used (how it works, its operation, O) and how well it performs (P) according to some norms (programme of requirements) all within a specific context.
In order to relate these three interrelated aspects of an artefact, the concept of 'affordance' introduced by the ecologist Gibson (1979) is used. An affordance of anything is the "specific combination of the properties of its substance and its surfaces taken with reference to an animal (*or human being*)" (Gibson 1979, p.67). An affordance tells us something about the possibilities an object offers us; like being sittable, like how the object invites us naturally. As Tzonis states: "Architecture formates places fit for a human action but also *explaining*

8. Frame semantic networks will be used because these powerful representations fit best with human cognition, i.e. the best way of representing knowledge. Well-definedness is of the greatest importance, frame semantic networks are powerful examples of well-definedness. A semantic network is a graph of the structure of meaning, where the nodes represent concepts and the links represent (meaningful) relations between these concepts. A frame is a data-structure for representing a concept or stereotyped situation. An example is shown in figure 1.
9. Morphology = science of morphemes. Morphemes are the smallest meaningful units of an object.

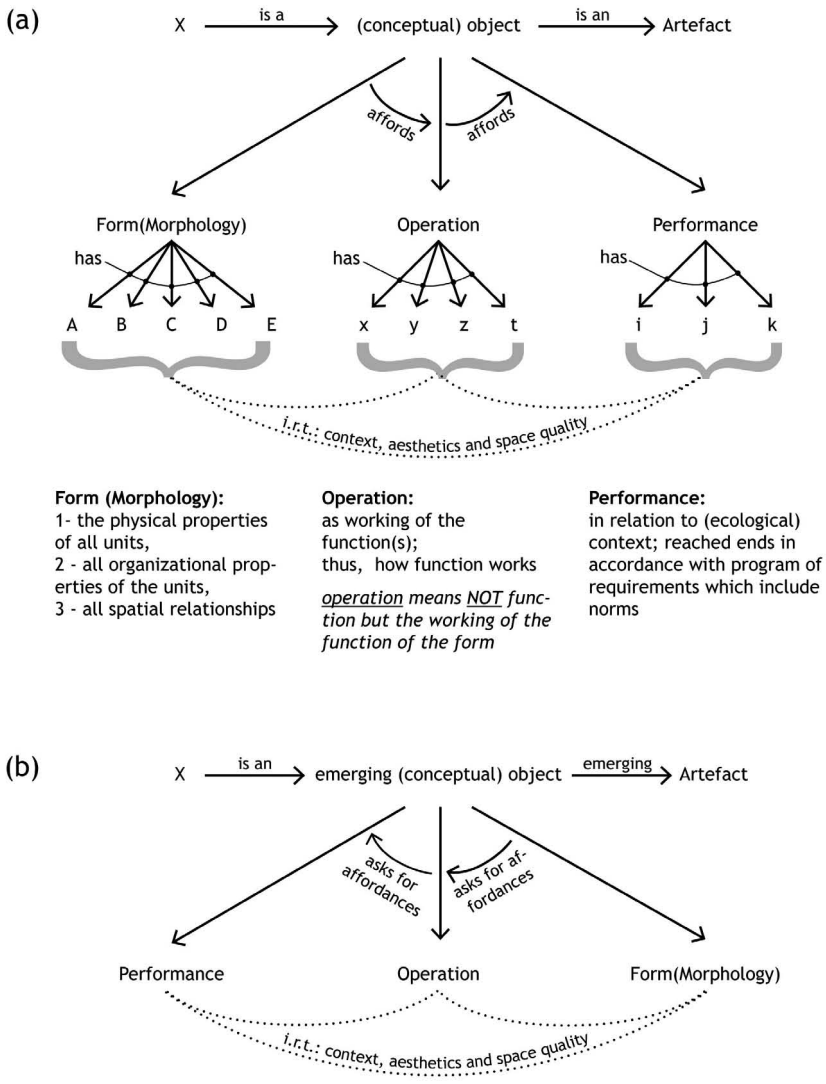

Figure 1
A possible cognitive structure of the design/synthesis and analysis process (Guney 2007, with a slight alteration)

to you that they are fit for it." (1965). Depending on the observers' culture, social setting, experience and intentions, different affordances will be highlighted (Gaver 1991 page 81). Nevertheless, because of the common sense of human beings, some affordances will be perceived by humans in general.
So, the relations between F(M)-O-P are not causal. The concept of affordance provides us with a type of relation which fits best with design-thinking, by including human being and their natural relationship to their environment in relation to perception and action. Using the concept of affordances opens up ways to come up with a more *ergonomic* environment, where an optimal fit is found between the users and their environment.

Analysis, F(M)-O-P, can be considered as deriving how a form affords some operations, and how these operations afford some performances, illustrated in figure 1a. Design/synthesis follows the opposite direction, P-O-F(M), illustrated in figure 1b. This scheme applies both to conceptual and physical objects.

"Besides all their abilities, if designers are alert enough they can link performance-related demands to operation, and operation to form since these are all interrelated.... Nevertheless, this is not only a linear process, but also recursive and iterative, as well." (Guney 2007)

Figure 2 aims at clarifying these concepts with an example concerning sitting in public space. (a) Although a chair affords 'sitting' well, sitting in a disturbing environment is not considered to be comfortable. Changing the configuration of the setting can improve the contextual factors, and by doing so, improves the performance of 'sitting'. (b) Although a staircase is not especially designed to be sat on, its dimensions and geometrical properties can invite us to sit on it in an appropriate context. In this case, sitting in a relatively enclosed space with the possibility to look at an open space and not be run over by people walking the stairs makes this place a good place to sit. (c) Another interesting case is when a form, such as a low wall adjacent to an escalator handrail, invites us to use it for sitting on, and at the same time tries to prevent us from using it that way, by using a sign. If the designer had been aware of the conflict between the apparent affordance he designed 'within' the artefact and the intended use, he would probably have made a different decision.

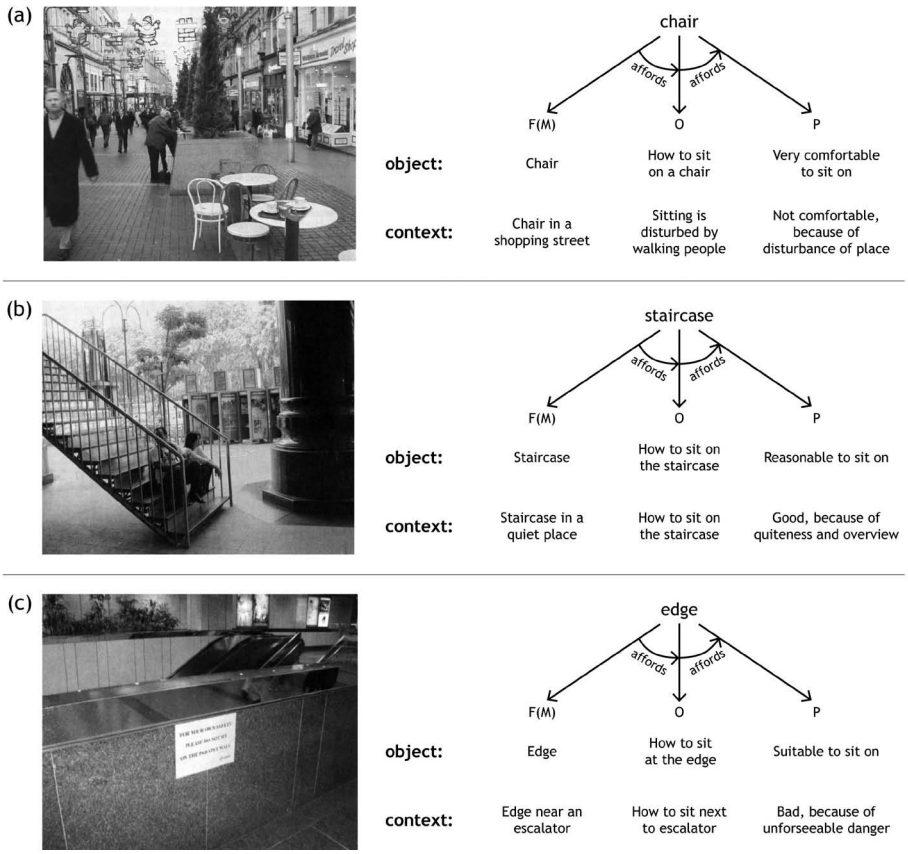

Figure 2
Operation 'sitting' in three different contexts (pictures adapted from Lawson 2001)

The example gives a clue about what we can expect if we want to evaluate design proposals on a large scale on its visual quality. The amount of interrelated relevant objects (*morphemes*), how they afford multiple operations and how these afford a complex network of performances, can lead us to think that this as an impossible undertaking. To some extent it is, but we deal with these complex networks of relations in the design process anyway, either implicitly or explicitly. Several tools are developed in order to support this process. Some preliminary results of the development of a tool for analysing large clusters of visual space more explicitly is shown below. It is only a modest step forward in evaluating (and designing with) visual impacts. In that sense it is worth mentioning in relation to the visual quality plans.

ISOVIST-BASED VISIBILITY ANALYSIS (IBVA) AS A SUPPORTIVE TOOL FOR VISUAL QUALITY PLANS

In this part of the article, the first step is taken towards a clearer description of some performances relevant to visual quality plans, by using the concept of an *isovist*. As we have mentioned above, we need to execute some sort of morphological analyses in order to start relating the form with performance through mediating operations.

If we go back to the initial goal of the image-quality-plans, it becomes apparent that the *performances* that need to be described, must somehow relate to what we can see. In order to analyse 'the visible', a computer programme[10] is used to support the designer in analysing existing situations as well as evaluating design proposals. One of the problems of analysing the large clusters of 'viewing space', is the large amount of geometrical objects with different properties which make it difficult to assess. Difficulties can arise when, because of the large amount of relevant objects, designers reduce the complexity too much, leading to non-humanised spaces. In order to deal with these kinds of complex visual characteristics, a framework is developed for three-dimensional Isovist-Based Visibility Analysis ('IBVA' see Bilsen and Stolk 2007). By using this framework, we can measure some properties of the 'visual field'.

An isovist (Benedikt 1979) is a Euclidian, geometrical representation of space (a region), which can be seen from one vantage point bounded by occluding surfaces. The space that an isovist encompasses has a volume, an outer boundary area and other geometrical characteristics. In a small room, with curtains closed, our isovist's volume is small. Out in the open field, however, our isovist's volume is enormous, bounded by the ground, horizon and sky. By calculating these characteristics at a large number of points in space one obtains a scalar field, such as a heat-map or a height-map. These points can be observation points at eye-level.

Describing the geometrical properties of a visual field is only one step towards a meaningful *performance-indicator*. In order to 'humanise' a space, it needs to afford several aspects, ranging from information about the spaces' possible usage, to attached meanings. Tzonis (1965) puts it as follows: "A place is a space with use and meaning". Visually perceived affordances like 'sittable', 'walkable' are not directly measurable from the isovist field. However, in future versions of the computer programme it will be possible to assign certain values

10 Software provided by AISOPHYST. The software provides high resolution 3D isovist analysis. A 3ds file can be used as input, an isovist map (including calculated measures) is generated as output. A typical analysis consists of several million points, whose properties are calculated on the basis of 48,600 sightlines.

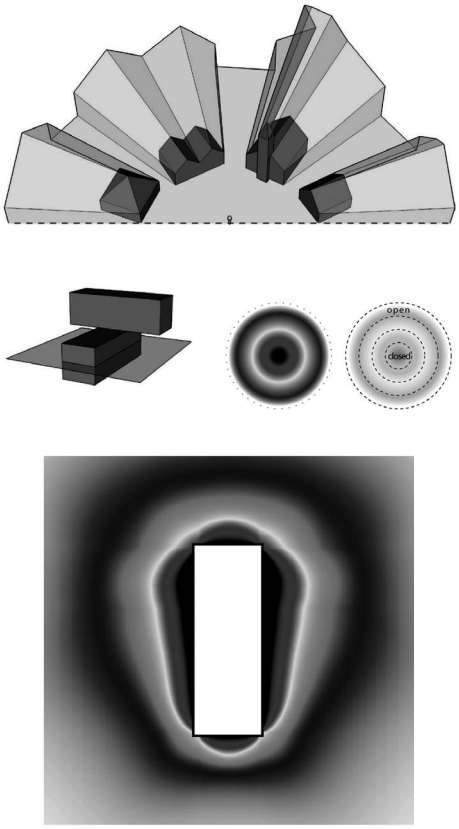

Figure 3

Upper: An observer in a 3D environment;

Middle: a three dimensional 'building';

Lower: the perceived openness at eye-level calculated at 512x512 points, with the visual impact of the upper part visible on the isovist map.

to objects in the visual field, like assigning the object to be 'sittable' or referring to a specific meaning. Finally, the goal is to derive geometrical ions (geons, see Biederman 1993), from the isovist fields, making it possible to apply some object recognition techniques, limiting the amount of values directly attached to objects.

Studies related to isovists

In 'The Evaluative Image of the City', Nasar (1998) gives an overview of some variables, which are closely related to possible performances derivable from isovist fields. Diverse studies have confirmed the prominence of spaciousness and related variables (such as openness, building density, and defined spaces) in human perception of the environment (Lynch 1960; Appleton 1975; Whyte 1980; Kaplan and Kaplan 1989). There is an increased preference associated with defined openness or open but bounded space. People prefer moderate and defined openness (or some spatial definition) to either wide-open or blocked views in both natural and built scenes.

IBVA also relates to 'space syntax' (for example Hillier 1998), as an axial-map is based upon lines of sight, although IBVA also includes the third dimension. These axial-maps can be derived algorithmically from certain isovist fields (Carvalho and Batty 2003). Within space syntax literature, several *performances* are found to correlate with these axial maps, from pedestrian movement patterns to socio-economic processes.

The current version of the computer programme can calculate the openness as a function of the volume of the isovist field. Empirical studies by Franz and Wiener (2005) and Stamps (2005) reveal that this is a good indicator of the perceived openness. Other measures are planned to be implemented in 2008.

THE ROLE OF SOME VISUAL CHARACTERISTICS IN DESIGN –ALMERE HOUT AS A CASE STUDY

An example of how designers can deal with several constraints derived from the visual field is shown in figure 4. Besides contextual factors and quantitative requirements, the programme of requirements for this design was based upon several measures derivable from isovist fields. These are:

1. The relation between local and global integration of the axial map needs to be 'good'[11];
2. The line-length distribution of axial-lines needs to follow a natural logarithm (Stolk 2005);
3. There needs to be a moderate diversity in perceived openness, directly related to measure (2).

By using constraint (1) one can measure the integration values of the axial-line-representation of the design, giving insight to the relation between the local and global structure, uncovering the potentials of the different streets. One could argue that by using this kind of measurement as a constraint in design a high degree of geometrical coherence (Salingaros 2005, p. 87) in the street lay-out is assured. (2) Provides us with a constraint for the variation in line lengths, which are important for the experienced diversity in street-depth and related issues. By coupling these lengths to typical (social) viewing distances, e.g. between 70-100 metres one can determine a person's sex, between 20-25 metres one can perceive other people's feelings and moods, etc. (Gehl 1996, p. 67-71), the question of scale and diversity is reflected in the design (see de Jong 1992). By using constraint (3) it is assured that there is a moderate diversity in perceived openness, as several studies show that this is appreciated most (Nasar 1998, p. 74-76).

11 Because of the programme of requirements, the R^2-value between the local and global integration needed to be between 0.65 and 0.80.

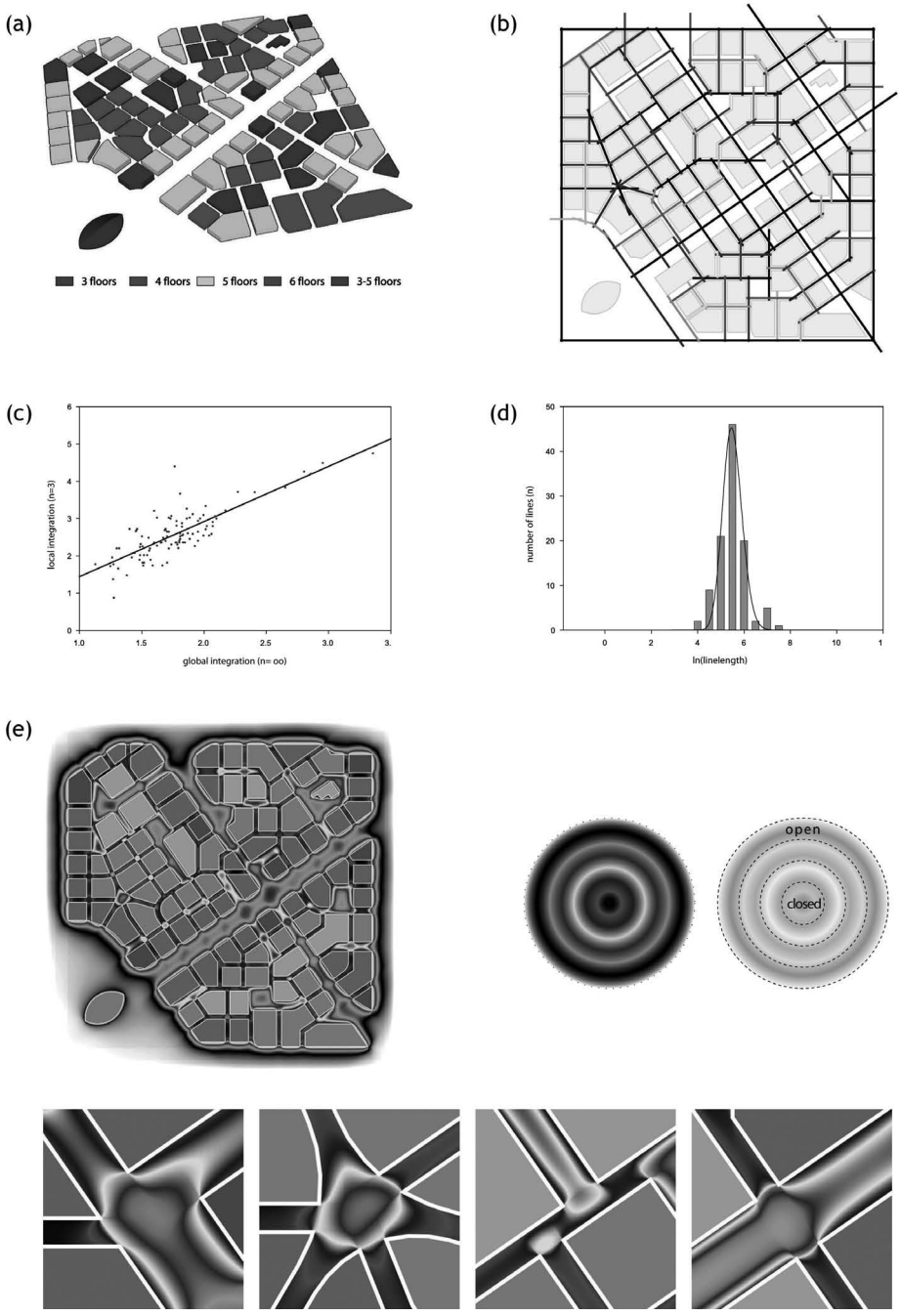

Figure 4
(a) 3D massing of the design; (b) The axial map; (c) The local-global integration, with an R^2 of 0.65; (d) The fit with the natural logarithm with an R^2 of 0.97; (e) The diversity in perceived openness, legend and some details.

This example shows how creative design is stimulated, on the basis of several isovist-related constraints. This has led to a design that can be described as 'coherent and diverse' not only at face value, but based upon some (empirical) scientific studies. If it had been done on the basis of intuition and trial and error alone, the experiential outcome quality would have been much vaguer. A careful application of space-syntax and IBVA helped and improved the creative design process; the iterative process of drawing and calculating enhanced the know-how of the designer, and made the designer more certain about the performances of the design.

CONCLUSIONS AND FUTURE DIRECTIONS

The need to link planning policy to the design process seems inevitable in order to achieve the intended spatial qualities mentioned in policy documents in real life.

Most research in the Netherlands focuses on describing performances, not relating them to physical morphological properties of the built environment at all (after Bulkens 2006). Constructing frameworks on the basis of those often ill-defined performances becomes like a language game without a clear content and meaning for people who need to work with them. The lack of precedents explaining the meaning of something like 'coherence' or 'diversity', and the lack of relations of these concepts to the visual field in general makes it problematic to use these kinds of frameworks in design in a meaningful way. On the other side of the spectrum, within GIS-systems there are some promising examples of morphological analyses and their relation to morphology is sometimes linked through some sort of operation to performance, although these linkages themselves are unclear.

F(M)-O-P is proposed as a possible mechanism to be implemented in provincial policy in order to make policy more design-driven. Maintaining the design activity as a black-box process is undesirable and unnecessary. The reason it is undesirable is because it makes a lot of potentially valuable research redundant. Unnecessary, because there is a vast amount of knowledge available on this issue which may be useful in describing the design process. The province should support design by providing powerful tools and techniques, stimulating designers to present their work, not on the basis of intuitive trial-and-error-design alone, but also on the basis of a rich body of knowledge strengthening their arguments. In this way, a stronger position in the planning process can be achieved. Furthermore, special attention should be given to the development of *interfaces* to enable stakeholders to understand each other better, using frame-semantic networks as an underlying structure.

Previous attempts of the province to provide references, precedents and background reports are valuable; and compared to other provinces and national policy, they are very rich. Nev-

ertheless an integrative step to link these to a coherent framework using F(M)-O-P is needed in order to implement the intentions of the policy. This should also be reflected in the design review committees; judgements should not be on personal views alone, but on the basis of thorough argumentation, judging the relations between the performances and the intended form through mediating operations.

The IBVA framework has the potential to quantify a number of relevant indicators for visual quality. Of these, several could eventually become norms. It can shed new light on current topics like the 'messing up of the landscape' (*verrommeling* in Dutch), and related indicators like 'openness'. In time it will be developed to execute more complex morphological analyses, enlarging the applicability for the province, and coming up with more advanced measures for, amongst others, diversity and coherence.

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PROFESSORS DEPARTMENT OF URBANISM

These are the nine chairs of the Department of Urbanism of the Faculty of Architecture at Delft University of Technology during 2006 and 2007:

Urban Design
Chair holder: Prof.ir. H.C. Bekkering
Education: MSc TU Eindhoven
Focus: Urban design, tradition and meaning, multifunctional and intensive land use, public space
communications to: H.C.Bekkering@tudelft.nl

Spatial Planning
Chair holder (emiritius): Prof.dr. P. Drewe
Education: MA and PhD University of Cologne
Focus: Spatial planning, Urban and regional development strategies, Telematics/ICTs and network urbanism
communications to: P.Drewe@tudelft.nl

Environmental Design
Chair holder: Prof.ir. C.A.J. Duijvestein
Education: MSc TU Delft
Focus: Sustainable Building; Spatial-, Ecological-, Social- and Economic Quality
communications to: C.A.J.Duijvestein@tudelft.nl

Belvedere
Chair holder: Prof.ir. E.A.J. Luiten
Education: MSc LU Wageningen
Focus: Cultural history, landscape architecture
communications to: E.A.J.Luiten@tudelft.nl

Technical Ecology and Methodology
Chair holder: Prof.dr.ir. T.M. de Jong
Education: MSc TU Delft, PhD TU Delft

Focus: Regional Physics
communications to: T.M.deJong@tudelft.nl
www.bk.tudelft.nl/urbanism/TEAM/

Urban Compositions
Chair holder: Prof.dr.ir. V.J. Meyer
Education: MSc TU Delft; PhD TU Delft
Focus: Fundaments of urban design as scientific discipline; urban compositions; design and planning of public works; the urban block
communications to: V.J.Meyer@tudelft.nl

Urban Renewal and Management
Chair: Prof.dipl.-ing. H.J. Rosemann
Education: Architecture and Urban Planning, TU Hanover, Germany
Focus: Strategies of urban renewal and transformation, globalisation and worldwide urbanisation processes, urban management, urban theories, research by design
communications to: H.J.Rosemann@tudelft.nl

Metropolitan and Regional Design
Chair holder: Prof.ir. J.M. Schrijnen
Education: MSc TU Delft
Focus: Redesign of exisiting cities towards a new network metropolis. Design of regional perspectives composed by large urban and regional projects.
communications to: J.M.Schrijnen@tudelft.nl

Landscape Architecture
Chair holder: Prof.dr.ir. C.M. Steenbergen
Education: MSc LU Wageningen, PhD TU Delft
Focus: Landscape architecture
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