

Flowscapes

Designing
infrastructure as
landscape



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STEFFEN NIJHUIS, DANIEL JAUSLIN,
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Flowscapes. Designing infrastructure as landscape

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Flowscapes

Designing infrastructure as landscape

Edited by

Steffen Nijhuis

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Delft University of Technology,

Faculty of Architecture and the Built Environment

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Social, cultural and technological developments require that we rethink the planning and design of landscapes and infrastructures while paying special attention to environmental issues and sustainability. Transportation, green and water infrastructures are important agents that facilitate processes that shape the built environment and contemporary landscapes. Movement and flows are at the core of these landscape infrastructures. They facilitate aesthetic, functional, social and ecological relationships between natural and human systems. We interpret them as *Flowscapes*.

Flowscapes explores infrastructure as a type of landscape and landscape as a type of infrastructure. The hybridisation of the two concepts seeks to redefine infrastructure beyond its strictly utilitarian definition, while allowing spatial design to gain operative force in territorial transformation processes. The publication provides perspectives on the subject from design-related disciplines such as architecture, urban design, urban planning, landscape architecture and civil engineering. The book builds upon the multidisciplinary colloquium on landscape infrastructures that is part of the *Flowscapes* graduation design studio of Landscape Architecture at Delft University of Technology.

The authors explore concepts, methods and techniques for design-related research on landscape infrastructures. Their main objective is to engage environmental and societal issues by means of integrative and design oriented approaches. Through focusing on interdisciplinary design-related research of landscape infrastructures they provide important clues for the development of spatial armatures that can guide urban and rural development and have cultural and civic significance. The geographical context of the papers covers Europe, Africa, Asia and Northern America. All contributions in the book are double blind reviewed by experts in the field.

The book is structured thematically in four parts. Part 1 consists of an overview that addresses the backgrounds of *Flowscapes* as a theory of net-

works and structures. While these papers treat the wider scope they also treat synthetic positions that overarch the whole variety of aspects touched upon by Flowscales, either thematically or in a specific place. From here on the book is separated into three lenses: parts 2, 3 and 4. These parts focus on three different scopes while they look into the same complexity, from angles that vary according to the author's multidisciplinary expertise, and each has a different specific place. The division into these three parts therefore is not to be seen as categorisation of phenomena but rather as an attempt to reveal similar phenomena in different infrastructures and in different landscapes. Part 2 treats the most obvious and spatially dominant type of infrastructure, which is nowadays transportation. The emphasis of the authors is on these Flowscales' diabolic character, challenges for design, and social relevance. Part 3 treats green infrastructures that are inherently more related to rural landscapes in the urban context of urbanised farming, the metropolitan park and architecture as landscape. Part 4 relates to the Dutch water systems and assesses spaces, structures and risks while considering them as spatial design briefs for the development of multifunctional landscapes.

An effort like this publication is only possible with the help and cooperation of many people. Firstly, we would like to acknowledge the esteemed members of the scientific committee: Adri van den Brink, Robert McCarter, Martin Prominski, Kelly Shannon and Han Vrijling for their critical reviews and constructive comments on the manuscripts. Furthermore, we would like to acknowledge the Delft Infrastructures & Mobility Initiative (DIMI) for their generous financial support. We would especially like to thank Hans de Boer for making this possible. We would also like to thank Anke Versteeg of TU Delft Library for her help in the publication process. And finally we would like to thank Linda Swaap, Katherine Sundermann and Marjan Vrolijk for their efforts making it a well-designed and accessible book.

The editors



BACKGROUNDS

Urban landscape infrastructures

Designing operative
landscape structures for
the built environment

STEFFEN NIJHUIS, DANIEL JAUSLIN

Abstract

This paper explores infrastructure as a type of landscape and landscape as a type of infrastructure. The hybridisation of the two concepts, landscape and infrastructure, seeks to redefine infrastructure beyond its strictly utilitarian definition, while allowing design disciplines to gain operative force in territorial transformation processes. This paper aims to put forward urban landscape infrastructures as a design concept, considering them as armatures for urban development and for facilitating functional, social and ecological interactions. It seeks to redefine infrastructural design as an interdisciplinary design effort to establish a local identity through tangible relationships to a place or region. Urban landscape infrastructures can thereby be used as a vehicle to re-establish the role of design as an integrating practice. This paper positions urban landscape infrastructure design in the contemporary discourse on landscape infrastructures. The space of flows, as opposed to the space of places, is introduced as an impetus to develop the concept of landscape infrastructure into a more comprehensive form of urban landscape architecture. Furthermore, this paper outlines a set of principles typical for urban landscape infrastructure design and suggests three potential fields of operation: transport, green and water landscape infrastructure. The design of these operative landscape structures is a crosscutting field that involves multiple disciplines in which the role of designers is essential.

KEYWORDS

landscape infrastructure; flowscapes; design; urbanism; transport; green infrastructure; infrastructural urbanism; landscape architecture; systems thinking; architecture; regional design; infrastructure

1. INTRODUCTION

Urbanisation, ecological crisis and climate change are several of the contemporary challenges of our society, which are demanding a fundamental review of the planning and design of our landscapes, in particular in relation to environmental issues and sustainability. While the technical challenges may be considerable, the spatial and cultural challenges are by far the largest. In this era known as the Anthropocene, a human-dominated geological epoch (Crutzen, 2002; Sijmons, 2014a), the architecture of the urban landscape has evolved into a complex system, extending far into the hinterland and deep into environmental systems, beyond any individual's understanding or direct influence. Infrastructures, by virtue of their scale, ubiquity and inability to be hidden, are an essential component of the urban landscape (Strang, 1996). Infrastructure has been in service of the conquest of nature, whereby the environment has been denied its natural dynamism in favour of colonisation that relies on more controlled and static systems. From the nineteenth century onwards, complete river systems became controlled by man in favour of economic growth (e.g. Cioc, 2002; Disco, 2008). Rail, road and energy infrastructures were constructed to integrate and control nations (e.g. Badenoch & Fickers, 2010; Guldi, 2012). Natural landscapes have been transformed into urban, logistic, industrial and waste landscapes (e.g. Meyer & Nijhuis, 2014; Waldheim & Berger, 2008; Prosssek et al., 2009; Berger, 2006) (figure 1).



Figure 1: The Maasvlakte Rotterdam, the Netherlands, as an example of a logistical landscape (photo: Ben ter Mull, 2014)

Though often successful in geopolitical and economical terms, the tendency to engineer infrastructures for 'single purpose' often resulted in disrupted landscapes, defaced retrofitted constructions and buildings, and erasure of cultural and natural values (Strang, 1996). However, widespread

insights into the potentially irreversible harm such single purpose-design has done to natural systems resulted in a growing awareness to strive for more harmonious forms of urban landscape architecture. This leads to large-scale economical commitment of national, international, European and global collaborations. Today infrastructure projects play a key role in global policy. Infrastructure is considered the primary field of investment of public authorities (European Commission, 2011, 2012). It is regarded as a backbone in which the increasingly privately financed urbanisation can be grafted (Shannon & Smets, 2010). As such, infrastructural design emerges as an important way to steer urbanisation. Yet the responsibility for infrastructural design is diffused, falling piecemeal to disciplines such as civil engineering, architecture, urban design, landscape architecture, agriculture and landscape ecology (cf. Strang, 1996). The unravelling of the dialectic between landscape and infrastructure, and the relationship between processes and formal aspects, is at the core of contemporary criticism and debate among the disciplines of landscape architecture, urban design, civil engineering and architecture. Though there are interesting examples of multi- and interdisciplinary design-related research on the infrastructural landscapes themselves, the potentials of infrastructure for performing the additional task of shaping urban landscapes is largely unexploited.

This paper aims to put forward urban landscape infrastructures as design concept considering them as armatures for the development of urban systems and which facilitate social and ecological interactions. It seeks to re-define infrastructural design as interdisciplinary design effort to establish a local identity that has tangible relationships to the region. Urban landscape infrastructures can thereby be used as a vehicle to re-establish the role of design as integrating practice. The paper elaborates on the hybridisation of the concepts of landscape and infrastructure and positions urban landscape infrastructure design in the contemporary discourse on landscape infrastructures. The space of flows is introduced as an impetus to develop the concept of landscape infrastructure into a more comprehensive form of urban landscape architecture. Furthermore the paper outlines a set of principles typical for urban landscape infrastructure design and suggests three potential fields of operation.

2. FROM INFRASTRUCTURE AS LANDSCAPE TO LANDSCAPE AS INFRASTRUCTURE

Infrastructure design was an essential feature of territorial planning and city development. As exemplified by Cronon (1991) for Chicago, Picon (2005, 2009) and Barles (2007) for Paris, and Van Acker (2014) for the Campine Region in Belgium, major hydraulic and transport infrastructures exert great

influence on the possibilities for economic and spatial development of urban landscapes. Infrastructures make things possible. In the eighteenth century Paris for instance, urban canals were used for transportation and to power mills and workshops. Consequently a complex set of manufacturing activities developed along the river banks (Picon, 2005). In the beginning of the twentieth century the sewer system of Paris was not only employed for the removal of human excreta to improve urban hygiene, but also aimed to produce the fertilizers needed in rural surroundings (Barles, 2007). The sewer system steered and facilitated the development of sewage farms, which played an important role in the food production for the city (figure 2). Though infrastructures were important technological utilitarian features in the urban landscape they were usually not imbued with a landscape connotation. However, appropriating infrastructure as landscape has the potential to gain operative force in territorial transformation processes and to explore the dynamic between structure and process.

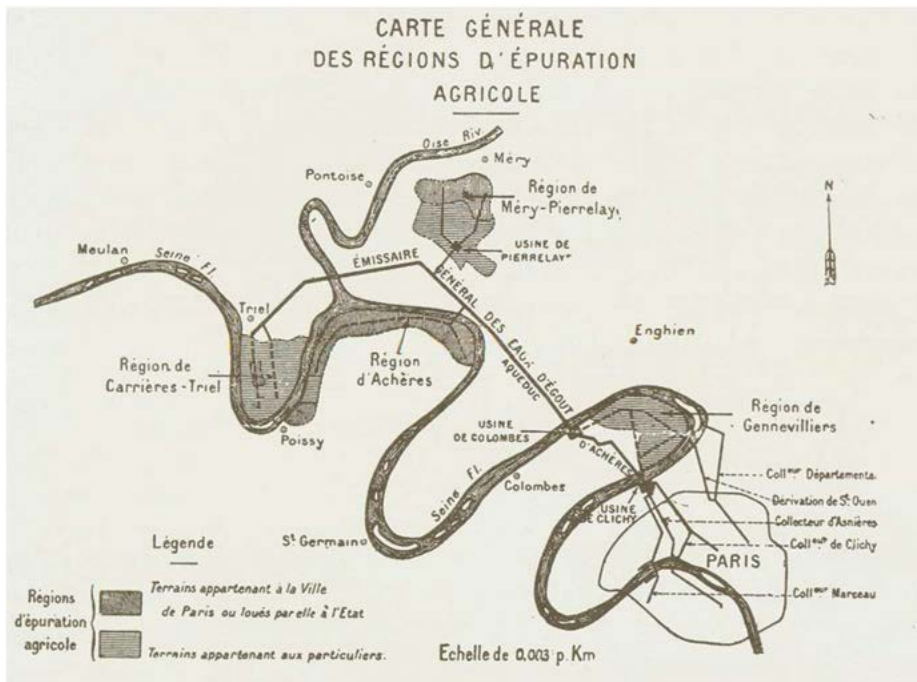


Figure 2: Infrastructure as condition for urban development exemplified by Paris (France) at the beginning of the 20th century. The sewer system steered and facilitated the development of sewage farms which played an important role in the food production for the city. Map by E. Gerards, 1907 (image from Barles, 2007)

Infrastructures can be defined as “*constructed facilities and natural features that shelter and support most human activities – buildings of all types, communications, energy generation and distribution, green spaces, transportation of all modes, water resources, and waste treatment and management*” (PERSI, 2006). Landscape on the other hand is defined as “*an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors*” (Council of Europe, 2000). As such, the current understanding describes infrastructure as the human impetus to alter the natural environment, while landscape is described as the inadvertent result. However, their combination offers an opportunity to redefine both notions into a more integral design brief where goals and means converge, resulting in operative landscape structures that serve multiple ends. In this perspective landscape and infrastructure merge and are the vessels of collective life, and must function, fit and be acceptable in order to enhance the quality of the landscape (Shannon & Smets, 2010). Hence, conceiving infrastructure as landscape enriches infrastructure with generating architecture, constructing landscapes and living environments; it engages social and imaginative dimensions as much as engineering (Shannon & Smets, 2010). This implies that infrastructures no longer belong to the realm of single disciplines like civil engineering, architecture or landscape architecture, but to a crosscutting field that involves multiple disciplines and in which the role of designers is essential (Shannon & Smets, 2011; Bélanger, 2010).

2.1 Infrastructure as landscape

The idea to conceive infrastructure as landscape or landscape as infrastructure is not new. From the second half of the eighteenth century infrastructure was regarded an integral part of the landscape by landscape designers. At this time they were involved in the design and scenography of routes in the English landscape garden. In the nineteenth century, during the industrial revolution in Europe, parks were regarded as important infrastructure for healthy cities (Hennebo & Schmidt, [1975]; Chadwick, 1966). The increasing use of automobiles and the vast urbanisation in Northern America at the end of the nineteenth century initiated the development of metropolitan parks and parkways (Schuyler, 1986; Zapatka, 1995; Dalby, 2002). Green spaces were considered green infrastructures for the city and routes as ‘flow landscapes’ where travelling was connected to the scenic experience of the natural environment. In the beginning of the twentieth century these ideas exerted great influence on metropolitan park planning and highway design in Northwest Europe (e.g. Dümpelmann, 2005; Zeller, 2002; Van Winden, 2015). From the 1940s onwards landscape architects and urban designers became also involved in design and transformation of infrastructures for electricity generation and flood control, but also brownfields (former industrial areas),

highways, or urban agriculture. Nowadays it is common practice for design disciplines to look at infrastructure as a type of landscape and they have developed particular specialisations (e.g. Berger, 2006; Hölzer et al., 2008; Shannon & Smets, 2010; Sijmons, 2014b; Braae, 2015) (figure 3).



Figure 3: The design of Landschaftspark Duisburg-Nord (Germany) in 1991 by Latz + Partner can be considered a benchmark for the redevelopment of former industrial brownfields into mixed-use use complexes where ecological and socio-cultural objectives blend (photo: Carschten, 2010, CC BY-SA 3.0 DE)

Considering infrastructure as landscape can be characterised as an object-oriented approach, where the infrastructure is the object, which is treated as an interdisciplinary landscape design brief with emphasis on the ‘scapes’. It is possible to identify at least four discourses of infrastructural design, which approach infrastructure as landscape from a spatial, ecological, technical, or social perspective. In practice these discourses usually overlap but differ in their main objectives. The spatial approach employs expert, phenomenological and psychological principles to allocate and design infrastructures, such as roads, dykes, and wind turbines, based on formal-architectural characteristics and spatio-visual experience (e.g. McClusky, 1979; Thayer, 1994; Shöbel, 2012). The ecological approach employs nature and environmental based techniques as operative instruments to create green infrastructures (also called greenways, ecological corridors, etc.) which are constellations of open space, woodlands, wildlife habitat, parks and other natural areas, sustaining clean air, water, and natural resources for sustainable cities (e.g. Hough, 2004; Rouse & Bunster-Ossa, 2013; Czechowski et al., 2015). In technical oriented approaches civil and agricultural techniques are the basis for the design of infrastructure as landscape. Examples can be found in for instance route design and design of flood control and urban agriculture (e.g. Snow, 1959; Prominski et al., 2012; Viljoen, 2005). The social approach is

characterised by a human-centred perspective which employs participatory or anthropometric design strategies, for instance via involving people in the development of infrastructures or the design of public space for reasons of social engineering and healthcare (e.g. Carr et al., 1992; Woolley, 2003; North, 2013).

2.2 Landscape as infrastructure

Parallel to the notion of infrastructure as landscape the idea of landscape as infrastructure evolved. Conceiving landscape as infrastructure can be characterised as a goal-oriented approach, where landscape is treated as an operative field that defines and sustains the urban development and ecological and economic processes are employed as formative design tools. Pioneering writings in that respect include Strang (1996), who coined the idea of landscape as infrastructure, and Allen (1999) who identified the field of infrastructural urbanism. Recently Bélanger (2009, 2010, 2013) and The Infrastructure Research Initiative at SWA (2011) introduced the term landscape infrastructure to re-define infrastructure as an integrated alternative for improving mass transit, enhancing public accessibility and ecological performance, while remaining economically sound. Landscape as such becomes the medium through which to formulate and articulate solutions for integration of infrastructure with viable programming that can address many pressing issues facing many cities all over the world (SWA, 2011) (figure 4). In this conception the landscape is often reduced to a set of essential systems that support cities and regions. It focuses on the ‘hardware’ – the systems of transport, water, production and commerce – and is largely disconnected from socio-cultural or biophysical functions (Duany & Talen, 2013; Carlson, 2013). However, the potential of considering landscape as infrastructure is put forward by Waldheim (2011, p. 4): *“By postponing the question of urban form, these proponents of a landscape infrastructural approach to the architecture of the city suggest that a focus on performance criteria, operational imperatives and contemporary flows might allow us to reengage with social and environmental subject.”*

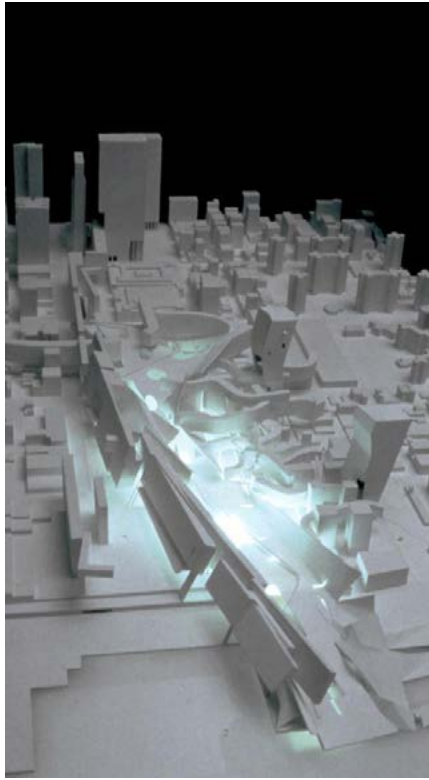


Figure 4: The work of Morphosis Architects in the New City Park competition for Manhattan (New York, USA) in 2009 considers the park as public armature of core programs and infrastructure; landscape as infrastructure (image courtesy: Morphosis Architects)

Among design disciplines, in particular in the field of urbanism as interdisciplinary planning and design activity towards the built environment, there is a recognisable tendency to consider landscape as infrastructure exemplified by the emergence of several ‘urbanisms’. Examples of emergent urbanisms in this respect are: infrastructural urbanism (Hauck et al., 2011), ecological urbanism (Mostafavi & Doherty, 2010; Reed & Lister, 2014), agrarian urbanism (Waldheim, 2010), water urbanism (De Meulder & Shannon, 2008), metabolic urbanism (Baccini & Brunner, 2012; Ferrao & Fernandez, 2013), combinatorial urbanism (Mayne, 2011) and landscape urbanism (Waldheim, 2002, 2006; Mostafavi & Najle, 2003). Though there are authors who strive for a more inclusive view (e.g. Tjallingi, 1995; Pollalis, et al., 2012; Hagan, 2015), several novel approaches to urbanism express a thematic, utilitarian lens towards landscape as infrastructure. Others emphasise the involvement of natural processes and hardly address socio-cultural aspects. The emphasis is in most cases on processes as open-ended steering devices, rather than a more form-oriented architectural approach, neglecting the biophysical landscape

as a condition for organising space and its material substance. This type of binary thinking ('this' vs 'that': 'ecology' vs 'sociology'; 'process' vs 'form') tends to blind design disciplines to see complex webs of relationships which constitutes the urban landscape (cf. Meyer, 1997). Yet, design is about putting things together rather than taking them apart, integration rather than reduction: it is about relations between things and not the things alone (Meyer, 1997; Sijmons, 2012). Planning and design operations should focus on the interaction between landscape processes and formal-aesthetic aspects and facilitate a multitude of relationships between natural and human systems (Nijhuis, 2013). This type of thinking addresses the integral nature of the urban landscape as a holistic and complex multi-scalar system and the mutual relationship between structure and process (figure 5).



Figure 5: The Boston Metropolitan Park System as proposed by Sylvester Baxter and Charles Eliot in 1893 offered a new vision of how a green-blue system could function as an armature for the rapidly expanding metropolitan area of Boston (Massachusetts, USA). The plan exemplifies the potential to shape urban and architectural form while employing social and ecological processes to establish a local identity that has tangible relationships to the region (image source: personal archive S. Nijhuis)

Considering urban landscapes as systems could provide a strong countervailing force. Design disciplines need to re-establish the role of design as synthesising activity (cf. Sijmons, 2012) and stimulate an interdisciplinary discourse where architects, urban designers, landscape architects and civil engineers work together on a more comprehensive form of urban landscape infrastructure design.

3. URBAN LANDSCAPE INFRASTRUCTURE DESIGN

Urban landscapes can be understood as complex systems composed of subsystems each with their own dynamics and speed of change (Otto, 2011; Portugali et al., 2012; Batty, 2013). In this perspective the urban landscape is considered a system where different processes and systems influence each other and have a different dynamic of change (Braudel, 1966). Systems are organised entities that are composed of elements and their interaction, and consist of structures and processes (Benyus, 2011; Batty, 2013). The urban landscape as system is a constellation of networks and locations with multiple levels of organisation (Doxiadis, 1968; Otto, 2011; Batty, 2013). Networks are important for interactions, communications and relationships. Locations are the result of the synthesis of interactions. The spatial dimension of networks and locations can be referred to as the *space of flows* and the *space of places* (Castells, 2000). The space of flows can be defined as the formal expression of structures for the (1) provision of food, energy, and fresh water; (2) support for transportation, production, nutrient cycling; (3) social services such as recreation, health, arts; and (4) regulation of climate, floods and waste water (figure 6). The space of places can be defined as the spatial expression of a locale whose form, function, and meaning are a result of social, ecological and economical processes. Though the relationship between the space of flows and the space of places is not pre-determined in its outcome, the space of flows is becoming more dominant as a spatial manifestation of power and function in our society (Castells, 2000). This shift implies that design disciplines should not only focus on the space of places but also on the space of flows because they have the potential to gain operative force in territorial transformation processes. The space of flows emerges as a new field of inquiry for design disciplines and opens up opportunities for shaping architectural and urban form to establish local identity with tangible relations to the region.

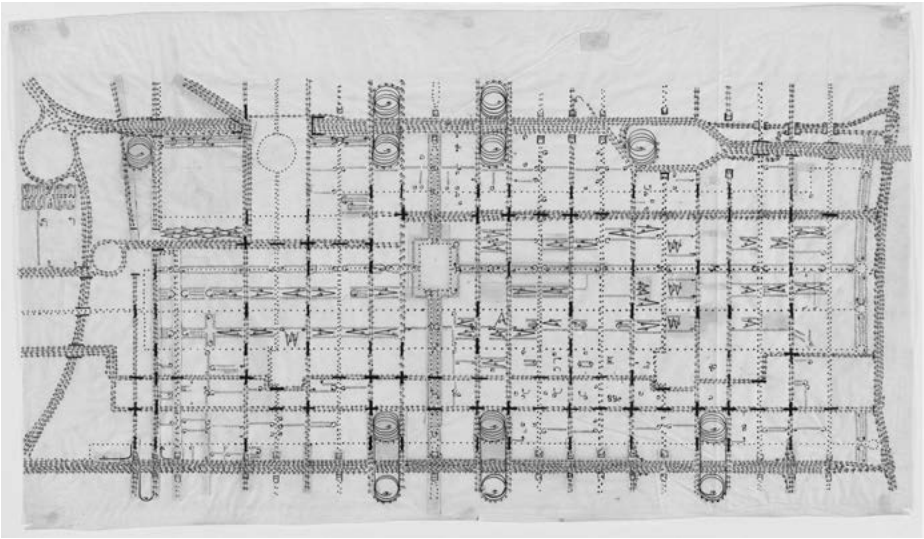


Figure 6: Understanding the space of flows as an formal expression of processes of interaction. Traffic Study project for Philadelphia (Pennsylvania, USA) by the architect Louis Kahn, 1951-1953 (image courtesy: Museum of Modern Art, New York)

3.1 Flowscapes: designing operative landscape structures

The notion of the space of flows or flowscapes could serve as an impetus to develop the concept of landscape infrastructure into a more comprehensive form of urban landscape architecture which addresses the complex webs of relationships constituting the urban landscape. These flowscapes can be regarded as operative landscape structures. They are operative because they direct and facilitate urban development, stimulate social and ecological interaction and establish the relation between process and form, between ‘flows’ and ‘scapes’. The resulting formal framework is a landscape design, which organises the space of places and its material substance. In that respect successful landscape design establishes a characteristic relationship between form and content throughout the scales.

Perhaps it is better to speak of urban landscape infrastructures since they facilitate and frame flows of people, living organisms, materials and information. Urban landscape infrastructures are not only support structures that direct, facilitate and create conditions for urban development, but also have spatial, ecological and socio-cultural qualities themselves. In the words of Habraken (1972, p. 72) they “cultivate the garden in such a way that the conditions for the growth of a living culture are set up.” As such urban landscape structures are considered armatures for urban and rural development, and facilitate interactions between natural and human systems. The urban landscape infrastructure is a mediator between nature and society, based on a material

space that exists as a structure of man-made patterns as well as an ecological system, and is independent of perception.

Urban landscape infrastructures can be used as a vehicle to re-establish the role of design as integrating activity in contemporary urban development and transformation. This implies that multi-functionality, connectivity, integration, long term strategies, ecology, social-inclusive and interdisciplinary design processes are at the core of spatial design. It aims to create landscapes from a perspective of sustainable development, so as to guide and shape changes which are brought about by socio-economic and environmental processes. Thinking in terms of urban landscape infrastructure design suggests more innovative and integral forms of planning and design. But what is the particular nature of urban landscape infrastructure design? The presumption is that the answer can be found in a particular repertoire of principles, building on grounds prepared by Habraken (1972), Allen (1999) and Kriken (2010).

Urban landscape infrastructure design is about construction of landscapes itself and not about specific technical constructions in a landscape. It is about creating conditions for future development. Here the concept of the *longue durée* is crucial: understanding the landscape as a long-term structure, which is changing rather slowly. Sustainable development in its original definition as planning for future generations (WCED, 1987) is inherent to this approach. Urban landscape infrastructure design works through the scales from regional to local, from general to specific, and maintains overall continuity as well as facilitates local contingency. The urban landscape infrastructures establish ways of balancing out services and qualities between parts of a territory (Busquets & Correa, 2006). Though they are static in and of themselves they guide and facilitate flows, movement and exchange. In that respect the urban landscape infrastructures are artificial ecologies, managing flows of energy and resources on a site and directing the density and distribution of natural or human habitats (Allen, 1999). Urban landscape infrastructure design is about the creation of robust and adaptive systems, which are open to change. Robustness refers to the persistence of certain characteristics under conditions of uncertainty. Openness is the degree to which the urban landscape infrastructure can adapt within distinct boundaries (Gharajedaghi, 2011). Thus in order to grow and develop urban landscape infrastructures both must persist and adapt; their organisational structures are sufficiently adaptive to withstand challenges, while also supple enough to morph and reorganise (Corner, 2004). Urban landscape infrastructure design recognises the collective nature of the urban tissue and allows for the participation of multiple authors. Urban landscape infrastructure creates a directed field where different participants can contribute (Allen, 1999). Urban landscape architecture design is an interdisciplinary effort where specialisations in engineering and ecology blend with spatial design thinking.

3.2 Potential fields for urban landscape infrastructure design

The concept of urban landscape infrastructure offers a renewed understanding of the landscape as infrastructure, which needs to be explored on its opportunities and possibilities for strategic regional design and local interventions. It stimulates design disciplines like architecture, urban planning and landscape architecture to cooperate and review the agency of design giving shape to the built environment, and establishes relationships between ecology and socio-cultural aspects, between process and form, between the space of flows and the space of places. Urban landscape infrastructure design employs civil-, agriculture-, nature-, and environment-based techniques as operative instruments, which implies cooperation with disciplines like civil engineering, hydraulic engineering and landscape ecology as well. There are at least three potential fields for urban landscape infrastructure design, which emerge from practices which employ the principles as described above:

(1) Transport landscape infrastructures

The first field is the design of urban landscape infrastructures that facilitate different modes of transportation, energy supply, waste treatment and information dissemination (e.g. telecommunications). This category includes the spatial design of vehicular, rail, and air systems, as well as ports and waterways. Energy systems (e.g. oil, gas, nuclear, wind), their transformation to produce energy, and their distribution are also important elements (e.g. power lines, pipelines). When considering these utilitarian systems as urban landscape infrastructures they become entities of multiple-use and integration where technical, aesthetic and social values blend. These multi-modal transportation systems shape conditions for urban development and offer opportunities for new types of public space. Typical design operations in this context are the planning and design of transit landscapes, shared spaces (traffic/public space), multimodal nodes and their environments, transit-oriented development, harbour and brownfield transformation and the development of energy landscapes (figure 7).



Figure 7 Transport landscape infrastructures as armature for urban development. Design study by Venhoeven CS Architecture & Urbanism and others of transit oriented development in Heerhugowaard (Metropolitan Region Amsterdam, the Netherlands). Development of a multi-nodal hub (1), a multi-functional park strip with new urban program connected to it (2), urban densification in a park like setting (3), and transformation of urban tissue in the transport corridor (4) (image source: De Boer et al., 2015)

(2) Green landscape infrastructures

The second field is the design of urban landscape infrastructures that maintain and develop natural ecosystem values and provide associated social, economic and aesthetic benefits to humans as a set of interconnected green space networks. Useful for planning and design is the concept of land mosaics consisting of green patches, corridors and matrices. Much of the foundation of this field draws on the planning principles of regional metropolitan park systems of the nineteenth century. Green space structures can act as organisational structures for sprawling metropolitan areas, providing space for nature development, leisure/recreation and cultural heritage. Food production and energy supply are becoming increasingly important as urban landscape infrastructures. Typical design operations include the planning and design of metropolitan park structures, development of agricultural urban landscapes, urban ecology and protection of heritage landscapes (figure 8).

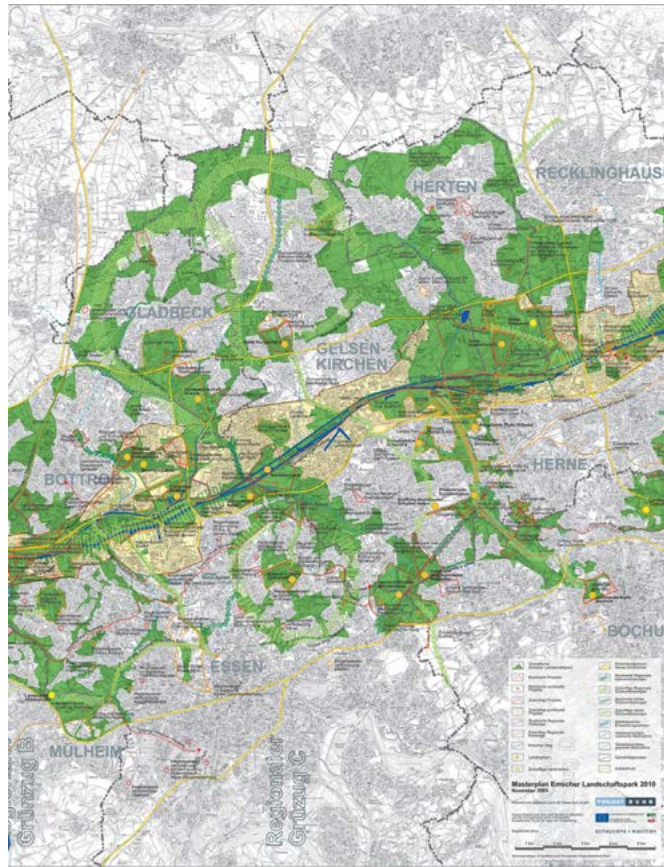


Figure 8: Green landscape infrastructures as armature for urban development. The Emscherpark is conceived as an interconnected green space network structuring the fragmented 'Zwischenstadt' or 'Middle landscape' in the Ruhr area (Germany) and provides space for nature development, leisure/recreation and cultural heritage. Top: section of the regional masterplan Emscher Landschaftspark (image source: Projekt Ruhr GmbH 2005). Below: a local design intervention, the Gleisboulevard in Zollverein Park (photo: Thomas Mayer, 2008)

(3) Water landscape infrastructures

The third field is the design of landscape infrastructures that focus on water management and riparian zones. Important issues here are coast and river management – including river modifications, seawalls and floodgates – as well as the use of beach nourishment, sand dune stabilisation, development of flood forests and coastal/estuarine wetlands to create new multifunctional landscapes. It includes the planning and design of land reclamations, major flood control systems (dikes, levees, major pumping stations and floodgates), drainage systems (storm sewers, ditches), major irrigation systems (fresh water reservoirs, irrigation canals), and also sewage collection and disposal of wastewater beyond their utilitarian use. Other important operations are planning and design of multifunctional flood defence structures, river landscape modifications, aquatic landscape development, fresh water storage and supply landscape infrastructures, water fronts, waste water treatment plants, and adaptive water protection measures (figure 9).

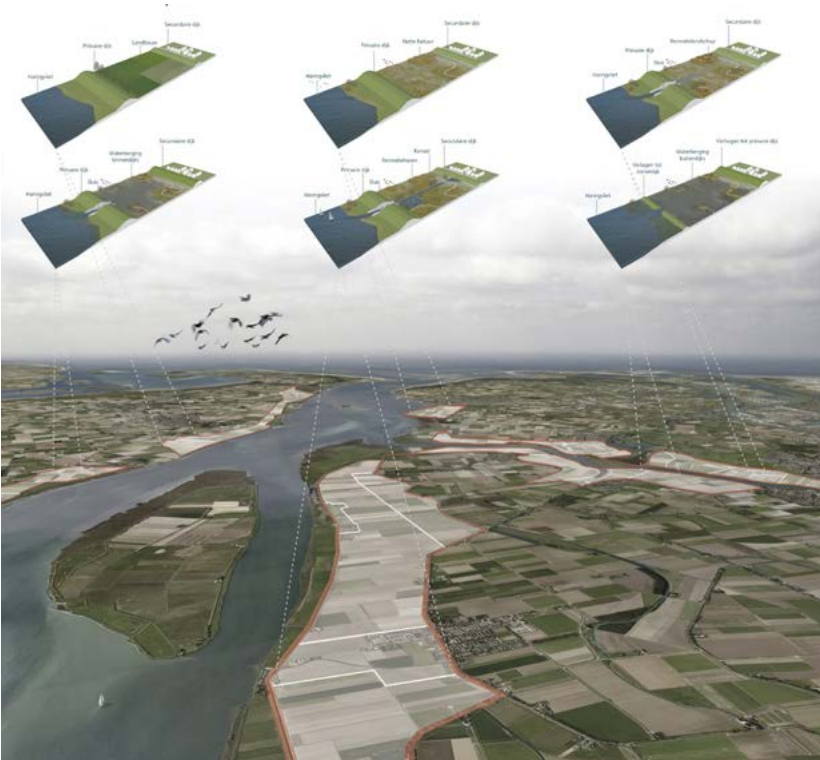


Figure 9: Water landscape infrastructures as armature for urban development. A robust adaptive framework as alternative water protection measure in the Southwest Delta of the Netherlands. The sections show the multiple possibilities for multifunctional development of the zones between the primary and secondary dikes in the rural areas south of Rotterdam (image source: Meyer et al., 2014)

These fields of urban landscape infrastructure design provide lenses to a more comprehensive form of urban landscape architecture and need to be explored and further developed in an interdisciplinary setting. Here research by design can be regarded as a powerful synthesising journey of discovery. The design is the vehicle to draw up hypotheses of possible spatial futures and to test their local and regional consequences. Through interdisciplinary design-based case studies at different spatial scale-levels designers can seek for a better understanding of the dynamic between social and ecological processes and typo-morphological aspects. These inquiries into urban landscape infrastructures should reconcile the desire for economic growth with efforts to create a built environment, which is more sustainable, and socially and ecologically balanced.

4. CONCLUDING REMARKS

In order to redeem control over the processes that shape the built environment and its contemporary landscapes, a fundamental review of the agency infrastructural design is needed. This paper has put forward urban landscape infrastructure design to gain operative force in territorial transformation processes while establishing local identity and tangible regional relationships through connecting ecological and social processes and urban and architectural form. The design of these operative landscape structures is a crosscutting field that involves multiple disciplines and in this field the role of designers as integrators is essential. The ability to interrelate systems in design becomes increasingly important, as the complex interconnection of different systems and their formal expression is a fundamental aspect of contemporary design tasks. The concept of urban landscape infrastructure focuses on the design of the space of flows, which can be characterised as transportation, green and water landscape infrastructures. While acknowledged in the differences amongst the three fields of urban landscape infrastructure design, it is important to understand their relationships and to address them integrally as armatures for urban development. With flows and movement at the core, urban landscape infrastructures facilitate functional, social and ecological relationships between natural and human systems and provide conditions for spatial development. Here the landscape is not considered as something stable, localised and qualified by its own site, but as the product of operations that are structured through a network of transmissions in a regional perspective. To study the urban landscape as a system of dynamic actions, and as a system of the interaction of space and process, opens up new perspectives of interdisciplinary spatial intervention, more in accordance with a society in perpetual transformation, a society in which the user feels more involved, committed, and in harmony with the environment. Urban landscape infrastructures as such have always a social and ecological

vocation, given that they have been conceived to facilitate society as an operative landscape structure for sustainable urban landscape architecture.

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Mapping flows

Switzerland as operational landscape

MARC ANGÉLIL, CARY SIRESS

Abstract

Drawing on episodes involving the use (and abuse) of maps in Switzerland, this essay pertains to the geopolitical agency of cartography in the production of urban territory. Maps generate and maintain particular discourses about the world, whether factual or fictional, with very real repercussions either way for the territory depicted. The UN motion made by Libyan leader Muammar al-Gaddafi to wipe Switzerland off the map, for instance, discloses just how much sway the cartographic imaginary holds in global relations. Guillaume-Henri Dufour's mid-nineteenth century map re-territorialised a loose coalition of fiercely independent cantons into that unified economic and legislative space known as 'Switzerland', while underwriting an infrastructural machine that remains as central to Swiss self-esteem as it is to the nation's economy. More recent examples of the map's formative authority come by way of two unusual bids made in 2010 to redraw the boundaries of Switzerland. The controversial map by Armed Forces Chief André Blattmann recast Europe as enemy territory in an effort to rekindle patriotic identity and legitimise the need for an army. Conversely, right-wing politician Dominique Baettig put forth an equally contentious map calling for the annexation of regions from neighbouring countries that would create a new Swiss megacity in the heart of Europe. Regardless of how it is mapped, Switzerland's contemporary urban fabric hardly adheres to an immaculate image, manifesting instead a disjunctive amalgam of bits and pieces that operate according to their own rules and agendas. And with such territorial entropy increasing on a planetary scale, we might wonder to what extent the map actively shapes these conditions as an actor in its own right rather than only neutrally reflecting them. In any case, territory is never simply given, but is constituted through the polymorphous elements, relations, and domains of reference that it assembles. Whereas the map might continue to express what is done in the name of territory, we do not yet know what territory itself can do.

KEYWORDS

mapping Switzerland; cartography; Swiss defence system; urban fabric; infrastructure network

1. ERASING SWITZERLAND OFF THE MAP

A motion submitted by Libyan leader Muammar al-Gaddafi in 2009 to the United Nations General Assembly made a plea for wiping Switzerland off the map and splitting its territories among neighbouring countries. His rather bold proposal – announced as an all-out Jihad or Holy War against the alpine state – came in response to the arrest of one of his sons in Geneva and the controversial ban on the construction of minarets in the country. In a rambling diatribe at the G8 Summit held in Italy in the same year Gaddafi labelled Switzerland a rogue nation:

“Switzerland is a world mafia and not a state. It is formed of an Italian community that should return to Italy, another German community that should return to Germany, and a third French community that should return to France.”¹

An oil embargo was declared, billions were withdrawn from Swiss bank accounts, commercial flights between the two countries cancelled, and two Swiss businessmen arrested for alleged visa irregularities. Although such retaliatory measures were quite serious and yielded much diplomatic damage, the media had a heyday with Gaddafi’s bizarre proposal, with countless maps drawn to illustrate Switzerland’s dissolution. Who would get the Gotthard and who would get the Matterhorn? But humour aside and notwithstanding Switzerland’s long-standing posture of neutrality, the short-lived episode brings to the forefront how politics and space are brought to interact on the very surface of the map. Whatever the intentions, whether justified or not, and whatever maps are drawn, they tend to leave their traces on both the geography of ideology and space.

2. PUTTING SWITZERLAND ON THE MAP

A significant amount of effort goes into maps and their production. As a matter of fact, Switzerland has made a name for itself in the production of hyper-accurate maps. Its territory, itself a model of accuracy, has been meticulously plotted to the nth degree with an exactitude that would even make Borges’s fabled guild of cartographers green with envy.² This passion for all things perfect is more than mere myth, it is the hallmark of Swiss identity both within and beyond its national borders. To keep things in good order – *en état* – is nearly constitutional law. In reality, map-making engenders territory, if not the nation itself, in the process triangulating scientific knowledge, politics, and space.³ This threesome fuels an obsessive machine that runs at full speed, at times threatening to overheat while consuming ever more resources to produce an urban landscape that expands beyond the borders of the map itself. Since the 1970s, the rate of land consumption for new construction in Switzerland is estimated to have reached nearly 1m²/sec, a num-

ber often cited in parliamentary debates and in the media, though slightly above the more precise figure of $0.86\text{m}^2/\text{sec}$ as calculated by the Swiss Federal Statistical Office; the plotting of territory and its dynamics through the elegance of number (Bundesamt für Statistik Schweiz, 2013).

There is indeed a map that put Switzerland on the map. Not by coincidence that landmark document is attributed to a military surveyor, Guillaume-Henri Dufour, whose training as an engineer and experience with fortifications for the French military made him the prime choice for charting the first comprehensive map of the country, albeit a country that had not yet been constitutionally formed. The undertaking comprised a monumental task that lasted from 1832 to 1865 (Gugerli & Speich, 2002; Gugerli, 1999). Switzerland at the time was a loose coalition of independent cantons separated by a capsular mentality that survives to this day. Efforts were made nevertheless to standardise anything from different currencies to disparate measuring systems in order to facilitate commerce and strengthen political cohesion while maintaining cultural diversity. With the objective of a unified Swiss economic and legislative space on the table, one of the initial measures was to create a new map that would give contours to “*the topographical designation Switzerland*” with a precision “*beyond all scientific doubt*” (Gugerli, 1998) (figure 1).

The project set out to homogenise the heterogeneous and gained significance as part of a progressive-liberal movement aiming to unite the country in a military, political, economic, and geographic sense (Gugerli, 1998: 96). A “*gigantic machinery of a new national recording system had come to fruition*”, and with it Switzerland was invented (Gugerli, 1998: 97). When the federal state was founded in 1848, the Dufour Map was well underway, giving legitimacy to the fledgling nation. Dufour himself profited from the enterprise, as he was elected General of the army just prior to the state’s formation, a move suggesting that the armed forces had already become more scientific in their orientation. Given that the map was underwritten by military interests, anything that either aided or obstructed the movement of troops was recorded in minute detail by squads of surveyors scaling mountainous terrain. Conversely, the map warranted the creation of new infrastructure – roads, railways, bridges, tunnels, and communication networks – likewise warranting the need to discipline, manage, and control territory. We encounter in this project an unexpected *ménage à trois* where knowledge, power, and space become entangled. It was little known at the time that to govern is to urbanise.

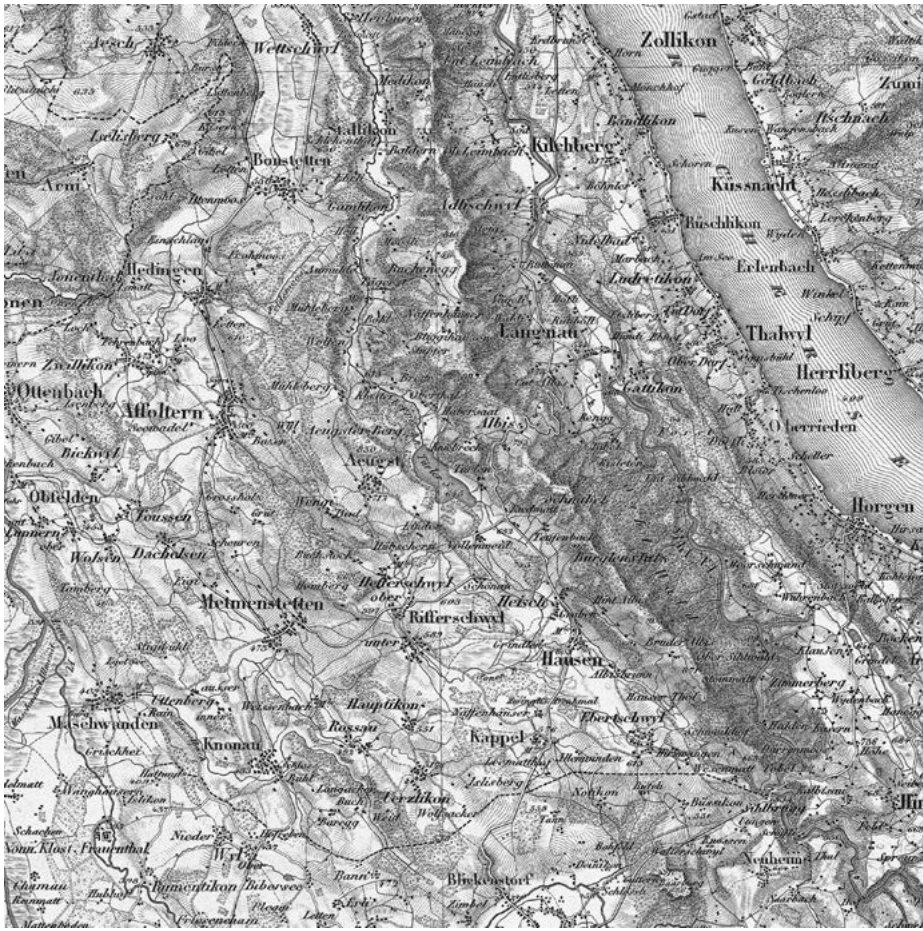


Figure 1 Excerpt from Dufour Map, surveyed at the scales 1:25,000 and 1:50,000 under General Guillaume-Henri Dufour, 1832-1865

The result is a completely managed landscape whose seamless flows and operational efficiency are understandably the pride of the nation and inspires awe abroad. Well engrained in collective memory, Switzerland predicates the image of perfection as a consummate collection of places to remember (Kreis, 2010). Not surprisingly, the conquest of nature by infrastructure and with it the taming of the Alps is celebrated in popular pastime activities by dads and their sons re-enacting feats of civil engineering in their basements, by model train clubs attracting hordes of want-to-be surveyors, and by countless magazines highlighting the latest accessories for miniature Switzerlands to customers worldwide (Hermann, 2010). One such model, a replica of the Gotthard North Ramp, was even built behind closed doors, behind the Iron Curtain to be exact, during the Cold War in the former DDR by model train aficio-

nados who had never visited the actual site (figure 2). Though born of fantasy, the project required up-to-date maps that were smuggled in and used to plot an elaborate duplicate of the real setting, one replete with rock formations, trees, lakes, snow, and not to forget those Swiss chalets and all the other necessary technical amenities for a picture-perfect, Heidi-esque set. What was undertaken as an innocent leisurely pursuit eventually got the East German hobbyists in trouble with agents from the Ministry for State Security, more commonly known as the Stasi, who were suspicious of the clandestine operation. But the story had a happy ending, as the maps used were deemed harmless by authorities and the co-opted image of Switzerland deemed benign.



Figure 2 Model Train of the Gotthard North Ramp (scale 1:120),
Model Train Club Leipzig, DDR, 1969-89

Without a doubt, the virtue of Swiss maps is their accuracy. Admittedly, as a cartographer's dream such accurateness can be blinding. Maps, though cloaked in objectivity, are thoroughly ideological. They are vehicles for translating values, motives, biases, beliefs, and desires into territory. Such translations require protocols based on norms that ensure their replication as a system, which in turn validates the values inscribed in them and the powers

behind them. Therefore, any change in ideology will inevitably leave its mark on the land. But such agents for ideology never stand alone. They are often met with other competing objectives, a clash which translates into territorial conflict, however absurd the grounds might seem.

3. WALLING SWITZERLAND

Case in point, a simple map can make a mountain out of a molehill. A media event in early March 2010 unleashed a firestorm in Switzerland, a country again long known for its understated political neutrality. The Swiss press released a military map positioning the small nation in the middle of hostile territory. Europe is portrayed as a battleground with threatening starburst symbols, tanks, nuclear missiles, and dollar signs spotting the continent. By contrast, the centre, marked by the little white cross on a red background – by now a brand of anything Swiss –, poised to defend the land's fragile peace. In place of natural terrain, the map's geography is drawn in game-board-relief of accentuated national borders rendered as deep ravines separating countries, with Switzerland cast as fortress. The map's legend is quite telling: orange starbursts stand for those states posing a threat arising from political, ethnic, and religious clashes, red starbursts denote post-9/11 terrorist attacks on European soil, black starbursts identify areas of social unrest, nuclear missiles indicate neighbouring countries with weapons of mass destruction, tanks symbolize regions torn by armed conflict, and perhaps no less menacing, the dollar sign represents nations with unstable economies. Europe is a scary place (figure 3).



Figure 3 Map presented to the Swiss Parliamentary Security Council by Chief of the Armed Forces André Blattmann, 2010

In reality the map is a carefully fabricated and precisely targeted document motivated by multiple agendas, some more clear than others. Its au-

thor, Chief of the Armed Forces André Blattmann, presented his case for maintaining the integrity of Switzerland in a routine military report to the Parliamentary Security Council. The transparencies used by Blattmann to make his point were, despite his authoritarian frankness, anything but transparent. The material subsequently made its way to the press who did not miss a beat to put it in the larger political context and thus highlight the ulterior motives of the campaign. To ease entry into the story, local television framed the incident in such a way as to reach the largest audience possible, thereby capitalising on the scandalous ramifications of vilifying neighbours. Popular vacation destinations across the continent offered the perfect foil for the spin, with tourist sites now depicted as the source of unwanted migratory flows of people threatening to invade Confederate Helvetic space. In fact, an official message delivered to the public by the military commander himself: “[o]ne can imagine situations in which the army has to protect our infrastructure, for large migration streams might require troop deployment.”⁴ Yet another part of his argument showcased imminent economic risks, using EU-member state Greece as a convenient example of an already destabilised financial system on the doorstep of bankruptcy. As if this was not enough, he went on brazenly to warn citizens about the danger of Taliban-launched nuclear assaults on the nation’s power grid just to add fuel to the fire.⁵

Reactions to this episode – which unfolded on the heels of the equally sensitive Minaret Initiative that had angered Gaddafi – was broad, cutting across party lines and national borders alike. As can be expected, local leaders throughout the country scrambled to soften the blow of political incorrectness, the liberal Swiss Social Party (SP/PS) moved to take advantage of Blattmann’s faux pas, and Greece was outraged.⁶ Ultimately, the fallout led to the heated question: of all nations, why does Switzerland need an army?⁷

This seems to be the very question that prompted military leaders to construct the map in the first place. Faced with budget cuts, a plan was concocted to breathe new life into the existential necessity of the army. And territory played no small part in the case made. Blattmann actually framed his argument in a newspaper interview from the vantage of real estate and the immense portfolio of property assets belonging to the armed forces, at the time of the interview valued at approximately 25 billion US dollars.⁸ To make the argument more palatable, he cited in his pitch the decrepit conditions of barracks and significant maintenance costs for their upkeep. The message was clear: more money is needed for the army. Yet, when asked why they had not resorted to selling portions of the land holdings, he called attention to the space required for military exercises and related installations. Clearly this was a concerted effort to cloud the more central issue of winning new prestige and thereby justifying the military’s *raison d’être as raison d’état*. Indeed, according to the Chief, the state of Switzerland *does* need an army!

A state of emergency had to be induced and a palpable sense of angst manufactured to prop up the call for protecting the homeland, with space played as an agent in a blatant politics of fear. With this agenda, a threat-map had to be deployed as tactical weapon. A difficult geography emerges in Blattmann's doomsday scenario as impending terror is invoked to re-construct territory, thus further institutionalising national security. By presenting conjecture as fact, he purposely plays the trump card of patriotic identity versus the evil other. Switzerland is interiorised, walled, not physically but dogmatically and ideologically, and all in order to secure more funds for the military and its industry.

There is a precedent to this protectionist impulse that remains deeply engrained in Swiss mentality. Known as the *réduit*, or redoubt, the Swiss-conceived alpine stronghold denotes a place of refuge during times of war. The term has both a physical and psychological dimension. On the one hand, it is comprised of a series of fortifications strategically situated across the country to defend prominent points and deter enemy attack. On the other hand, it figures as the core of 'spiritual national defence' invoked to raise collective morale and remind citizens of the country's critical situation amidst hostile neighbours (Mooser, 2000). Blattmann plays on this very sentiment.

While of vital significance during World War II, the *réduit* dates back to the early 19th century and later gained importance in connection with the Gotthard railroad tunnel built in 1882 (Stamm, 2003). And this was no coincidence as the Gotthard Pass lies at the heart of the country and forms the key link between north and south. A caricature published at that time entitled 'After the Gotthard, the Matterhorn' ironically shows the ramifications of the Alps conceived as weapon (figure 4 & 5).



Figure 4 Caricature entitled 'After the Gotthard, the Matterhorn', published in the satirical weekly *Der Nebelspalter*, November 19, 1887



Figure 5 Via Tremola, Old St. Gotthard Road,
south side of the St. Gotthard Pass, 1928

Thoroughly excavated by caverns and encrusted with roads and cannons, the mountain becomes a technological object. During World War II, defence construction further escalated with considerable investments made in building more fortifications, which to some degree are still used by the army today. Henri Guisan, General of the armed forces during the war and no doubt a role model for Blattmann, reanimated the national call for resistance in the spirit of the *réduit* (Kurz, 1965). He declared in July 1940 that in case of attack by Axis forces, the Swiss would defend the high Alps and its infrastructure above all. To get a sense of the scale of the operation, 40 000 fortresses and subterranean installations were built during the war alone (Kurz, 1965: 77). Whereas the majority of these structures form extensive hidden networks, they most often surface in the landscape as idyllic, yet fake chalets, camouflaged as quotidian domestic architecture (Schwager, 2004). The Alps have been literally hollowed to become an infrastructural armature for national defence. The image of a perforated mountain range, not unlike Swiss cheese, increased the mythical power of the *réduit* as the last bulwark of territorial resistance (Kreis, 2010: 182) (figure 6).

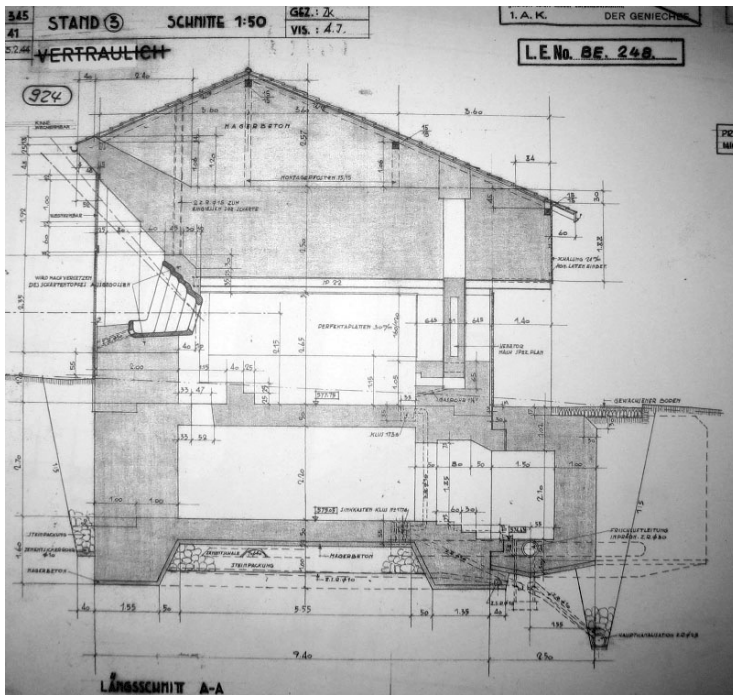


Figure 6 Section of World War II bunker camouflaged as Swiss chalet, 1944 (courtesy of the Swiss Army)

The effort to arm national space continued after the war, with commanders of the army still stubbornly committed to the idea of the *réduit*. While the rest of Europe had more or less ceased building fortresses, Switzerland kept looking for its protection underground. While approximately a billion US dollars had been swallowed up for fortifying the nation during World War II, an additional 10 billion was invested for the same purpose until the end of the Cold War, providing in the interim a welcome boost to the building industry (Stamm, 2003: 77).

Whether in the past or now, this intricate coupling of private sector business with a publicly funded army drives the very production of territory. This joint venture fuels a political economy that churns out state-of-the-art infrastructure turning country into machine. Known for its daunting natural landscape, which challenges the enterprise of grand designs, Switzerland has mastered the disciplining of topography by deploying civil engineering to turn an otherwise picturesque setting into strategic advantage: tunnels bore through miles of solid rock; bridges span treacherous valleys; and highways are laid with seeming indifference to rugged terrain – all built with first-rate cement produced by prosperous domestic industries. The heroics of such efforts were pointedly captured in an early documentary by Jean-Luc Godard

entitled *Opération Béton* released in 1958 – before Godard became the famed ‘Godard’ – that celebrates the construction of La Grande Dixence, a massive hydraulic dam built into the rocky landscape of the Alps. His voiceover expresses excitement about conquering topography and a sense of urgency associated with this national cause.

To top off the overall operation, post-war legislation in 1963, fuelled by prevalent Cold War fears of a nuclear offensive on home soil, even dictates that all buildings must be equipped with a subterranean concrete shelter for every Swiss man and woman (Führer & Wild, 2010; Aeberhard, 1983; Bachmann & Grosjean, 1969). Constituting one of the biggest building projects implemented in the history of the country, this venture takes the concept of the *réduit* down to the smallest, most filigree scale to form a decentralised network of capsular space. Moreover, ‘fortress Switzerland’ as project works to merge civilian and military purpose to secure national protection. Motivated by this insular mentality, it becomes clear that Blattmann’s map is just a cog in the wheel of a more complex machine. By demonising surrounding countries, the map serves the battle cry for ever more infrastructure that, of course, enables Switzerland to function like a fine-tuned clockwork nation should.

4. GREATER SWITZERLAND

If Blattmann’s map seems outrageous, it was outdone by an even more outlandish map published a few weeks later. Whereas the protectionist bid by Blattmann foresaw a walling of Switzerland, a subsequent initiative proposed by the right-wing Swiss People’s Party (SVP/UDC) envisioned instead an expansionist course for the country. In place of a military cause, here diplomatic negotiation was enlisted – a Swiss asset if there ever was one. A motion was submitted to the Parliament on March 18, 2010 by Senate member Dominique Baettig and co-signed by 28 of his fellow party affiliates. The plan was driven by the desire for a ‘Greater Switzerland’ and commissioned the Swiss National Council to investigate the legislative steps required to achieve this objective.⁹ Simply put, the appeal amounted to a coup as it concerned the annexation of regions from neighbouring countries. Said takeover would seize parts of France, Germany, Austria, and Italy, thereby altering the familiar political geography of Europe. The arguments in favour of participating in Swiss welfare are hard to resist: a direct democracy, an affluent market economy, and low taxes. Polls taken in those respective territories showed an affirmative reaction by local populations.¹⁰ The message seemed obvious, everyone would love to be Swiss.

Known in his pastime as an avid hunter, Baettig made a name for himself in politics as a staunch conservative. His background includes involvement in right-wing radical activities and associated journals. He likes to see himself as agitator or *agent provocateur*. In the context of the contentious Minaret Initiative, for example, he equated migrants with “*territorially-foreign species of invasive insects*” when provoking the Parliament to consider the economic consequences of uncontrolled immigration into Switzerland.¹¹ Intervening in politics abroad, he even had the audacity in a speech in France to suggest that minarets are phallic symbols of male potency. He received accolades from a cheering crowd of extremists in a country where the Muslim issue is already explosive. Clearly, the ulterior motive was to attack what he considered an icon not just of religious but also of political power in the Islamic world. He was caught on camera at this event by Swiss TV, a bout of media exposure that only reinforced his position with supporters at home.¹² What plainly functioned as propaganda ultimately served his later motion to gain a stronger foothold in Europe for the Helvetic Confederation through the appropriation of territory from neighbouring states.

Responses to Baettig’s proposition varied from applause to dismay, both nationally and internationally. Domestically, at the highest echelons of power, an argument was made against disturbing friendly relations with European neighbours, as those relations had already been tested by recent disclosures of foreign deposits in Swiss banks made to evade taxes at home. To counter this argument, the SVP/UDC cited widespread discontent by inhabitants from bordering regions. Situated on the periphery of their respective nations, this presumably dispirited constituency, according to Baettig and his party, has been disenfranchised by their own governments. The case put forth was to appease these regions by assembling them as new cantons under the umbrella of Swiss democracy and, in effect, prompt their surreptitious defection from the European Union. Viewed by the Swiss conservatives with disdain, EU government officials continue to be portrayed as an elite *classe politique* operating top-down from their remote headquarters in Brussels, the very argument made by Switzerland itself for not joining the EU. At stake is nothing less than the mobilization of sovereignty brought about by the annexation of territory.

This is a touchy issue with a sensitive history. The relationship between Switzerland and Europe has been marked by ambiguity both now and in the past. Although proudly autonomous, Switzerland is nevertheless tied to Europe. The small Alpine country enjoys the best of both worlds by maintaining independence and cultivating select cross-border relations at the same time. Basically, it gets its cake and eats it too. But this works two ways, insofar as adjoining countries have always enjoyed a safe haven of courteous hospitality coupled with gentlemanly discretion in financial matters. Maps of Europe

most often reveal this dual condition, with Switzerland depicted as either a blank hole or as privileged refuge. Whatever the case, to be situated in the middle proves to be an opportune place for manoeuvring, both politically and economically. This is certainly true for Switzerland in that it plays the role of strategic relay within a space of circulation. Here again, infrastructure is a crucial component in the business of routing and re-routing flows.

But these flows are not always visible as demonstrated by Switzerland's part in World War II. Then, trade relations and territorial disposition, as we now know, went hand in hand with political diplomacy. The prevalent picture painted during and after the war was that of a small country at the mercy of great powers – a classic David versus Goliath standoff. While figuring the *réduit* as key to defending Swiss independence might be reassuring even today, in reality accommodation, negotiation, and political savvy served as equally effective modes of keeping fascist aggression at bay. Yet, as advantageous as it was at the time for Switzerland to play strategic relay for financial transactions, including loans and credit to Axis powers, the exposure of this very practice taints the image of the country's neutrality. The so-called 'Swiss miracle' of coming out of the conflict unscathed is widely viewed today as a 'Swiss malaise' (Perrenoud, 2000: 26–27). It would seem that the business of give and take was crucial to national defence. Government authorities and industrial leaders acted, it is argued, more pragmatically than heroically when faced with the threat of invasion: industries supplied specialised products and financial institutions offered the liquidity essential to the war effort (Perrenoud, 2000: 28).¹³ To facilitate the movement of goods and money, things needed to be put in place and a complex apparatus was required, including everything from administrative procedures to logistical protocols and infrastructural systems that stretched far beyond national borders. Project 'network Switzerland' was furthered in the process.

Contrary to the *réduit* mentality behind Blattmann's vision for a porcupine-like posture toward the outside, the move to extend political and economic tentacles into a larger arena reveals another attitude regarding territory, one this time directed by circulation, movement, exchange, and so forth. This is what Baettig's scheme banked on, for there are significant benefits to his expansionist dream. Take the State of Baden-Württemberg for example. As one of the most prosperous regions targeted in the venture, it performs as a German Silicon Valley and functions literally as the country's economic motor, with elite universities and blue-chip company headquarters such as Porsche, Mercedes-Benz, Bosch, and SAP located there. The proposed incorporation of the region into Greater Switzerland would yield a match made in heaven considering the parity of the work ethic between Swiss and Germans, a deeply engrained ethic founded on a prudent morality coupled with economic thrift as addressed by Max Weber in his early 20th century treatise *The*

Protestant Ethic and the Spirit of Capitalism (Weber, 2011)). As a matter of fact, the territories of both countries are already integrated at least infrastructurally and commercially, forming a well-functioning transnational entity. But remember, Baden-Württemberg is only one piece of Baettig's larger plan for a Greater Switzerland (figure 7).

Were his motion to be approved by all involved parties, including those from France, Austria, and Italy, Switzerland would gain an additional 17 million citizens and its territory would triple in size overnight. To all intents and purposes, this would give rise to a politically ratified metropolitan cluster, if not a megacity in the centre of Europe. Whereas current domestic planning efforts and academic studies are inclined to view Switzerland as a large urban conglomeration, most still treat the country as fixed in terms of sacrosanct borders. Conversely, research projects such as those by ETH Studio Basel and Avenir Suisse have begun to soften the edges of the nation and consider mergers forming between city regions on its periphery (Schneider & Eisinger, 2003; Diener et al., 2004). This very perspective of seeing Swiss urbanization leak beyond national borders was taken up in a landmark document entitled *Spatial Concept Switzerland* and ratified in 2012 that showed, for instance, the region of Ticino spilling into the agglomeration of Milan, that of Basel flowing out into the Rhine Valley, and that of Geneva extending well into French territory.¹⁴ Surprisingly, Baettig's map was not far off the mark, for it seemed to anticipate the next logical step of a process already underway, one that challenges the political make-up of Europe as mapped in terms of bounded sovereign nations that are held in place by device of clearly drawn lines.



Figure 7 'La Grande Suisse', foreseen expansion of Switzerland's territory as proposed by the right-wing party, *Le Temps*, June 2010

5. ENTROPIC SWITZERLAND

Looking back at two figments of cartographic imagination, Switzerland seems to be faced with the incommensurable options of isolation or expansion: Blattmann is pitted against Baettig. Fantasy notwithstanding, the country is in fact pursuing both routes. What seems like opposing ideologies actually work in tandem to produce territory by taming space. Each plan relies on the provision of infrastructural networks to secure optimal channels for managing order. However, while each ideology aims for order, they unexpectedly contribute to an entropic territorial condition. Against better judgment and counterintuitive to the will to discipline, more control creates more disorder.

By now a well-known phenomenon and one that has plagued scores of scientists, geographers, engineers, planners, and politicians alike, entropy, or the tendency of a system toward spontaneous change, has spawned ever new tools to get a handle on a condition that by definition resists control. From GIS technology and anamorphic mapping to spatial statistics and morphological modelling, empirical data are crunched into what has effectively become our contemporary version of landscape painting, all diagramming urbanity without pause. With due respect, such labour faces the Sisyphean task of trying to contain cities and their metropolitan regions. As composed as it might appear, Switzerland's urban fabric no longer yields to an immaculate image, whether idealised on a map or rationalised in the mind. Quite the contrary, although clean and efficient, this urbanised country manifests an amalgam of disjunctive bits and pieces, each operating according to their own rules and agendas (figure 8).



Figure 8 Anamorphic map of Swiss agglomerations registering different population densities of communities in the country, 2000 (courtesy of Jacques Lévy, Chôros Laboratory, EPFL)

Though maps tend to homogenise whatever they address, the physical constitution of the territory at issue is comprised by a heterogeneous mixture of dense urban networks connected by endless conduits of infrastructure, loose agglomerations lined with industrial and commercial strips, areas of little or no activity, land set aside for agriculture, restricted military compounds, and plenty of nature to go around, all shaped by the mechanics of political and economic interests. What results is a fractured space that nevertheless functions as if by its own momentum, a diffuse arrangement not just of stuff, but also of regulations, standards, customs, and anything else needed to manage the operation of capitalising territory.

Switzerland's federalist model of governance exacerbates this condition, with over 2 700 constituent communities enjoying direct democratic representation. Everybody has a say. The distribution of power to localities is stamped directly into the land. Each community, for instance, devises its own zoning regulations that specify land-use in the spirit of the Charter of Athens's separation of functions, producing a spatial pixilation of sorts whereby the urban landscape is peppered with normalising codes ad infinitum. Though maps are the instrument of choice for translating normality into a geographic order, the resulting proliferation of regulation gives way to spatial cacophony. This in turn requires even more elaborate administrative protocols for municipal officials who are more often than not overwhelmed by the task of controlling development. But this account is only from the bottom up. Top-down management of territory involving regional planning at both cantonal and federal levels is also at play, inevitably leading to conflict with communal ambitions. One example dates from 1958 when a bill was passed in a national referendum involving a constitutional amendment to give the green light to a new freeway system that by now stretches over 1800 km throughout the tiny nation (Heller & Volk, 1999). Add to this the recent trend of roundabouts that has altered the face of domestic transit, with thousands and thousands of traffic circles introduced as if overnight. Darling of engineers, these beloved technical objects are the subject of countless manuals that cite their efficiency in facilitating circulation. You never have to stop while driving around in circles (figure 9).

And, these are only a few examples of the regulatory frenzy that bombards territory at all scales. Disciplining space is the name of the game; discipline normalises.

"Discipline, of course, analyses and breaks down; it breaks down individuals, places, time, movements, actions, and operations" (Foucault, 2007: 56)



Figure 9 Swiss military map at army training facility depicting German territory, Thun, 2005 (photograph by Deane Simpson)

Yet it seems that discipline cannot help but generate its opposite, a let-be-attitude toward a state of things, when multiplied ad absurdum. As side effect of hyper-discipline, this *laissez-faire* or *laissez-aller* state of things finds its equivalent in the economy, the key engine of urban development. Indeed ‘letting things take their course’ is an integral feature of the free market (Foucault, 2007: 41). While banking on entropy might well serve the financial sector, it also reconfigures contemporary city regions. One critical case in point are the variously adjusted tax codes at the cantonal and communal levels, which act as a precisely designed lure to attract both businesses and affluent citizens to settle in specific jurisdictions – triggering a veritable tax competition between communities. The lower the taxes, the higher the real estate value of property, leading to an uneven distribution of wealth and social rank that again leaves its traces in patches throughout the nation. At its most extreme, companies listed in Switzerland have no more than a post-box presence here in order to profit from tax incentives. For locals unable to pay ever rising rents, this often results in domestic migration from high-priced to more affordable regions. This exodus is compounded by immigration from nearby countries by foreigners wanting to avoid paying higher taxes back home while looking for a higher quality of life – an added flow of people that only sets off more territorial entropy.¹⁵

With no option except competition within a milieu of free movement of virtually everything, space as much as place is bought and sold. The mechanisms at work in the financial sector align with those of urban production. Anything profitable goes, and if not, is disposed of. For land holdings are just as dispensable as any other commodity, open to the market, with their scraps scattered across the map. So what is referred to as ‘open city’ in academia is

not necessarily an ideal setting for coexistence, for it is most often embraced by developers and investors as a pretext for anything goes (Christiaanse et al. 2009). Over and above hopeful thinking as so often manifested in pretty renderings, freedom of circulation rules as a technology of power in our current political economy.

At work here are modes of urban production that are not exclusive to Switzerland, as this itinerant economic geography knows no borders. With free circulation as its core principle, the urbanisation of territory gives rise to a transnational mentality of governance, a form of 'governmentality' to borrow an expression of Michel Foucault, that is formed by a nexus where profit and power trump space (Foucault, 2007: 108).[16] Yet, the pace of de-territorialisation and the appetite for unhindered development at all costs demands another frame of mind than those that bank on discipline alone. We need to enter the clockwork itself, operating from the middle-out and reversing its prescribed course if necessary. This might require a modified political economy that alters its view of territory as a neutral backdrop left submissive to forces that act upon it. Instead, territory can be viewed as active, as a dynamic network of actors in and of itself. This would mean that territory could take the lead and act to redirect political economy toward a more constructive mindset, where the physical milieu is empowered and viewed as an equal delegate at the negotiating table. Then, the map could no longer master territory, nor would territory be scattered around as passive victim by the whims of special interests. Rather, territory would be re-territorialised on interests inherent to territory itself, as vital resource and source of cultural identity, and not *just* raw material awaiting development. But this may require a change of direction, if not a flight of imagination that goes against the flow and counter clockwise to taken-for-granted cycles of capital.

ENDNOTES

- 1 Excerpt of Gaddafi's speech at the 35th G8 Summit in Abruzzo, Italy that took place in July 2009, see Samira Shackle, 'Colonel Gaddafi: "mad dog"?', *New Statesman*, February 25, 2010.
- 2 "In that Empire, the cartographer's art achieved such a degree of perfection that the map of a single province occupied an entire city, and the map of the Empire, an entire province. In time, these vast maps were no longer sufficient. The guild of cartographers created a map of the Empire, which perfectly coincided with the Empire itself. But succeeding generations, with diminished interest in the study of cartography, believed that this immense map was of no use, and not impiously, they abandoned it to the inclemency of the sun and numerous winters. In the deserts of the west ruined fragments of the map survive, inhabited by animals and beggars; in all the country there is no other relic of the geographical disciplines." Jorge Luis Borges (1935) *Historia universal de la infamia 'Etceteras'*, trans. Norman Thomas de Giovanni, *A Universal History of Infamy* (1975), London: Penguin Books, pp 28-29.
- 3 "The territory no longer precedes the map, nor survives it. Henceforth, it is the map that precedes the territory – PRECESSION OF SIMULACRA – it is the map that engenders the territory and if we were to revive the fable today, it would be the territory whose shreds are slowly rotting across the map. It is the real, and not the map, whose vestiges subsist here and there, in the deserts which are no longer those of the Empire, but our own." Jean Baudrillard (1981) *Simulacres et Simulation*, 'The Precession of Simulacra', in: *Simulations*, trans. Paul Foss, Paul Patton, and Philip Beitchman, New York: Semiotexte, p. 2.
- 4 André Blattmann interviewed by Patrick Feuz and Daniel Foppa, "Denkbar wäre ein Pikett-WK", *Tages-Anzeiger*, March 10, 2010.
- 5 Patrick Feuz, "Achtung, eine A-Bombe! Armeechef warnt vor Nuklearangriff in der Schweiz", *Tages-Anzeiger*, March 17, 2010.
- 6 "Armee Chef Blattmanns kuriose Karte", *Tages-Anzeiger*, March 15, 2010.
- 7 See Max Frisch (1989) *Schweiz ohne Armee? Ein Palaver*, Zurich: Limmat Verlag, written on the occasion of the national referendum to abolish the Swiss Army and support a comprehensive politics of peace in 1989 – with 35,6% of the voters in favor of the proposition.
- 8 Op. cit., *Tages-Anzeiger*, March 10, 2010.
- 9 Yves Petignat, "Boutefeu, l'UDC est prête à accueillir Aoste ou la Savoie", *Le Temps*, June 10, 2010.
- 10 "Umfrage: Nachbarregionen wollen der Schweiz beitreten", *Die Weltwoche*, July 22, 2010.
- 11 Heidi Gmür, "SVP-Nationalrat vergleicht Ausländer mit Insekten", *NZZ am Sonntag*, October 18, 2009.
- 12 Hans Stutz, "Es ist mir eine Ehre", *Die Wochenzeitung (WOZ)*, December 10, 2009.
- 13 See also the report by the Independent Commission of Experts Switzerland – Second World War (2002) *Die Schweiz, der Nationalsozialismus und der Zweite Weltkrieg*, also known as the Bergier Report, Zurich: Pendo Verlag.
- 14 *Raumkonzept Schweiz*, published by the Swiss Confederation (Berne: Schweizerischer Bundesrat, 2012).
- 15 For more on the uneven distribution of wealth in Switzerland see Philipp Löpfe and Werner Vontobel, 'Die Reichen ins Ghetto', in *Aufruhr im Paradies: Die Neue Zuwanderung Spaltet die Schweiz* (Zurich: Orell Füssli Verlag, 2011), 40-59.
- 16 Foucault defines the term as follows: "By 'governmentality' I understand the ensemble formed by institutions, procedures, analyses and reflections, calculations, and tactics that allow the exercise of this very specific, albeit very complex, power that has the population as its target, political economy as its major form of knowledge, and apparatuses of security as its essential technical instrument."

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Planning with water and traffic networks

Carrying structures of
the urban landscape

SYBRAND TJALLINGII

Abstract

The two networks strategy is a guiding model for planning and design that takes the networks of water and traffic as carrying structures. Its origin is in the early 1990s when it resulted from research by design projects aiming at the generation of tools for making urban development and the urban landscape more ecological. Reviewing practical experiences is one reason to look again at the strategy. A second reason is to explore the possible contribution to current debates such as those about complexity, landscape urbanism and landscape as infrastructure. The origin of the two networks strategy goes back to Ian McHarg's *Design with Nature* and Michael Hough's *City Form and Natural Process*. Inspired by them, the approach does not, in the first place, take nature and ecology to create limiting but carrying conditions. This asks for carrying structures. In the urban landscape there are at least three crucial fields of synergy between activities that ask for carrying structures: the territorial or spatial field or the area perspective, the activities related to flows that pass through these areas or the flow perspective, and the human activities involved in the plan and in the planning process or the actor perspective. The two networks create conditions for two multi-functional environments of synergy. The fast lane is the competitive profit-oriented zone where efficient production comes first. The traffic network is the carrier. The slow lane is the co-operation based non-profit oriented zone where water safety and quality, landscape and heritage, biodiversity, recreation and local food production are brought together. Here, the water network based on the drainage pattern is the carrier.

KEYWORDS

urban planning; urban design; landscape; infrastructure; landscape ecology; water networks; traffic networks; flows; strategic planning

1. INTRODUCTION

How is it possible to design spatial structures for urban and regional development that gear the diversity of needs and amenity to the carrying capacity of the planet and the ecological potential of the local landscape? In the early 1990s the idea emerged to answer this question by taking water and traffic networks as carrying structures in the making of strategic plans. Since then the *two networks strategy* has evolved as a conceptual guiding model for planning and design projects in the urban landscape.

Traditionally, biologists and environmentalists tend to take ecology to their own corner, the corner of conservation. Urbanisation is perceived as the enemy. In search of a more integrated approach and inspired by the emerging spirit of sustainable development that led to the Rio Conference in 1992, researchers and designers from different backgrounds embarked upon a programme of studies and pilot projects to make urban development itself more ecological. This implied a reframing of the issue: from ecology providing limiting conditions to ecology providing carrying conditions. The Dutch National Spatial Planning Agency initiated and stimulated this process in the years that followed (Tjallingii, 1981, 1995, 1996; Zonneveld & Dubbeling, 1996). The *two networks strategy* is one of the fruits of this programme. Over the last twenty years this strategy served as a conceptual tool, a guiding model that has guided planning and design projects at different levels. The purpose of this paper is to provide a critical review of these practical experiences. Learning from practice, the paper further elaborates on key elements of the strategy and explores the contribution that can be made to current debates about complexity, landscape urbanism and landscape as infrastructure. In this way the paper is part of a process of learning. In the TU Delft methodology review *Ways to Study and Research* this is called study by design (De Jong & Van der Voordt, 2002:19, 20; Frieling, 2002: 493).

1.1 Basic questions

This paper focuses on the role of the *two networks strategy* as a guiding model, as a conceptual tool. How is it used? Did it play the role of creating a frame for integrated urban development? The term ‘integrated’ is approached from three corners (see figure 1). From an area perspective, it is a question of durable diversity: the use of the identity and the ecological potential of the area for economic development and other activities such as maintaining biodiversity. Do the spatial elements fit together? From a flow perspective, it is a question of the safe and sustained use of resources. This includes balancing the upstream and downstream use of flows, and working with the ‘reduce, reuse, recycling’ principle. Do flows fit to the local situation and to each other?

From an actor perspective, the question is about a sustained commitment from the actors. This includes the capacity of the carrying structures

to act as a frame for a flexible infill that can meet the needs of yet unknown future activities. Does the structure create conditions for avoiding conflicts and promoting synergism?

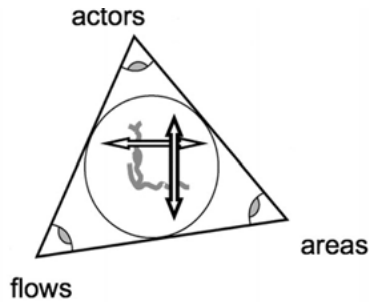


Figure 1 Three action-oriented integration perspectives (Tjallingii, 1996)

1.2 Outline

After a short description of the origin of the approach in an international perspective, the paper will discuss the area, flow and actor perspectives highlighting practical experiences and comparing with other concepts. In the conclusions, the paper focuses on the Schalkwijk case, an example of an integrated project that used the *two networks strategy* to structure the plan. The case illustrates answers to the basic questions posed. The final section compares this strategy with other integrated approaches.

2. ORIGIN AND HISTORY OF THE APPROACH

Rapid urban and industrial development in the period after the Second World War triggered a wave of environmental awareness in the 1960s and 1970s. Most ecologists with a biological background perceived urban development as a threat to ecology. The 3rd edition of the well-known textbook *Fundamentals of Ecology* by Eugene Odum, published in 1971, characterised urban-industrial environments as non-vital systems. (Odum, 1971: 269). Today, however, urban metabolism studies have become a major field of research (Holmes & Pincetl, 2012). And even biological research programmes such as the *Long-Term Studies of Urban Ecological Systems* (Grimm et al., 2000) are now based on two approaches: the ecology in the city, referring to wildlife in the city, and the ecology of the city, referring to the city itself as an ecosystem.

Unsurprisingly, planners and designers have less difficulty with integrated approaches. Frederick Law Olmsted was a great pioneer in this respect who with his 1887 plan for the Boston Emerald Necklace Park System showed how urban development can benefit from a design that incorporates natural valleys that act as drainage and water retention systems combined with an urban park (Spirn, 1984: 147; Ahern, 1999). This is a good case of good practice preceding the theory of it. Unfortunately, in the first half of the 20th century, practice was dominated by geometric form and function based concepts and it took nearly a century for Olmsted's ideas to be put into practice again. Planners like Patrick Geddes and Lewis Mumford continued and elaborated on these ideas, but it was Ian McHarg with *Design with Nature* (1969) who really brought ecology back as both a source of inspiration and a practical guide for urban design. To McHarg the use of what he calls natural process lands is central. In the urban landscape this implies a central role for the water cycle and its natural drainage pattern, valleys, floodplains, aquifers, steep slopes and forests. For reasons of safety, health and identity, urban man-made structures should fit to this existing natural order. Inspired by McHarg, other landscape architects, such as Michael Hough and Ann Spirn, further explored and elaborated this approach to urban design. For them too natural processes, not nature as an object, constitute the basis for urban design. In his *City Form and Natural Process* (1984) Michael Hough argued for an integrated management philosophy for the planning and design of open space. Beyond recreational and aesthetic values, open spaces should assume multi-functional roles, including water and waste management and biodiversity. Also in Europe, integrated ecological approaches to urban planning emerged (Tomasek, 1979; Tjallingii, 1981; Adam & Grohé, 1984; Neddens, 1986). In this tradition, the *two networks strategy* was introduced as one of the conceptual tools of the *Ecópolis strategy* (Tjallingii, 1995), later deepened and widened to the *Ecological Conditions Strategy* (Tjallingii, 1996).

Figure 1 summarises the key issues of this integrated ecological approach to planning. Traditionally, specialists such as spatial planners, engineers and policy makers tend to take urban development to their own corners represented by the area, flow and actor corners of the triangle. The scheme points at the need to turn around and keep an eye on the whole, represented by the circle. Just as the specialists in a hospital are expected to keep an eye on the whole person, the specialists in urban and regional planning are invited to use their own expertise but share their views with others and together focus on the integrated urban landscape. This paper approaches several basic action oriented questions from the different perspectives of each of the three corners. The focus here is on the two networks.

Reframing the role of ecology from creating limiting conditions to creating carrying conditions leads to a search for spatial and functional carrying structures. Here, the *two networks strategy* follows a line of thinking that took shape in the Netherlands around 1990 with the ‘casco concept’ (frame concept), a conceptual strategy that takes water networks as a carrying frame for rural development (Sijmons, 1990; Kerkstra & Vrijlandt, 1990). The casco concept sought to create a frame as a carrying structure based on the synergism of water management and nature – both in terms of conservation and new habitat construction – and created conditions for industrial land-bound agriculture in the spaces opened by the frame. The path-breaking plan *Ooievaar* (‘Stork’ in Dutch) illustrated this approach for the rivers of the Dutch delta (De Bruin et al., 1987). The plan proposed a framework of floodplains where nature was to replace agriculture. The *two networks strategy* expanded this idea to include urban development and took the traffic network as a second carrying structure for both agricultural and industrial activities. These activities require transport conditions that meet the demands of the dynamics of technology and economy. After its first publication (Tjallingii, 1992 English version 1995) the *two networks strategy* found its way to Dutch practitioners (Zonneveld & Dubbeling, 1996), to European platforms (Expert Group, 1996: 199) and to subsequent studies and projects that made use of the strategy (Aalbers & Jonkhof, 2003; Tjallingii, 2000, 2004, 2005). In 1997, the strategy inspired one of four prospective scenarios for The Netherlands in 2030, commissioned by the Dutch National Spatial Planning Agency (Tjallingii, Langeveld & Bus, 1999). At the local level the strategy was used in a number of projects. Some are discussed in Aalbers & Jonkhof (2003).

3. AREA PERSPECTIVES

How does the strategy work in plans and projects at different levels of scale if we look at it from a territorial quality point of view?

3.1 Design at the neighbourhood level

Figure 2 shows how the model can guide the design process at the scale of a small urban neighbourhood: the Poptahof project in Delft, the Netherlands. The neighbourhood of Poptahof, Delft was built in 1969 and renovated over the last ten years. (Van Dorst, 2005). The site consists of two groups of six apartment buildings, 11 and five storeys high. The schemes on the right represent them as two grey rectangles. Design option *b* for the roads and *c* for surface waters offer the most promising combination and create conditions for a quiet central zone of a park with a pond, a place to sit, walk and talk, where children can play safely. The pond can also store storm water run-off.

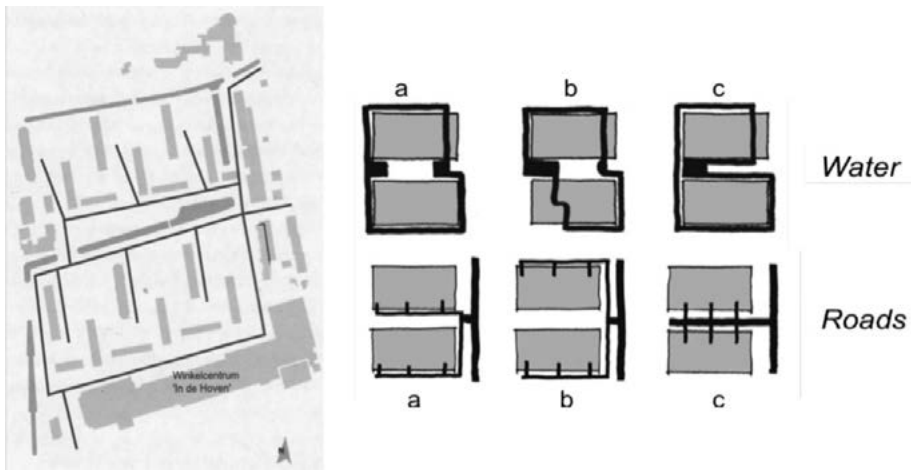


Figure 2 Delft, Poptahof. Design options for an urban neighbourhood.

Left: existing situation, light grey: buildings; dark grey: water; black: roads. Right: design options

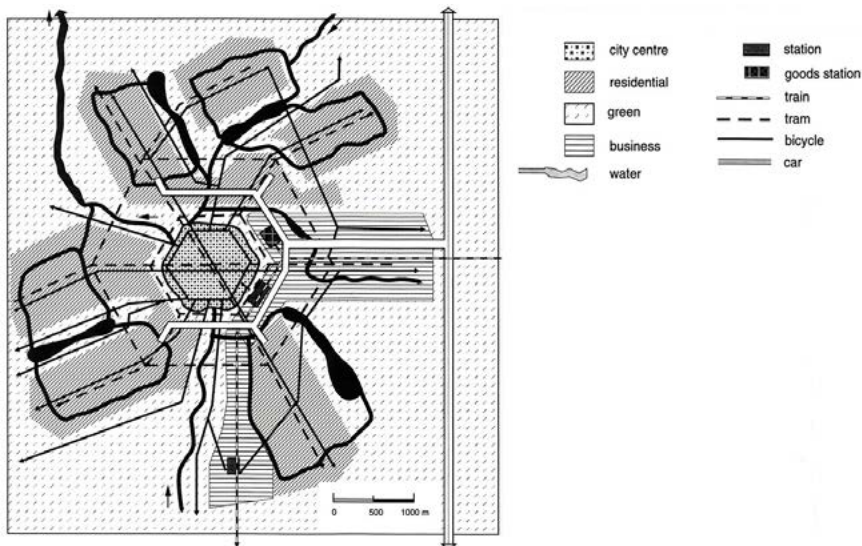


Figure 3 The city model (Tjallingii, 1995)

3.2 A city model (figure 3)

The city model in figure 3 shows a guiding model based on the *two networks strategy* suitable for medium-sized cities of 100 000 inhabitants as presented in Ecópolis (Tjallingii, 1995: 94). In short, the model uses the well-known experiences of many lobe shaped cities with green wedges, such as Copenhagen.

From an area perspective, the model creates conditions for a long quiet edge with attractive residential environments, close to urban services and close to green areas. The green wedges offer opportunities for recreation, biodiversity and urban agriculture. They also are a basis for a green cycle network and for water storage. The motorway on the right side gives direct access to the business district and connects to the residential areas with minimal disturbance.

In design practice, the use of this guiding model is sometimes met with difficulties. Many cities, for example, are not star-like. The model, however, is an abstraction and the essential characteristic is not that of star form, but the edge qualities of a green structure that penetrates into the built environment. In a European project entitled *Green Structure and Urban Planning* (Werquin et al., 2005; Tjallingii, 2007) detailed studies situated in cities from 15 different countries demonstrated that it was not the limiting conditions of greenbelt strategies, but the carrying conditions of green structure strategies that offered a promising perspective for the qualities of green edges, supported by the *two networks strategy*.

In some cases the green structure is a new artificial design. More often however, urban green structures relate to river valleys, floodplains, coastal zones and other elements of the existing ground layer of the urban landscapes. Even in cities with high-density built-up areas and no green spaces, it is sometimes possible to redevelop old railway yards, industrial or harbour areas and re-introduce green structures. The city model may offer a strategy for the integration of green spaces into an existing city.

3.3 A regional model (figure 4)

The *two networks strategy* introduced in the first publications did not present full networks, only parts. Yet at the regional level this is inadequate. An opportunity to elaborate a full regional network scheme presented itself in the research and teaching programme of the IUAV University in Venice, Italy. The structuring capacity of water and asphalt, the infrastructure of these two networks, is a leading theme in this programme that focuses on the dispersed form of the European city as found in the Veneto plains north of Venice (Vigano, 2008). Here, the capillary networks of mobility and water have created *città diffusa* (diffuse city), an urban landscape characterised by many phenomena that are 'equal in all directions' or isotropic. This area is also characterised by a high degree of self-organisation based on a culture of small family based businesses. Yet more recently, these local networks have become part of global supply chains and market networks. As a result, hierarchy confronts isotropy. Big 'tubes' of new impermeable motorways cut into the existing permeable capillary 'sponge' of road networks (Secchi, 2011). An increasing number of trucks, private cars and farming machines use the same narrow roads. Expanded paved surfaces increase the risk of flooding. The *cit-*

tà diffusa is under pressure. The *Regional Model* (figure 4) develops a scheme that guides the construction of scenarios for the future of different parts of the plains (Tjallingii, 2010). The basic idea is to upgrade and downgrade both roads and watercourses. The thick black roads will be upgraded to accommodate car-based traffic, especially goods transport. In this way traffic can serve the needs of industry and world market oriented agriculture. Moreover, these roads reduce congestion and the risks of busy roads crossing residential areas.

Some watercourses will be upgraded to accommodate water storage and purification. In this way the plains will be better prepared for climate change. At the same time these blue-green structures provide attractive green spaces close to residential areas and supported by multifunctional agriculture.

The landscape will still be isotropic in that it carries a multifunctional diversity of comparable qualities in all directions. However it will be diffuse at a higher scale. There is no way back to the fine-grained patterns of fifty years ago but at the lowest level there are good conditions for the quality of the edges. This can also be an attractive perspective for many other regions with diffuse urbanisation processes.

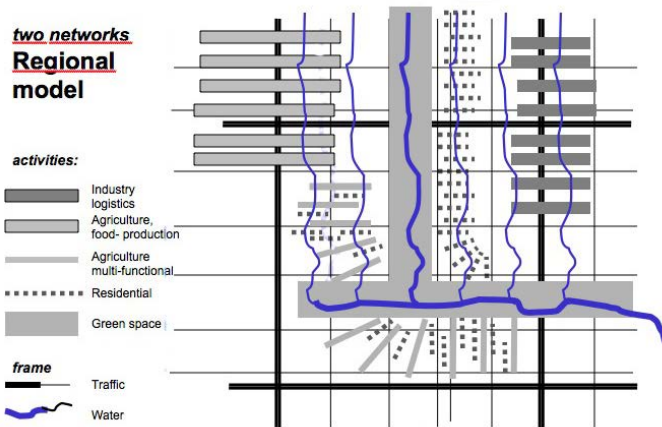


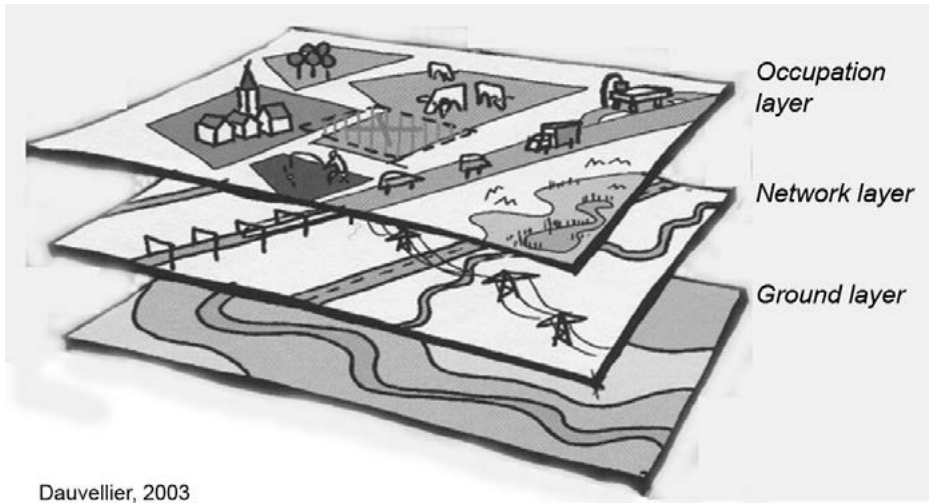
Figure 4 Regional model (Tjallingii, 2010)

3.4 Starting with the network layer

From both practical experiences and further elaboration of the *two networks strategy* it becomes clear that it can guide the design of a carrying structure for activities. However, the relationship to the potentialities of the underlying urban landscape is also an essential element. The so-called layer model, presented in figure 5, illustrates the position of the networks ap-

proach. The layer model is an analytical scheme; it does not guide planning actions. In practice, planning is often programme oriented: it starts with the occupation layer, then seeks to develop the supporting networks and then looks at the way the ground layer has to be adapted to the chosen land-use objectives.

In this way development tends to generate environmental problems as undesired externalities. The *two networks strategy* is different. It starts with the network layer. In designing the water structure it starts with the ground layer that includes the hydrology of the area resulting from the historical interaction between nature and culture. Designing the traffic structure, however, is starting with the occupation layer, the first idea about the activities' programme that triggers the planning process. In this way, the *two networks strategy* plays an intermediate role in seeking the best balance in the interaction between activities and the ecological basis.



Dauvellier, 2003

Figure 5 The Layer approach (Ministerie van VROM, 2004; Commission of the European Communities, 1999)

4. FLOW PERSPECTIVES

If we were to look at it from a flow point of view, how does the strategy work in plans and projects of different levels of scale?

4.1 Flows and networks

From a flow perspective, the *two networks strategy* addresses central issues of water and traffic flows. These are the flows with most spatial implications for the plan. Figure 6 presents the model of the strategy with an emphasis on the flows.

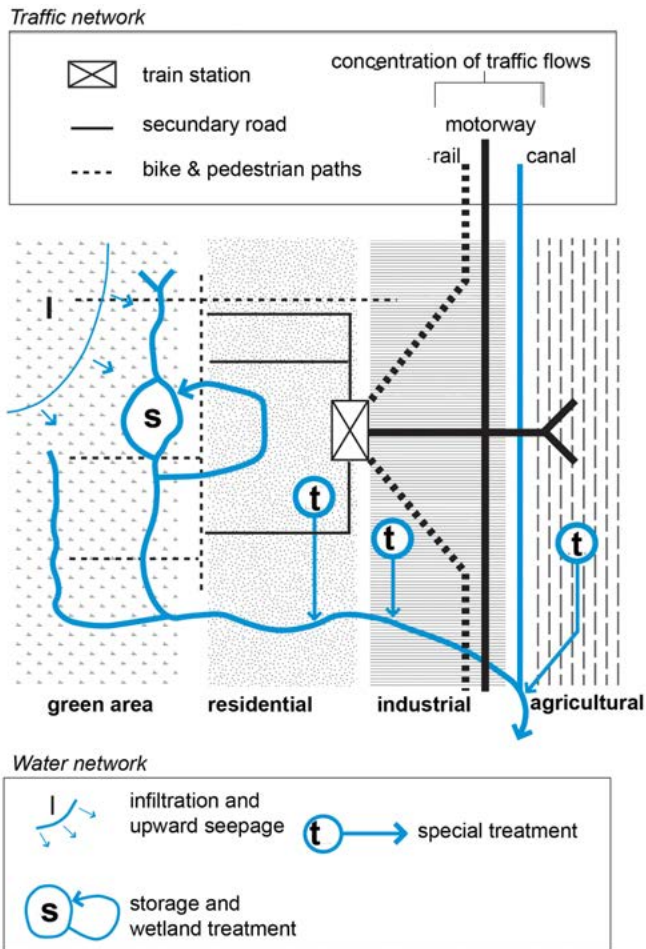


Figure 6 The two networks strategy guiding model (Tjallingii, 1995, 2005)

4.2 Water flows

The implication is that of all the water flows, the infiltration and drainage networks, can play a role as a spatially organising structure: the infiltration zones, small rivers and valleys, bigger rivers and floodplains, wetlands and lakes. Shipping canals may have a role in the supply or discharge of surface water, but their position and direction primarily depend on transport considerations.

In the top left corner of the general model in figure 6 there is a hill with infiltration, then, at the foot of the hill, there is a zone of springs with upward seepage that generates a network of smaller and bigger rivers. A key element is the presence of water bodies for storage. Increasing paved surfaces leads to peaks of storm water run-off that require rainwater peak storage to

prevent flooding. But too little water can also be a problem. For the green parts of the urban landscape it is important to have seasonal storage, surface water or ground water bodies that can store water temporarily in order to use the wet season's surpluses for dry season's needs. The strategy shown in figure 6 demonstrates creating space for peak and seasonal storage in the green zone. In the other zones more technical strategies can be applied. For example slowing down storm water run-off by using rainwater inside buildings or by installing green roofs. This is a discussion about quantity. From a water quality point of view the key question is how to address downstream pollution problems caused by upstream sources of pollution. If there is only moderate pollution, as in green and residential zones, wetland treatment can be effective and the space required can be found by combining the wetlands with the storage lake. More heavily polluted wastewater from offices, shops, factories or high production farms may require special technical treatment as indicated by (t) in figure 6. For water pollution it also applies that 'an ounce of prevention is worth a pound of cure'. Good design is prevention.

In quiet zones, the green zone and the adjacent quiet side of the residential zone, the models shown in figure 7 can guide the ecologically and spatially detailed design process. The bypass and gully model is a strategy to deal with the risks of river floods. As a guiding model for increasing the flood plain capacity it is derived from the Dutch *Room for the River* programme (Rijkswaterstaat, 2000) which has been adopted as official policy and is currently being realised.

The infiltration model is a solution for run-off problems in situations where groundwater and soils allow for infiltration. Rainwater can be stored in groundwater. The circulation model performs the same role in situations with impermeable clay soils and shallow groundwater tables. In that case fluctuating surface water levels can provide storage. The infiltration and circulation models create rainwater storage at the neighbourhood level, a condition for separating wastewater and rainwater. In the past twenty years these models have developed as common conceptual design tools (Tjallingii, 2012). Explicitly or implicitly the basic principles of these models have been used in a great number of projects in Europe, America and Australia.

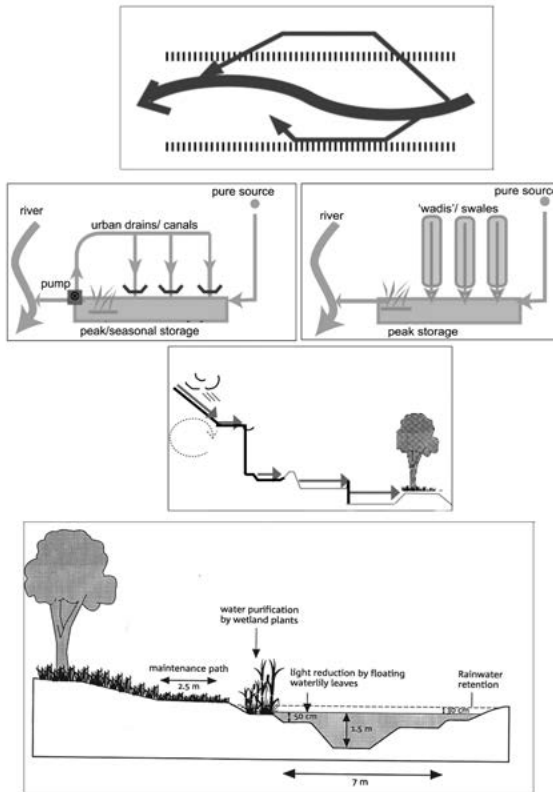


Figure 7 Water guiding models (Tjallingii, 2012)

4.3 Traffic flows

Traffic can be a flow of vehicles, carrying flows of materials, but it can also be approached as a flow in its own right. Figure 6 shows a traffic corridor on the right hand side to serve the industrial and agricultural businesses. On the other side there is no busy traffic to disturb the quiet residential and green zones. How do these simple proposals relate to theory and practice of traffic networks? In practice many cities developed on the waterside at a time that shipping was the most important way to transport goods. As a result, businesses set up along the water and big roads were built there to serve them. Shipping is still important for some goods and for cruises, but the seaport activities have moved seaward to deeper waters and river harbours have developed outside the city centres. But many roads are still there. Paris, for example, struggles with busy roads on both sides of the Seine that make the waterside almost inaccessible. Cologne has built a tunnel for traffic and on top of it a river promenade along the Rhine. Many cities, such as Barcelona have realised similar projects as part of their waterfront redevelopments. And

now also Paris has made a first step. In summer, part of the busy road is closed and replaced by a temporary promenade along the river: *Paris plage*. Clearly watersides are attractive for slow lane activities and these are not compatible with fast lane dynamics.

Current transport and traffic studies (Immers & Stada, 2004) distinguish between three main fields of choices in traffic planning related to urban development:

1. the *travel market*, where the need for transportation is the central question;
2. the *transport market*, where the choice of transport means is the issue;
3. the *traffic market*, where the opportunities of regulating the flows is the focus.

Figure 8 shows some traffic guiding models for different situations that require different detailed traffic network design solutions, all fitting within the general scheme of the *two networks strategy*.

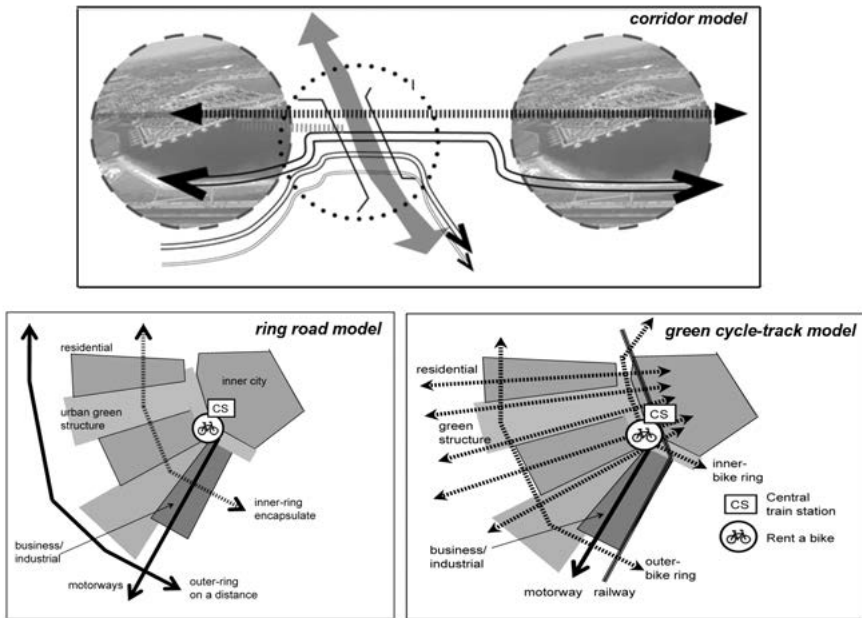


Figure 8 Traffic guiding models

The ring road model aims to offer attractive green environments with residential quality on the edges of the city so that people can buy or rent a house that is close to both green areas and urban services and jobs. This may reduce the transport need for commuters who want to live in the green and work in the city.

The green cycle-track model further elaborates the possibilities of an attractive network for the movement of bicycles based on the blue-green network of the city. Also electric bikes and low-speed electric vehicles may use this network. Blue-green and slow traffic networks are good allies.

The traffic corridor model seeks to reduce congestion by functionally separating long distance and short distance flows. From a spatial point of view concentration is desirable. The model indicates how spatial concentration can create effective investment in noise and pollution control and in bridges and tunnels to reduce the barriers. This facilitates the crossing of blue-green networks.

4.4 Industrial ecology and landscape ecology

The *two networks strategy* model shows a quiet zone or slow lane, carried by the water network and a dynamic zone, the fast lane, carried by the traffic network. In the slow lane, space is made available for water storage and consequently the hydrology, geology, soils and geomorphology of the local landscape play an important role. Here, landscape ecology is a key discipline for planning. In the fast lane, however, industrial and agricultural activities have changed the natural landscape more radically and there is a strong competition for space. Here environmental criteria for design are equally important but they tend to be more related to resources and waste issues of the wider environment or other parts of the world. The emphasis of design solutions is more on technology and the key discipline is industrial ecology.

5. ACTOR PERSPECTIVES

5.1 Social aspects of fast and slow lane dynamics

In urban planning, there are strong arguments for creating zoning for fast and slow lane worlds: not the traditional mono-functional zoning, but a multifunctional spatial organisation. The distinction is based on activities and their spatial behaviour (figure 9). In the two multifunctional activity zones the ecological approach is linked to social and economic processes.

The social aspect of slow lane and fast lane zoning is based on understanding “*how vital it is for a town to give people both intense activity and deep and satisfying quiet*” (Alexander et al., 1977). This is the contrast the city has to offer its citizens. Creating a long edge and quality of the edge is a basic condition for giving access of a great variety of urban citizens to a wide variety of urban environments.

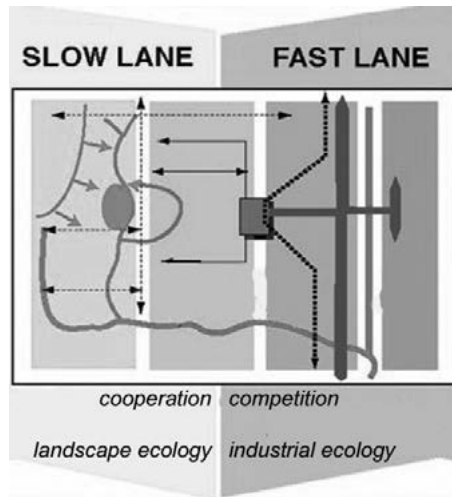


Figure 9 Activities model of the *two networks strategy*

5,2 Economic and financial aspects of fast and slow lane dynamics

The economic aspect of the slow-fast dichotomy is on the one hand the increasing importance of heavy infrastructure for the industrial and commercial activities that have to survive in a competitive global economy. The fast lane is the competitive profit-oriented zone where efficient production comes first. The role of the government here is to invest in the transport infrastructure and to stimulate innovation in production and in industrial ecology. Public investment will be recouped from profitable business activities.

On the other hand for companies it has become increasingly important to follow the preference of their employees for close proximity to a green and quiet residential and recreation landscape. This is illustrated for example by the collective efforts in the German Ruhrgebiet to revitalise the Emscher Region blue-green structure as part of the economic survival strategy for the old industrial area (Schmid, 1995). Thus, the fast lane world depends on the quality of nearby slow lane environments. The slow lane is the co-operation based non-profit oriented zone where water safety and quality, landscape and heritage, biodiversity, recreation and local food production are brought together to create long term conditions for safety, health and quality of life. These activities are not suitable for making short-term profits. The role of the government is primarily to create an institutional and financial setting for public and private organisations to operate cost effectively.

5.3 Two economic models for farming

Modern land-based farming is part of the world market and can only survive if the farms have optimal transport connections. It is part of the fast lane world. Economic pressure forces the farmers to adapt land and landscape, fill ditches, lower groundwater tables and cut trees. In this economic context, land-based farming cannot support fine-grained landscapes. A recent study by the *Institute for Agricultural Economy* in the Netherlands has made clear that a fruitful synergy between agriculture and the urban landscape of the Randstad depends on a new economic model for urban agriculture with short food chains, sustainable small-scale production and regional products (Vogelzang et al., 2011). Financial support for these farmers in exchange for what is called green-blue services is part of this economic model. Only in a slow lane environment can multi-functional urban agriculture play a role as an economic carrier of fine-grained landscapes.

6. TWO NETWORKS STRATEGY IN AN INTEGRATED CASE: SCHALKWIJK

The Schalkwijk case (figure 10) is chosen to illustrate how the strategy can act as a guiding model in a real process of planning and design. This case is a good example because the planners explicitly took the *two networks strategy* as a guiding model. Schalkwijk is a residential district in Haarlem, west of Amsterdam, with 30 000 inhabitants and built in the post-war period. It is a one-sided social housing area with predominantly rental apartments and a shopping centre. As in many of these developments of the same age, this area threatens to slip into a downward spiral of unemployment, poverty and poor living conditions due to social and economic change. The *two networks strategy* guided the structure plan (Van Eijk, 2003) that was adopted in 1999. The basic structure has been realised and now serves as a frame for further infill and detailed projects. Here, we take the basic questions raised in the introduction of this paper to demonstrate how the strategy guided the structure of the plan and the planning process.

From an area perspective the Schalkwijk planning process, guided by the strategy, led to the decision not to build a ring road in the urban fringe but to concentrate car-traffic and slow down its speed in the central zone to give access to the offices and the shopping mall that is in a process of modernisation and upgrading. As a result, the fringe zone with water as a carrying structure can become a quiet zone with a park, urban agriculture and interesting natural habitats for biodiversity. This is a multi-functional zone that uses the identity of the historic landscape structure.

From a water flow perspective, a storage lake and wetlands in the urban fringe provide peak storage, seasonal storage and quality control of surface waters. From the storage lake, the water re-circulates through the built-up areas and then returns to the fringe. The guiding model used in this case is the circulation model (figure 7). Only rainfall exceeding the storage capacity flows into the river Spaarne that runs to the sea.

From a traffic flow perspective the ring road is kept at a distance and the inner ring and access road has reduced speed and improved crossings. The central position creates conditions for collective transport and the blue-green structure also carries an attractive network for bikes. In this way the ring road and green cycle track models (figure 8) have guided the design. The structure plan creates conditions for more sustainable management of water and traffic flows.

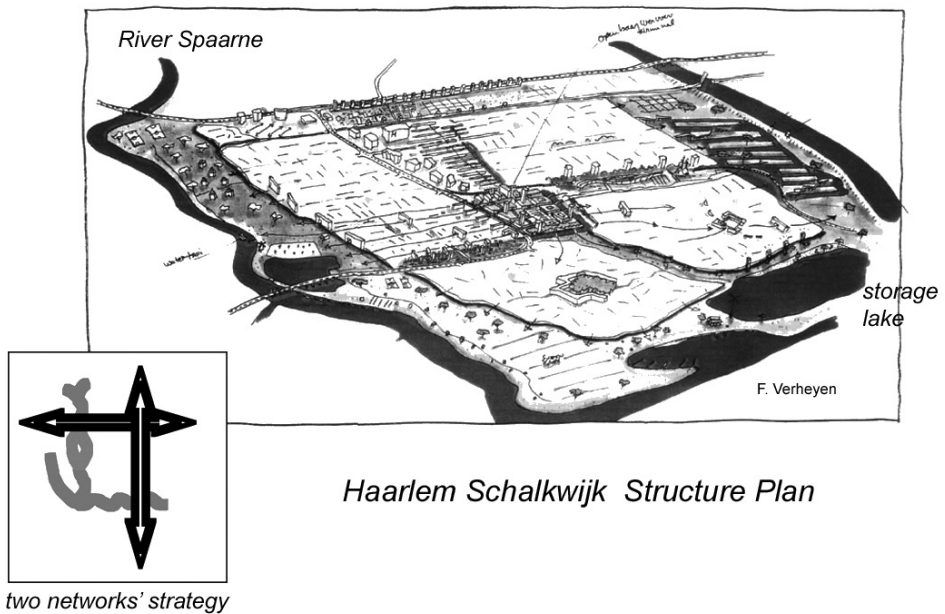


Figure 10 *The Two Networks Strategy* and the Schalkwijk restructuring plan. Water is shown in black

From an actor perspective, the network approach stimulated the actors to discuss their ideas in a long-term perspective regarding needs and potentialities. In an early stage a workshop with residents generated seventy proposals that were used by working groups of public officials and private organizations to solve social, environmental and spatial issues in the plan. The redesigned

fringe area greatly enhances the quality of the edge, creating attractive places for the construction of middle class houses that combine a nice view with the proximity of both green spaces and the shopping centre. Diversification of the housing stock is one of the social objectives. For those residents that improve their income, it creates possibilities to stay in the Schalkwijk area and move to the new houses on the edge. Given the demand, investment and development is relatively easy. Also lower income residents from the apartment buildings will benefit from the presence of the green and quiet fringe zone. The durable frame of the carrying structures creates two magnetic fields of fast lane and slow lane environments allowing for a flexible infill in the future. The spatial structure avoids conflicts and promotes synergism.

7. DISCUSSION

7.1 Theory and practice

Urban planning practitioners are often sceptical about conceptual models such as the *two networks strategy*, “because our situation is different”. In discussions it is assumed that they may be useful in new greenfield urban developments but not in existing situations. However, the Schalkwijk case demonstrates how the guiding model is used in restructuring an existing residential area. The regional model also refers to an existing landscape. Even in old industrial brownfield areas, with no green spaces available, the strategy can be a fruitful guide. In many old cities the river valleys provided hydro-power and thus became the carrier of early industrial development. The study by Werquin et al. (2005) discussed many examples, such as Sheffield, where the industrial backbone is turned into a blue-green axis for recreation and nature. In more recent transformations, we often see that polluted lands left behind after the collapse of heavy industry may become part of a green structure, often in combination with phyto-remediation or other decontamination procedures. Thus the former fast lane becomes part of the slow lane.

7.2 Cradle to cradle and Blue Economy

The approach of the *two networks strategy* presented here combines flow management with territorial structure. From a flow perspective, it is compatible with the ‘cradle to cradle’ vision (Mc Donough & Braungart, 2002), however the ‘cradle to cradle’ recycling strategies aim primarily at “*remaking the way we make things*” which relates directly to industrial ecology. With traffic and water flows the issue is not only recycling but the use of the territorial structure in relation to cascading, storage, model split and the design of crossings. This implies that the approach starts with landscape ecology before it goes to industrial ecology. But of course the combination is what counts in

the end. In this respect the *two networks strategy* fits very well in what Gunther Pauli calls the *Blue Economy* (Pauli, 2012). Here the issue is the optimal use of local resources in a multi-functional approach.

7.3 The ecological footprint

In flow analysis and urban metabolism studies, input and output are key issues. The ecological footprint approach (Rees, 1995) focuses on input and output and offers a method to calculate the impact of an urban system on the neighbouring countryside or on other parts of the world. Aside from the discussions regarding quantitative values used in the calculations, a critical remark can be made about the implications for planning. The suggestion is that a small footprint is always better and this idea has stimulated many environmentalists and architects to design and develop self-sufficient buildings or neighbourhoods. A network approach does not discourage self-reliant systems, but creates a basis for strategies that seek the synergism between the parts, for example between town and country, fringe and centre. If synergism works, the footprint of the parts is less important. The fitness of the whole is more than the sum of the efficiency of its parts.

7.4 Coping with uncertainty

The *two networks strategy* is a guiding model for strategic plans. These plans aim to improve decision-making. They create the frame for operational decisions that effectively change the world (Faludi, 1987: 118). This is problem setting and not yet problem solving (Schön, 1983 [1991: 40]). Weighing and detailed calculations will play a role in later operational stages of planning. The strategic frame however, creates a basis for coping with uncertainty. For example, one cannot with certainty determine the capacity of a retention lake that can cope with future heavy rainstorms because we do not exactly know what can be expected as a result of climate change. In such a case it may be useful to create other good reasons to design a lake with a considerable size. Creating allies, synergistic systems, is a matter of strategic plans. The water guiding models address uncertainties related to climate change and the traffic strategies address basic complexity and uncertainties related to economic globalization. By combining them in a two networks approach we create a durable frame that allows for flexible infill.

7.5 The layer approach and landscape urbanism

This approach takes landscape as a basis for urban planning. As discussed in the comments that go with figure 5, landscape is both the ground layer of spatial potentials and the occupation layer of spatial intentions. The *two networks strategy* suggests starting with the water network and the slow lane environment and adjusting them to the ground layer. Then the traffic net-

work and the fast lane environment will be planned on the basis of future occupation. In this way the two networks offer an action oriented strategy that fits well in the approach of the studies and plans discussed in the *Landscape Urbanism Reader* (Waldheim, 2006). It seems, however, that in most of these cases more attention is given to industrial ecology than to landscape ecology. The rehabilitation of abandoned industrial areas, waste dumps, former mines and other drosscapes (Berger, 2006) seem to play a more important role than design with nature as design with the ground layer, in the tradition of Mc Harg and Hough. The two networks approach offers an opportunity to combine the industrial and landscape ecological strategies. In the context of landscape urbanism, the concept of infrastructure is not always clear. In his book *Landscape Infrastructure*, Bélanger (2013), discusses the urban landscape as a whole as infrastructure in a combined engineering and design perspective. It seems better to distinguish between landscape as a combination of the three layers and infrastructure as one of the layers: a network of carrying structures.

7.8 Alexander's Pattern Language

The water and traffic flow guiding models in section 5 illustrate the use of conceptual models to guide the design process. This comes close to the use of patterns in Christopher Alexander's pattern language (Alexander et al., 1977). Both patterns and guiding models can act as a documented language for learning in design and planning practice. However, if patterns look like forms they may create confusion among designers. The experiences with the city model point at the advantages of starting with guiding models that provide ecological-technical structures that can carry a variety of forms. In the words of McHarg, "*form follows nothing – it is integral with all processes*" (1969 [1971: 173]).

8. CONCLUSION

The discussion of experiences with the *two networks strategy* in this paper demonstrates the feasibility of taking water and traffic networks as carriers for urban development. Learning from practice has enriched the theory and deepened our understanding of area, flow and actor aspects. The emphasis on integration characterises the guiding model as a general tool for the making of strategic plans. To what extent is it an ecological approach?

In general terms the slow lane environment asks for landscape ecology that can work on the basis of the ecology of diversity. Activities support landscape diversity and even urban agriculture ultimately serves landscape diversity. The fast lane landscape, on the other hand, supports the efficient productivity of activities. This includes the industrial ecology of recycling,

waste treatment and waste prevention strategies. From a planning perspective the slow lane environment requires for strategies of co-operation and key involvement from non-profit organisations, both private and public. In the fast lane, strategies for competition are the driving force. There can be no fence between the two worlds of course. They need each other and should be planned as a polarity of magnetic fields that prevent conflicts and support a synergy of activities.

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Waking Leviathan

Frank Lloyd Wright's rural urban ideal

From *Art and Craft Of The Machine* (1901) to *The Living City* (1958)

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'Destruction of Leviathan' 1865 Engraving by Gustave Doré

“I readily admit that the Americans have as yet no poets; I cannot allow that they have no poetic ideas. In Europe people talk a great deal of the wilds of America, but the Americans themselves never think about them: they are insensible to the wonders of inanimate nature, and they may be said not to perceive the mighty forests which surround them until they fall beneath the hatchet. Their eyes are fixed upon another sight: the American people views its own march across these wilds – drying swamps, turning the course of rivers, peopling solitudes, and subduing nature. This magnificent image of themselves does not meet the gaze of the Americans at intervals only; it may be said to haunt every one of them in his least as well as in his most important actions, and to be always flitting before his mind. Nothing conceivable is so petty, so insipid, so crowded with paltry interests, in one word so anti-poetic, as the life of a man in the United States. But amongst the thoughts which it suggests there is always one which is full of poetry, and that is the hidden nerve which gives vigour to the frame.”

Alexis de Tocqueville, *Democracy in America*, Book 1, Chapter XVII: Of Some Of The Sources Of Poetry Amongst Democratic Nations (1831–33)

Abstract

There still exists in the collective global imagination a ghostly 'image of progress' framed by a nature-dominating narrative that distorts reality. As living standards rise worldwide, the demand for natural resources is accelerating in a familiar pattern: cities eat the rural, and the rural eats the wilderness. Ecology, society and economy are not the either/or variables they are often portrayed as being: there is no society without ecology, and no economy without society, each is embedded in context. As globalised societies become increasingly urban, the notion that cities ought to become self-sufficient has been widely popularised in both the architectural profession and in academia, legitimated through the use of the term autopoiesis (Greek αὐ'to 'self' and ποίησις 'creation'), borrowed from the field of chronobiology. The opposite of autopoiesis, a closed process in which context might be an afterthought, is allopoiesis, the process whereby an organisationally open system produces something other than itself. Reality is many-layered and emphatically simultaneous, and while designers are busy fine-tuning daydreams of 'self-sufficient cities', regions and ecological systems now supporting real cities are being fragmented and erased in vast swaths, often taking once thriving cities along with them, further accelerating centralised urbanisation. Frank Lloyd Wright's *The Living City* is a conceptual rural urban model for decentralised development that attempts, through its evolution in several iterations (from 1901 till 1958) to provide a humane alternative to centralised commercial urbanism. Wright's life (1867-1959) and work spanned from the Victorian age to the space age, and *The Living City* is arguably his most ambitious attempt to 'bridge the gap'. In arguing for contextual, open-ended planning methods it provides a suitable polar counterpoint to contemporary notions of cities as self-sufficient. As a precedent stimulating awareness of the fundamental need for the 'humane proportion' of industry and agronomy, it is of urgent relevance today.

KEYWORDS

regional design; infrastructure; networks; regionalism; contextualism; regional design; contextual infrastructure; dual networks; climatic periodicity; radical contextualism; critical regionalism; second nature; rural urban dynamics; contrapuntal thinking

1. INTERGENERATIONAL LEGACY

There still exists in the collective global imagination a ghostly ‘image of progress’ framed by a nature-dominating narrative that distorts reality – as worldwide living standards rise, the demand for natural resources is accelerating in a familiar pattern: cities eat rural regions, and rural eats wilderness. Ecology, society and economy are not the either/or variables they are often portrayed as being: there is no society without ecology, and no economy without society – each is embedded in context. As globalised societies become increasingly urban, the notion that cities ought to become self-sufficient has been widely popularised in both the architectural profession and academia. But reality is many-layered and emphatically simultaneous, and while designers are busy fine-tuning daydreams of ‘self-sufficient cities’, however poetic¹, the rural regions and ecological systems now supporting real cities are being fragmented and erased in vast swaths – often taking once thriving cities along with them, further accelerating centralised urbanisation.

In 45 BC Cicero conceived of rural and urban regions as engaged in a interaction balance involving existing landscapes. Rural and urban are seen as the mutually interrelated counterparts of the same civilising force, polarities of an on-going initiative Cicero termed *second nature* (Cicero, 2008). Contemporary recognition of the importance of context is again broadening the conceptual scope of design. As an alternative to the image of progress, whose nature-negating narrative was that of ‘manifest destiny’ – recalling de Toqueville’s text – and contemporary architects advocacy of taking ‘insane risks’, it is interesting to consider other precedents. Low-risk strategies that harness urban acceleration and mitigate ecological degradation have an established legacy, an alternative *image-of-progress*. Cicero wrote of a rural/urban second nature, and Vitruvius’ reflections on the work done in Cicero’s time has had an enduring influence: from Roman villas, to English public gardens, to Olmsted’s urban parks, to Wright’s *Living City*, to Cedric Price’s *Fun Palace*, Archizoom’s *No-Stop City* and Banham’s *Architecture of the Well-Tempered Environment*, leading straight to the use of contemporary GIS and parametric methods in landscape infrastructure-related initiatives. Yet the tendency to reject altogether that which has come before still prevails, causing wild oscillations in the name of progress – a disruptive intergenerational dissonance. Beaux-Arts was rejected by Wright, while Wright’s expressive machine-ornamentation was called a ‘crime’ by Adolf Loos. History itself was rejected by the Modernists, and Modernism was considered a failure by the next generation. Subsequent movements, whether New Urbanism, Parametricism, or Landscape Urbanism, are taken up and rejected in turn, often with little evaluation of internal counter-currents that could fruitfully align these trajectories. Team 10 is credited with bringing about the end of CIAM, and, indeed, they seemed to relish doing so – but wasn’t a course correction their

stated aim? This essay focuses on one project in the timeline, on the eve of the Frank Lloyd Wright Archives relocating from Taliesin West to Columbia University's Avery Library and what can only be considered a new era of Wright scholarship. There are many treasures in the archive, certainly – I recall finding *Wendingen* journal editor T.H. Wijdeveld's letters to Wright, beautifully crafted, with translucent paper and gold ink; or Wright's illustrations for Jens Jensen's non-profit *Friends of Our Native Landscape* – but I believe among all the archive's contents it is inevitable that Wright's rural urban strategy, *The Living City*, will be given renewed, even urgent scholarly attention.

2. AN ALTERNATIVE TO URBANISM

Frank Lloyd Wright's *The Living City* (Wright, 1958) is a conceptual rural urban model for decentralised development that attempts, through its evolution in several texts, and the models and drawings accompanying them, to provide a humane alternative to centralised commercial urbanism. In that regard it is as interesting for what is omitted as for what is shown in the models and drawings – that is, the context from which the work emerged, beyond the models and outside of the drawings. This consideration is an exercise that requires 'zooming out', and taking into account the context in which the work itself was done. References to this may be found in Wright's numerous texts, in which he develops what might be called his *radical humanism*, and in the legacy of ideas, opportunities and personalities the project engages in its socio-political context over time – relating the social logic, physical proportion and spatial anatomy of the strategy itself to its underlying environmental framework. In Wright's time, as in our own, the rapid urban transformation of formerly rural sites of strategic interest contributed to a myopic enthusiasm for urbanisation. This was evidenced then in the widespread adoption of centralised socio-economic models such as Von Thunen's *The Isolated State* (1826) (figure 1), as it is now in popular academic and professional ideals of the self-sufficient city. Yet the city has never existed in isolation, and neglecting to acknowledge the city 'in context' has contributed to both ecological and social degradation from generation to generation. We have seen that this degradation actually leads to fewer lifestyle options – and to cities of utter sameness.

Can the technologically advanced city be reconciled with existing environmental and social contexts, or must it impose another order? The following pages provide an overview of how Wright framed this question verbally, socially and spatially – and how he responded to it with *The Living City*. The text concludes with a critical consideration of this response given the cultural context in which it was produced, and an evaluation of the contribution that response might still make to contemporary research.

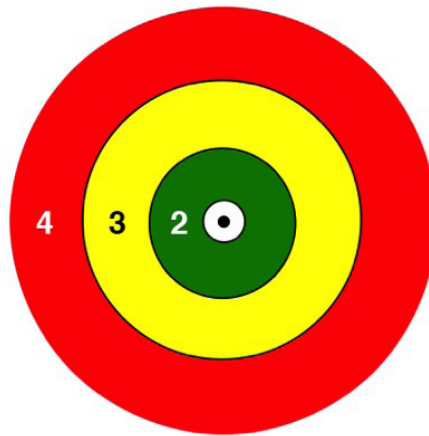


Figure 1 The Isolated State' (1826) Johann Heinrich von Thünen developed a model that is considered to be the first serious treatment of spatial economics and economic geography – connecting it with the theory of rent. The black dot represents a city; 1 (white) dairy and market gardening; 2 (green) forest for fuel; 3 (yellow) grains and field crops; 4 (red) ranching; the area beyond this represents wilderness where agriculture is not profitable

Origins and elaboration

The main themes developed in *The Living City* can all be found in Wright's early writings of the 1890's, and are directly related to his personal experience. Raised in a socially progressive Wisconsin agricultural community of Welsh immigrants, his immediate family members were leaders in the Unitarian church, and the important philosopher and educator John Dewey was an associate of his teacher-aunts, for whom Wright designed the renowned Hillside Home School in 1896, and additional buildings subsequently. These ultimately became the home of the Taliesin Fellowship in 1932, initially conceived of as the *Hillside School for the Allied Arts* in 1928. Of rural origins, as a youth coming of age he experienced the very modern phenomenon of leaving the country for the city, living and working in industrial-era Chicago, where both the vitality and the ills of industrial-era cities were abundantly manifest: from the coexistence of extreme wealth and poverty, to progressive social initiatives and the exploitation of ever-abundant immigrant labour, to the creation of remarkable urban parks and the destruction of entire ecological systems such as those lost by reversing the flow of the Chicago River from 1892 to 1900 by engineers (Chicago River, 2013). The key themes in his early texts were also the subject of his personal and professional efforts – namely the intergenerational continuity of knowledge in a site-specific context, the creative use of technology for humane purposes, and a notion of rural and urban settlements together as the living 'body of civilization'.

These themes coalesced in his essay *The Art and Craft of the Machine* (Wright, 1901), which was prepared and delivered for a meeting of the Chicago Society of Arts and Crafts at Jane Addam's Hull House, an institution with a broad reputation for its advocacy of social reform (cf. Johnson, 2004). From its founding in 1889 until its sudden, politically-motivated closure in 2012, Hull House was considered a standard-bearer for innovative social, educational and artistic programs for immigrant and working-class families. The Chicago Society of Arts and Crafts itself was founded in response to the rapid industrialisation of production methods, and sought collective means by which to stem the proliferation of cheap goods and to retain the arts and crafts as viable livelihoods. As distinct from the tendency to regard industrialisation of production as exclusively negative in social terms, Wright asserted that the machine was but another tool, arguing that in the hands of the artist and craftsman it could also serve to bring about a more humane society. Indeed, the architect accepted the machine as an inevitable means of production, but sought to control its consequences at the scale of architecture and the city:

"As we work along our various ways, there takes shape within us, in some sort, an ideal – something we are to become, some work to be done. This, I think, is denied to very few, and we begin really to live only when the thrill of this ideality moves us in what we will to accomplish. In the years which have been devoted in my own life to working out in stubborn materials a feeling for the beautiful, in the vortex of distorted complex conditions, a hope has grown stronger with the experience of each year, amounting now to a gradually deepening conviction that in the Machine lies the only future of art and craft – as I believe, a glorious future; that the Machine is, in fact, the metamorphosis of ancient art and craft; that we are at last face to face with the machine – the modern Sphinx – whose riddle the artist must solve if he would that art live, for his nature holds the key." (Wright, 1901)

As an extension of human will, he describes the city in terms of an explicitly biological analogy – the modern city as the offspring of the 'machine-Sphinx', consistent with the image of the mechanised city as *Leviathan* he portrays in the essay's dramatic conclusion:

"[...] be gently lifted at nightfall to the top of a great downtown office building, and you may see how in the image of material man, at once his glory and menace, is this thing we call a city. There beneath, grown up in a night, is the monster leviathan, stretching acre upon acre into the far distance. High overhead hangs the stagnant pall of its fetid breath, reddened with the light from its myriad eyes endlessly everywhere blinking. Ten thousand acres of cellular tissue, layer upon layer, the city's flesh, outspreads enmeshed by intricate network of veins and arteries, radiating into

the gloom, and there with muffled, persistent roar, pulses and circulates as the blood in your veins, the ceaseless beat of the activity to whose necessities it all conforms [...]. If the pulse of activity in this great city, to which the tremor of the mammoth skeleton beneath our feet is but an awe-inspiring response, is thrilling, what of this prolific, silent obedience? And the texture of the tissue of this great thing, this Forerunner of Democracy, the Machine, has been deposited particle by particle, in blind obedience to organic law, the law to which the great solar universe is but an obedient machine.

Thus is the thing into which the forces of Art are to breathe the thrill of ideality! A SOUL!” (Wright, 1901)

This analogy of the body of civilisation as an obedient, pulsing machine frames the answer he gives as to the nature of the architect’s ultimate objective – to bring, through art, ‘a soul’ to the city-machine, the *Leviathan*, rendering it empathetic and beneficial to humanity as a habitable artefact. I believe that it was Thomas Hobbes’ classic 1651 text, *LEVIATHAN or The Matter, Form, and Power of a Commonwealth Ecclesiastical and Civil* (Hobbes, 1977), which influenced Wright’s choice of that particular term in characterising the city. Indeed, in *LEVIATHAN* Hobbes lays the foundation for ‘the science of natural justice’, which he regarded as the culmination of ‘the science of consequences’ – he illustrates this with a diagram of the fields of knowledge as then interpreted (figure 2). The holistic, inclusive ambition of Hobbes to grapple with the issues of society *en masse* and *in situ* anticipates the scope Wright attempts to bring forward in his essay.

When *The Art and Craft of the Machine* was delivered in Chicago the industrial age was in full force. Although benefitting some, capitalised industry throughout the world was creating a massive and often genuinely oppressed labour class, while technologies to increase automated productivity were displacing artists and workers, and ever more powerfully impacting both agricultural and urban regions. In his text, Wright acknowledges the difficulties arising from the machine’s implementation, asserting that they are not inherent in the machine, but are the result of greed and the misuse of a powerful tool: the machine is ‘the creature and not the creator’ of political iniquity. His open attitude toward the machine was not then common among artists and intellectuals involved in the Arts and Crafts movement, many of whom actively protested any collaboration with industry. By his own account, this optimism was motivated by having read Victor Hugo’s *Notre-Dame de Paris* as a child.

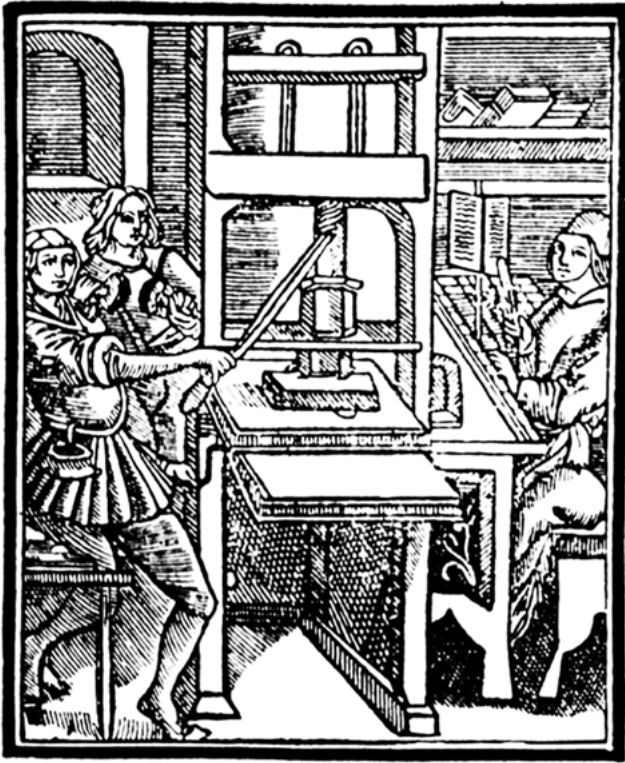


Figure 3 Gutenberg's press, ca. 1439

“Architecture is dethroned.

Gutenberg’s letters of lead are about to supersede Orpheus’ letters of stone.

The book is about to kill the edifice. The invention of printing was the greatest event in history. It was the first great machine, after the great city. It is human thought stripping off one form and donning another. Printed, thought is more imperishable than ever – it is volatile, indestructible.

As architecture it was solid; it is now alive; it passes from duration in point of time to immortality.”

(Wright, 1901)

One can see the further development of this interpretation of the historic trajectory of technology in *The Disappearing City*, the next major effort he made to address these themes. He began writing the book in 1928, and it was published in 1932 (Wright, 1932). The book’s independent publisher was William Farquhar Payson, formerly a journalist for the *New York Times* and managing editor at *Vogue Magazine* in the late 1890s, who in 1928 had supervised the

publication of Le Corbusier's *Toward a New Architecture*, and in 1929 had published a second book by Le Corbusier, *The City of To-morrow and its Planning*, and Henry Russell Hitchcock's *Modern Architecture*.

Certainly *The Disappearing City* can be seen as in dialogue with the architectural community at large. Prior to its publication, Wright had further developed his ideas for the book through a series of public lectures with the theme 'The City' at Princeton University in 1930. In this lecture series he questioned the nature of the centralised city and speculated about its gradual dissolution: 'human thought stripping off one form and donning another', and identified numerous factors of polycentralisation that have since been widely recognised, such as various forms of mobility and communication technologies. *The Disappearing City* issues an unrelenting indictment of the commercialised industrial city, describing it as "some tumor grown malignant [...] a menace to the future of humanity." The opening illustration in the book is an aerial view of New York City eerily shrouded in smog – an illustration retained in subsequent publications, including his final book *The Living City*, bearing the caption, 'Find the citizen' (figure 4).

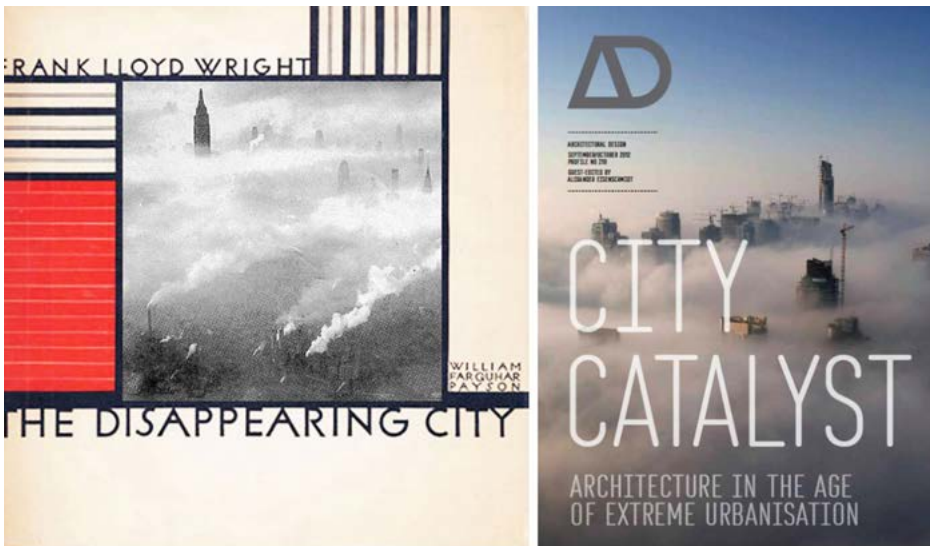


Figure 4 *The Disappearing City* (1932) features an aerial view of New York City from the early 1900s that bears a striking similarity to a view of Dubai used on the cover of *AD magazine* from over a century later – illustrating what little progress has been made in terms of conceptualising the city.

In place of illustrations are vivid descriptions of what the decentralised city, in the hands of the artist-architect enabled by the machine, might become:

“Imagine spacious landscaped highways [...] giant roads, themselves great architecture. Pass public service stations, no longer eyesores, expanded to include all kinds of service and comfort. They unite and separate – separate and unite the series of diversified units, the farm units, the factory units, the roadside markets, the garden schools, the dwelling places (each on its acre of individually adorned and cultivated ground), the places for pleasure and leisure [...] This integral whole composes the great city that I see embracing all of this country – the Broadacre City of tomorrow.” (Wright, 1932)

This description of the future city, first coining here the term *Broadacre City*, was to take form in 1934–35 in a series of drawings, models and publications related to an exhibition of that name which toured from Rockefeller Center in New York, to Washington DC, to Pittsburgh, and to several cities in rural Michigan and Wisconsin before embarking on an extensive international tour (figure 5).

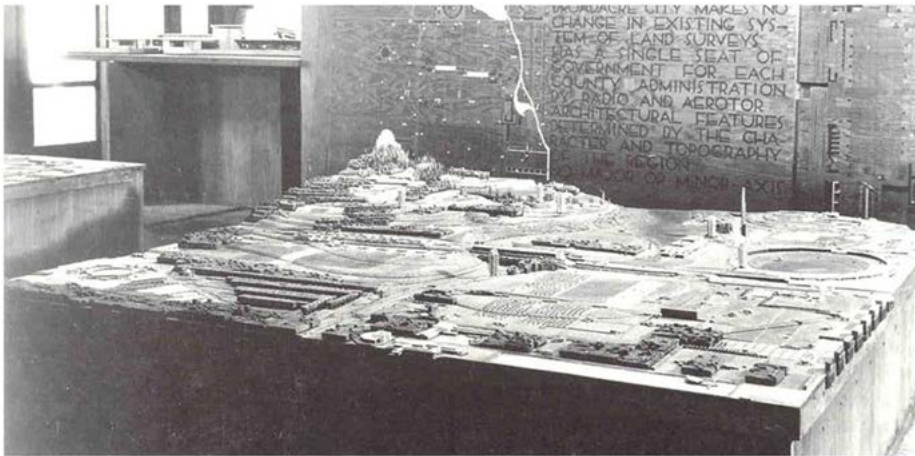


Figure 5 *Broadacre City* (1934) model quarter section, scale 1 inch = 75 feet (source: The Frank Lloyd Wright Foundation Archives at The Museum of Modern Art | Avery Architectural & Fine Arts Library, Columbia University, New York)

In 1945 *The Disappearing City* was fully revised, expanded, and illustrated with this new material, and it was published with the title *When Democracy Builds* (Wright, 1945).

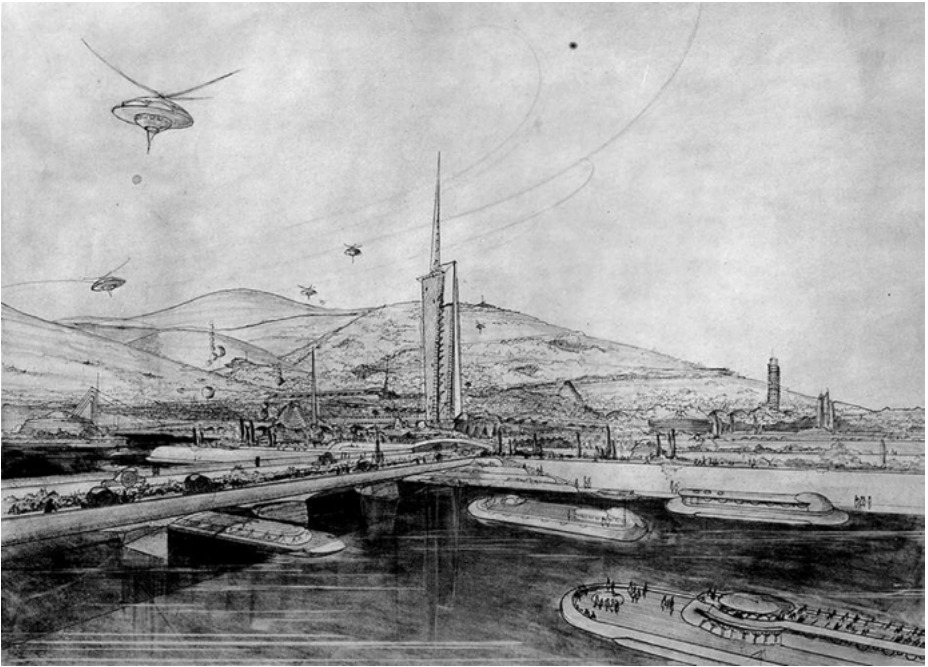


Figure 6 *The Living City* (1958) aerial view (source: The Frank Lloyd Wright Foundation Archives at The Museum of Modern Art | Avery Architectural & Fine Arts Library, Columbia University, New York)

The architect's final and most comprehensive treatise on the subject, *The Living City* (Wright, 1958) (figure 6), supplements the earlier texts with richly detailed perspective drawings and reflections about the impact of technology on an overarching social narrative.² Under the heading 'Illusion', he again correlates his key themes:

“Centralization now proves to be something that, used to wind space up tighter and tighter, smaller and higher, is like some centripetal device revolving at increasing speed until – terrible, beyond control – it turns centrifugal, ending all by dispersal or explosion. Meantime, what possible control? Government? No – or only to a very limited extent. In democracy, more and more limited to expedients: politics. The only possible control, then, is profoundly educational. In democracy, is education – when on speaking terms with culture – not the true answer to such exaggerations of artificiality as machine power in production, or as crowding? On behalf of humane freedom it is the growth of this human intelligence ultimately applied to the city that we must interfere by such pressures as it can exert there where pressure does most good. Salvation from the false economies of centralization lies in a wider grasp of the limitations and danger of these powers – machine powers all – multiplied to excess. What hope is there for our future in this machine age, if indeed the machine age is

to have any future, unless decentralization and appropriate reintegration are soon encouraged – given right-of-way in actual practice?” (Wright, 1958: 33-34)

He goes on to criticise the “three major artificialities [...] grafted by law upon all modern production”: rent for land (leading to speculative development), rent for money (leading to unscrupulous banking practices), and rent for inventions (leading to patents and proprietary knowledge):

“A new speculative commodity has therefore appeared – money, unnatural as commodity, now becoming monstrosity. The modern city is its stronghold and chief defender; and insurance is one of its commodities.” (Wright, 1958: 34-35) “And when urban men of commerce themselves succeed, they become more than ever vicarious. Soon these very successful men sink into the sham luxury their city life so continually produces. But they create nothing! Spiritually impotent, a fixation has them where impotence wants them: fixation in a cliché.” (Wright, 1958: 20)

Thus it is the cliché image of the city-as-progress, and its marketing propagandists, at which his treatise takes aim:

“So this modern monster, degeneration of the Renaissance city, becomes the form universal of anxiety, all stated in various forms of rent. The citizen’s very life is tenant, himself rented, in a rented world. Production is now trying to control consumption...this it is that turns the nation into a vast factory, greedy for foreign markets, with the spectre of war as inevitable clearing house.” (Wright, 1958: 21)

In contrast to this, he asserts:

“Our natural resource now is in new possibilities of access to good uses for good ground: an agronomy intelligently administered...The living, consuming man-unit of our society will ultimately decide this momentous issue. Consumption must control production. This matter will only be decided by consumption in proper control of an organic basis for distribution, man to man, nation to nation...The road to a good life is still open. But today this road must lead on through public obstruction...hindrances legally erected, legalities exploiting his good faith – a general depravity in a drift toward quantity at expense to quality, until we find all heading in toward war or revolution: this time the revolution industrial – yes. Agrarian, no. About time now our agronomy asserted itself in his behalf.” (Wright, 1958: 38-41)

In his closing notes, he reflects on the various iterations the work has taken:

“Does The Art and Craft of the Machine, first read at Hull House [...] seems to suffer contradiction here? No. I then dreaded the machine unless well in the hand of the creative artist. Saying so then, I say so now. I knew then that this power we call the Machine was, otherwise, socially malevolent [...] but today the Machine is running away [...] it has been far too exploited by industrialism and science at expense to art and true religion.” (Wright, 1958: 246)

He goes on:

“Machine facilities have increased inordinate quantity production beyond consumption until total mechanization is trying to control distribution and the market. By total industrialism war, more war is always in sight, paid for in advance – all but the bloodshed. The machine is now become more the engine of destruction, and propaganda for increasing our national insecurity by wage-slavery is everywhere in the social fabric of the news. Higher human faculties, which the machine should serve to release in our Democracy, are officially and academically emasculated, the humane interest fast disappearing. That is why the belated writing of this – seeming to me now – more timely, more important than ever book, original advocate of organic architecture; again to take the stand for the ‘consumer’ (the people) as against the ubiquitous, thoughtless producer for profit. The ‘consumer’ now must take what ‘production’ decides to make [...]. This antithesis of the democratic process is a menace, a drift toward deadly conformity.” (Wright, 1958: 246)

He concludes:

“Finally, then, this long discourse, hard to write or read, is a sincere attempt to take apart and show, from inside, the radical simplicities of fate to which our own machine skills have now laid us wide open and try to show how radical eliminations are now essential to our spiritual health, and to the culture, if not the countenance, of democratic civilization itself [...]. ‘The Living City’ then is nothing less than inspiration, or better, than restraint upon the effects of ill planning by the trustees whose responsibility it is – our young architects. I hope this book is at least an exhortation for them, a warning for the farmer, a caution and encouragement for the small manufacturer and for national colleges of architecture and agriculture, or such cultural nurseries as this nation has raised or razed or carelessly left standing. We cannot achieve our democratic destiny by mere industrialism, however great. We are by nature gifted as a vast agronomy. In the humane proportion of those two – industrialism and agronomy – we will produce the culture that belongs to Democracy organic [...]. The present is the ever moving shadow that divides yesterday from tomorrow. In that lies hope.” (Wright, 1958: 248)

3. CRITICAL RECEPTION AND CONTEMPORARY INTERPRETATION

Historically, academics and architectural professionals have seriously considered little of Wright's work in the extra-large scale – and when it has been considered it has generally been done rather cursorily. Architecture critic Witold Rybczynski summarized a view often held by the establishment when he described the *Broadacre City* project as the “*embarrassing foible of an aging master*” (Rybczynski, 1996). Herbert Muschamp, before he was the architecture critic of *The New York Times*, concluded that the plan was “*too real to be Utopian and too dreamlike to be of practical importance.*” While author, historian and critic Lewis Mumford had early praise for it: “*On the whole, Wright's philosophy of life and his mode of planning have never shown to better advantage*”, 30 years later he criticized the plan's “*sprawling, open, individualistic structure*” as being “*almost antisocial in its dispersal and its random pattern.*” This is a particularly interesting observation, given Mumford's close friendship with Wright, and his instrumental role in establishing the Regional Planning Association (Regional Plan Association), an organization closely associated with the Chicago School of Sociology, that nevertheless has been an influential advocate of many *Living City* concepts and remains active today. Of course, among several notable exceptions to this historic disregard are Robert Fishman's classic *Urban Utopias in the Twentieth Century* (Fishman, 1982) and Charles Waldheim's essay *Towards a History of Agrarian Urbanism* (Waldheim, 2010) – which aside from Chris Reed's passing reference to *The Living City* and inclusion of an image of one of the 1958 aerial perspectives (mistakenly dated 1935) in his essay *Public Works Practice* in 2006's *Landscape Urbanism Reader* (Reed, 2006) also edited by Waldheim, is the only reference to the project I have come across in the landscape urbanism discourse.

Wright maintained close friendships and professional collaborations with many of the individuals who figure prominently in the evolving contemporary discourse around landscape urbanism, ecological urbanism, and landscape infrastructure. Landscape architect Jens Jensen was a long-time collaborator, and Wright volunteered his services for Jensen's not-for-profit organization Friends of Our Native Landscape; Wright corresponded with Olmsted, designed houses for his Riverside masterplan, and his son, Frank Lloyd Wright Jr., worked with the Olmsted Brothers practice directly after working with his father; landscape architect Lawrence Halprin attests that he entered the field after visiting Wright's Taliesin, etcetera. Clearly these exchanges exerted a reciprocal influence, and one can only imagine what deeper scholarship in this area will reveal. As UCLA prof. emeritus Lionel March has written,

“[...] contrary to the impression given by Wright's critics, these views [represented by Wright in *The Living City*] were in fact shared by some of the most no-

table intellectuals and practicing politicians of his day. In particular I have in mind those social reformers, progressives and liberals [...] whom he ‘read and respected,’ or whom he knew as friends [...] such as William James and John Dewey, the American pragmatists; Henry George the popular economist; two of John Maynard Keynes’ ‘heretics’ – C.H. Douglas and Silvio Gesell – as well as the American institutional economists Thorstein Veblen and John Commons and the economic historian Charles Beard; in industry Henry Ford and Owen D. Young (of General Electric); in politics the ‘Wisconsin Idea’ progressives, the La Follettes; and in social matters, Jane Addams, Edward Ross, and Richard Ely. All of them are at once idealistic and people of action [...] at least in the context of this particular liberal milieu [...]. Wright’s views of society were unexceptionable and [...] in Broadacres, Wright was attempting as the best architect of his day to give potential architectural and urban form to what he believed to be the best thoughts and the best social actions of his American contemporaries [...] [they] did not consider democracy to be a form of government, so much as a way of living. This distinction between form on one hand and way or process on the other was a preoccupation of American pragmatic philosophy at the turn of the century [...] in contrast to the systematic philosophies of the established old world, the pragmatists conceived of an open-ended approach to cope with an entirely new and emergent situation [...] the dissemination of the pluralistic values of a polyglot people.” (March, 1983)

March goes on to establish many connections between *The Living City* and contemporary progressive initiatives in governance, economic and educational policy, substantiating his assertion that the design is indeed more procedurally – that is to say *dynamically* – conceived than it is formally, or *statically*, contrived. This brings up what is certainly a valid critique of *The Living City*: although ostensibly built on the basis of a real quarter-section of land in the American Midwest, and Wright’s initial, evocative hand sketches of curvilinear, landscape-responsive Broadacre variants exist in the archives (figure 7).

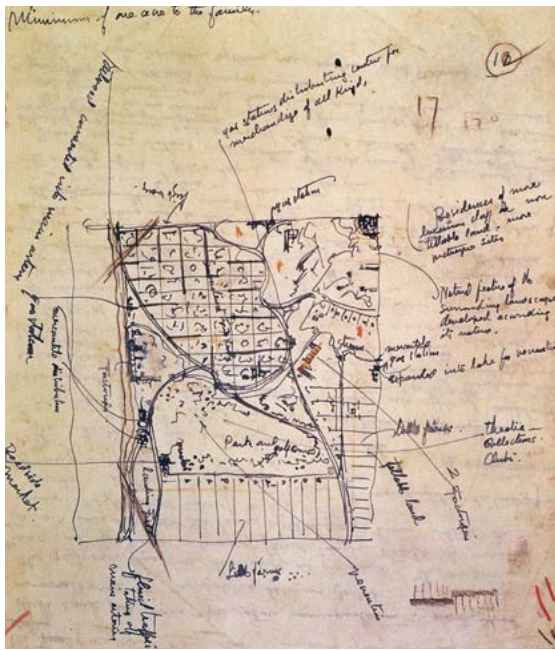


Figure 7 Frank Lloyd Wright, Broadacre City plan sketch, 1934. Ink, colour pencil on paper. 9 3/8 x 8 1/2 in (source: The Frank Lloyd Wright Foundation Archives at The Museum of Modern Art | Avery Architectural & Fine Arts Library, Columbia University, New York)

Wright never illustrated the scheme in the broader regional context. How was one district to relate to another? Was it to be deployed like a carpet, as a linear city, or as a polycentric network in which areas like this serve as nodes?³ Nevertheless, it is interesting to note that March's extrapolated assessments of *The Living City's* performative capabilities – made on the basis of what is represented in the project – provide evidence that rather than being a short-sighted model of automobile-induced sprawl, as had commonly been asserted, *The Living City* emerges as a meticulously scaled diagram of a compact transportation corridor network, whose rural urban dynamic could sustain the entire US population within a total footprint of 4% of the nation's area, leaving 96% to go back to wilderness. These figures include the agricultural and industrial land necessary to sustain the urban districts as well, creating what is effectively an integrated rural urban regional metabolism, as distinct from an isolated, self-sufficient city (Sargent, 1992). At a one-to-one scale this is, conveniently, about equivalent to the length of the US Interstate highway system when two miles on either side of the roadway (figure 8). Of course, in practice *The Living City* strategy is unlikely to be either uniform or symmetrical, as environmental and socio-political settings will vary, and it was clearly conceived of as responsive to these contextual factors (figure 9).



Figure 8 US interstate highway system, 4% of land mass, equivalent to Broadacre City's footprint when housing entire US population (2000 census), after L. March



Figure 9 Broadacre City Model (1934) and the Vitra Museum's *The Living City* (1997): this later exhibition reinterpreted the models in an aesthetically beautiful way, while neglecting the axial role of the transportation corridor 'spine' in relation to which the entire scheme is a gradation of density toward the edge – an interpretation unfortunately obscuring the essential formal logic of the scheme (source: The Frank Lloyd Wright Foundation Archives at The Museum of Modern Art | Avery Architectural & Fine Arts Library, Columbia University, New York (left); Vitra Museum, Basel (right))

Although such a digression hardly matches the scope of this essay, it would be interesting to write the genealogy of ideas leading from Wright to Team 10 and the Texas Rangers: both these counter-cultural groups gained ascendancy in the mid-late 1950s as Wright was fading – both emphasised, as did Wright, the social and spatial as drivers of architecture and urbanisation – and it seems clear to me that they are the closest thing yet to a ‘Wrightian’ legacy in architecture, polemic though that legacy may be.⁴

Certainly reactions against this legacy are still present. For instance when Peter Eisenman (a student of Colin Rowe – a Texas Ranger – and of Wittkower) was asked about the contemporary relevance of his PhD thesis, in which he analysed what he described as Wright’s ‘multi-axial’, ‘linear spatial’ compositions, he responded:

“I hate Wright. I’ve always hated Wright. I only studied him to figure out why I hated him so much [...]. I hate nature. If you love nature so much you should be a damned landscape architect.”⁵

In the same discussion Eisenman stated that Rem Koolhaas had been one of his ‘great discoveries’, and of course it was Koolhaas who has famously asserted that the subtext of contemporary super-urbanism is ‘f**k context’ (Koolhaas, 1998). Certainly there is ample precedent for this apparent compulsion to obscure context. In behavioural sciences it is generally associated with the repression of memory itself within the subconscious. Repressed memory is a psychological condition in which a memory has been blocked due to a high level of stress or trauma – although the individual often cannot recall the memory, it may still be affecting him. It is still a controversial topic in the discipline of psychology, and according to some psychologists repressed memories can be recovered through therapy, while others believe that repressed memories are in fact a cultural symptom because there is no documentation of their existence before the 1800s. This is a fascinating question – but whether repressed memory is an individual or cultural phenomenon, it may well be that contemporary cities’ persistent and general disassociation from context is attributable to traumatic events, both local and global.

Just so, in counterpoint to ascendant memory-negating theories of super-urbanism, the contemporary historian Sébastien Marot develops a direction of thought he describes as *sub-urbanism*, ‘a theoretical hypothesis, not necessarily exclusive of its opposite’ in which the conventional urban paradigm is inverted (figure 10).

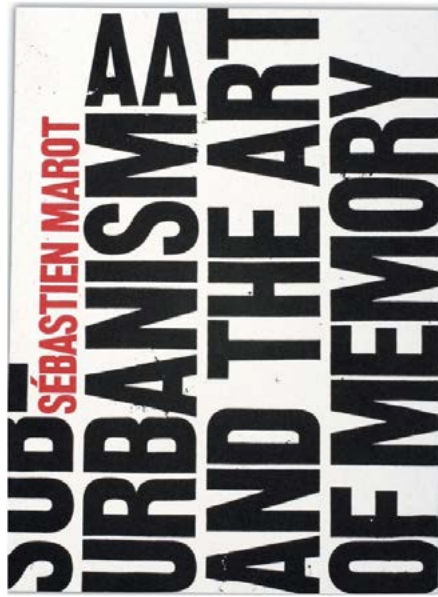


Figure 10 'Sub-Urbanism and the Art of Memory' (2003) Sébastien Marot's treatise is explicitly written in counterpoint to Koolhaas' 'Delirious New York' (source: Architectural Association, London)

Rather than program being the defining parameter of the project, as is the architectural tendency when amplified to the scale of the city, the existing site – that is, both the landscape and social context – are taken as definitive of suitable programs. He elegantly characterises such an approach with four attitudes: an 'active regard' for the memory of the site, an 'in depth' rather than 'planar' view of open and public space, seeing site and design as 'fields of relations' rather than as objects, and seeing these as 'processes' rather than as products. Marot explains, *"I regard these four principles not as inflexible rules of ethics but rather as the precepts (themselves essentially relative) of a preliminary and therefore imperfect code of conduct that, to borrow from Descartes, 'can be followed by way of provision, so long as one doesn't know any better'"* (Marot, 1993). Such an approach would indeed be consistent with the principles outlined in *The Living City*, and might still provide effective therapy for traumatised, dis-associated regions and their inhabitants.

4. TO WAKE THE LEVIATHAN

The relationship between individual memory, imagination and cultural memory played an important role in Hobbes' *Leviathan*. The source of Hobbes'

use of the term was evidently Biblical scripture, in which perhaps the most famous reference to it is in the book of Job, where Leviathan is mentioned in the context of its obscuring not only memory, and light, but even time itself. To set the stage: Job has been a blameless and successful man, living well with his family and his deserved wealth, until one day he loses everything, even his health. His friends come to visit him, “[...] and they sat with him seven days and seven nights, and no one spoke a word to him, for they saw that his suffering was very great”:

“After this Job opened his mouth and cursed the day of his birth. And Job said: ‘Let the day perish wherein I was born, and the night which said, A man-child is conceived. Let that day be darkness! May God above not seek it, nor light shine upon it. Let gloom and deep darkness claim it. Let clouds dwell upon it; let the blackness of the day terrify it. That night – let thick darkness seize it! Let it not rejoice among the days of the year, let it not come into the number of months. Yea, let that night be barren; let no joyful cry be heard in it. Let those curse it who curse the day, who are skilled to wake Leviathan.’”⁶

While Job itself is likely not a mythological book, this reference to Leviathan is no doubt an allusion to mythology. Many scholars identify the Leviathan of this verse with a mythological creature described in Ugaritic myths, according to which a marine monster named Lotan was capable of altering the entire world order by eclipsing the sun or moon with its body.⁷ So Job, angry and frustrated, employs the most forceful, vividly poetic language available to him in order to call for the obliteration of that day. Clearly the evocative use made of the term *Leviathan* by Hobbes and Wright is consistent with this earlier use. When asked by his apprentices in later years what they should read of the architectural classics, Wright consistently referred to Victor Hugo’s aforementioned essay, which he cited so extensively in *The Art and Craft of the Machine*, and to the work of Eugène-Emmanuel Viollet-le-Duc, who in 1868 (incidentally the year following Wright’s birth) identified the machine as promising to fulfil the Gothic ideal in its ability to “*express the qualities of materials and to transform static relationships into dynamic ones based on balances between opposing forces*” (Viollet le Duc, 1868).

Throughout *The Living City* Wright uses the term *static* to connote outdated notions, and *dynamic* to connote progress. He describes his interest in “*looking into instead of at*”, championing the analysis of dynamics over the comparison of appearances, with practical implications both for structurally optimising oscillations between tension and compression in the form of a building, as for situating the city within the material and spatial dynamics of environmental, social, and economic forces. These forces are now common-

ly regarded, in the parlance of contemporary macro-economic analysis, as PESTEL: Politics, Economics, Sociology, Technology, Environment and Law. When correlated with current computational technology at the scale of the city, these dynamics are seen as even subtler geometric interactions, meta-data describing energetic affinities, attracting, repelling, and generating form. The ever-growing sophistication of technology eventually facilitates the subtler optimisation of the form of the city and its architecture, enabling the creation of buildings, environments and social infrastructures that are profoundly humane. Clearly the scope of Wright's ambition encompassed not only the city, nor merely the reunification of the arts and crafts that were ensemble in the Gothic era, but the radical humanisation of the entire ecology of the forces of our modern era and whose interactions transform the shape of society – materially and energetically. At the same time, his regard for cultures of the past prompted him to reject as reactionary the dismissal either of tradition or of the machine. This progressive interest came with a sense of responsibility to the past – “*that the new art to come might not have dropped too many stitches nor have unravelled what would still be useful to her*” (Wright 1901d). After all, we still have the building and the book, rural and urban – and the ideal city, however imperfect, ought to be inclusive of the humanity epitomised by each.

Wright's life and work spanned from the Victorian age to the space age, and *The Living City* is arguably his most ambitious attempt to ‘bridge the gap’. In arguing for contextual, open-ended planning methods it provides a suitable polar counterpoint to contemporary notions of cities as self-sufficient. As a precedent stimulating an awareness of the fundamental need of a ‘humane proportion’ of industry and agronomy, it is of urgent relevance today. Certainly in many ways we are still in that era: although the ever-increasing precision of modern technology enables incredibly powerful machines, new scientific insights regularly expand our horizons and every day proud new cities sprawl Leviathan-like across the face of the earth, it is up to us to require that they be humane. Perhaps humanity is ever to go on learning the lesson of the printing press: iterative and exploratory are often still preferable to permanent and perfect, as they are better suited to our inter-generational human condition. *The Living City* – a project resulting from the architect's own initiative, not a client's – gives form to decentralised power in direct affinity with woman's suffrage, civil rights movements, anti-trust legislation and open source networks. If the mythological deep-sea Leviathan can be equated with submerged, repressed memories, and fear of it equated with individual or cultural anxieties related to these, then ‘waking Leviathan’ could be just the therapy needed for us to realise that the shadow threatening to blot out memory, light, and time, is our own.

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ENDNOTES

- 1 A correlation in emerging academic discourse exists here that is worth mentioning, insofar as reference to the 'poetic' - here in the sense that term is used in the de Tocqueville citation - is currently undergoing a dramatic resurgence, thanks in part to the work of Lynn Margulis in the still emerging field of chronobiology, which examines periodicity - or cyclic phenomena - in living organisms, and their adaptation to solar and lunar rhythms. As referred to in the text, current enthusiasm for autonomy, for urban self-sufficiency, tends to construe the implications of biological analogy along the lines of ideas like *autopoiesis*, which refers to a system capable of reproducing and maintaining itself. However, its opposite seems a more likely biological analogy: *allopoiesis* is the process whereby a system produces something other than the system itself, like a crystal, or an assembly line, where the final product is distinct from the means of production. Thinking that cities come from cities, or that architecture comes from architecture, is somehow not quite right. To quote pianist Keith Jarrett as regards music: "It is like saying babies come from babies. It just isn't true! Music doesn't come from music - it comes from everything but music." [Keith Jarrett: *The Art of Improvisation* (DVD 2005)]
- 2 As for instance from *The Living City*, p. 42: "That government is best which governs least" said a Thomas Jefferson crossing an Alexander Hamilton. George Washington, Thomas Paine, Abraham Lincoln, William Lloyd Garrison, John Brown, Emerson, Whitman, Thoreau, Henry George, Louis Sullivan - such as these and their kind were her sons. In them the original ideal was held clear."
- 3 See, for example A.C. Nelson (1995) *The Planning of Exurban America: Lessons from Frank Lloyd Wright's Broadacre City*, *Journal of Architectural and Planning Research* 12 (4) (winter, 1995): pp. 337-356, note illustration p. 347, interestingly attempting to situate Broadacre into a Central City/Garden City/Edge City planning model.
- 4 It is interesting to note that, according to John Hejduk, Rowe and Hejduk quit the Texas Rangers because of their incompatible views about Wright: they'd taken tours visiting Wright's projects, Rowe starting out as a Wright advocate, and Hejduk an advocate of Le Corbusier - by the end of the tour they'd swapped positions, passionately. Of course, they each went on to their own academic careers, notably influencing their students - many of whom are now successful architects, with works strongly reflecting the attitudes of their mentors. For example, Elizabeth Diller was a student of Hejduk, and is very open to these Wrightian influences; Eisenman was a student of Rowe, and clearly was not so inclined to openness - at least in later years. Bernard Hoesli, another Texas Ranger, seems to have been the peacemaker, usefully integrating both Wright and Le Corbusier in his curricula.
- 5 This exchange between the author and Peter Eisenman was documented at the Berlage Institute in Rotterdam, and can be seen on video at The Berlage (The Berlage, 2010).
- 6 Job 3:1-8; also see Hailey, 1994, p. 49.
- 7 Payne, 1980, 1: p. 472

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TRANSPORTATION INFRASTRUCTURES

The diabolic highway

On the tradition of the beautiful road in the Dutch landscape and the appetite for the magnificent highway in the big city

WILFRIED VAN WINDEN

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Abstract

The highways of the Netherlands are used intensively, yet most of us are unable to summon up as much appreciation for them as we can for an attractive square, park or landscape. Highways may well be component parts of our public space, but they are not part of our aesthetic culture. From the history of the landscape we know that the impressionability of the poet and the depiction of the painting were needed to train the gaze. Appreciation follows representation. Is there a schematic organisation of visual perception that could assume the role of yesteryear's landscape painting in the present day? Here and there voices tenaciously proclaim that no aesthetic principles are applied in the laying of highways in the Netherlands, and that the road is purely the product of the art of engineering and the immanent logic of its technology. In the essay this myth is unmasked and brings an almost forgotten dimension into the limelight: the aesthetic design. Immediately after the Second World War, the engineer K.E. Huizinga explicitly gave shape to an aesthetic theory for the highway. So the design of highways in the Netherlands does indeed boast an aesthetic tradition of no small measure. Therein Huizinga's 'spatially expressive approach', the Dutch heir of the parkway and the Autobahn, has proven to be the leitmotif that courses from the beginnings right through to the present day. The parkway has found its counterpart in terms of landscape in the autonomous motorway. Aesthetic as well as sublime ideals of beauty are, however, carried to the grave by the urban counterpart, the highway in the big city: the Diabolical Highway. Take, for example, the Boulevard Périphérique in Paris, which is a Diabolical Highway without compare. We cast our minds back to Siegfried Giedion. The parkway, his parkway, as the backbone of a new city planning, gives the motorist the uplifting feeling of rust calm and freedom. The Diabolical Highway is, however, anything but that. There is no calm rust and everything is coincidental. They are roads in overly tight spaces, hectic experiences, but also metropolitan experiences. The essay makes a distinction between three types of highway, each of which is elucidated by an example: the parkway, the autonomous motorway and the diabolical highway. Thus in the design of the urban highway lies the greatest challenge, and as yet few principles have been devised for it.

KEYWORDS

highway design; scenic road; urban planning; spatio-scenic approach

1. INTRODUCTION

Some seventy per cent of the world population will be living in urban areas by 2050, which poses the designers of these urban areas for major design questions. The future of the metropolis depends on the degree to which congestion can be addressed. Infrastructural networks are undergoing a development that is characterised by the pursuit of an optimisation of mobility by eliminating barriers and an increasing interdependency (Nijenhuis & Van Winden, 1996). Urban planning will be increasingly connected with the issue of mobility and the design of infrastructure.

Motorways are used intensively, yet most of us cannot muster as much appreciation for them as for an attractive square, park or landscape. Motorways may well be part of our public space, but they play no part in our aesthetic culture; they have to make do with the status of banal and cursorily perceived 'surroundings'. The history of the landscape has taught us that in order to train the gaze we need to have the receptiveness of the poet and the visualisation of the painting. Portrayal begets appreciation. So which schematic dispositions of seeing would today assume the role of the landscape painting of yesteryear? What makes a motorway attractive? What are the aesthetic paradigms of motorway design?

2. OUTLINE

This essay explores the development of motorways in the Netherlands, especially their aesthetic design, as a case study.¹ In comparison to other European countries during the interwar years, the development of motorways in the Netherlands and Germany was quite advanced. From the 1960s onwards the construction of motorways became more widespread across the rest of Western Europe (Crowe, 1960).² This essay reveals a modern visual experience that is universal: that of time and space and the experience from a dynamic perspective, against the backdrop of the specific historical development of motorway design in the Netherlands.

The motorway is attractive when the engineer has tailored his practical art to what the motorist racing along it will experience. The principles of the attractive motorway are a typical product of modernity: form is considered, as is time – their object being the spatio-temporal form. These principles show us how to bypass the mind and appeal directly to the heart, without the intercession of the intellect. It lends itself to comparison with listening to music or watching a film and the experience of architecture, but secretly its pact is with choreography.

The aesthetics of the motorway is partly due to a mysterious conspiracy between 'the desire for maximum velocity', the 'dynamic perspective' and

the irresistible 'kinetic thrust' of curves rolling onward without end.

The history of roads, from the *Via Appia* to the *Champs Elysées*, teaches us that endeavouring to create beautiful roads has been a constant, and this applies for the Netherlands as well: boulevards and avenues designed for the city and parkways for the countryside. Our day and age are in sharp contrast to this: we lack any concept of how the attractive motorway in the city, tailored to the speed of today, ought to look. We have no conception whatsoever of a contemporary motorway boulevard, motorway avenue or motorway lane. We are familiar only with tunnels, noise barriers, and poor and laborious attempts to tame and re-forged the motorway into a city thoroughfare with addresses.

Here and there one encounters stubborn opinions that no aesthetic principles have been employed in the construction of motorways in the Netherlands and that the road is merely the product of the art of engineering and the immanent logic of its technology. These criticasters are essentially arguing that there has been no conscious pursuit of beauty in the design process. This essay debunks this myth and brings a well-nigh forgotten dimension to the fore: the aesthetic design of the Dutch motorway.

Immediately after the Second World War, the civil engineer K.E. Huizinga, an employee of Rijkswaterstaat (the Directorate-General for Public Works and Water Management) explicitly fleshed out an aesthetic theory for the motorway, and not only with his designs – which were wonderful – but also in his writings, his lectures, his excursions and the course he taught about road design. The design of motorways in the Netherlands does actually boast a considerable aesthetic tradition. This has its origins in the 1920s and alongside Huizinga there were other designers within Staatsbosbeheer (the Dutch Forestry Commission) and Rijkswaterstaat, such as Overdijkink, Elffers, Zuurdeeg and Nakken, who were part of this ethos.

3. METHODOLOGY

This tradition is not very well documented and has until now been charted only sketchily. No accessible archives have been collated and much material has been lost, because of reorganisations and the extended timelines of projects. The small amount of documentation has been general in nature, without mentioning names, never mind any critique. We therefore chose to interview as many of the people involved in motorway design as possible. In addition we made a study of the literature, collected widely dispersed documents and, of course, drove along all the roads.

The study proceeded from a widely accepted periodisation. The pre-war era, from 1920 to 1940, was reputed to be idyllic and romantic. The period from 1940 to 1960 was marked by the development of machine and technol-

ogy. The 1960s was the period of expansion in mobility and the 1970s was the period of democratisation and attention to safety. Ecology prevailed in the 1980s and the 1990s were typified by congestion and a cultural shift in the conception of the motorway.

It soon became obvious that this periodisation helped to organise questions on the planological level, but it does not dovetail with the subject of this study. It is impossible to divide the aesthetics of motorway design into periods: it is rather characterised by a limited number of road types, each of which represents a *beau idéal* that courses like a leitmotif through the various periods. We therefore made a distinction between three types of motorway, each of which is clarified by an example: the parkway, the autonomous motorway and the diabolic motorway.

The parkway has its origins in nineteenth-century designs by Frederick Law Olmsted (1822–1903) and Calvert Vaux (1824–1895), who coined the term for the idea of connecting the city with national parks by means of recreational routes. In the twentieth century Robert Moses (1888–1981) elaborated the idea for motor traffic in New York, while Sigfried Giedion (1888–1968) provided it with a theoretical framework and couched it in cultural terms. The American parkways, in turn, served as an example for the German designers of the *Autobahn*.

The autonomous road is as old as the road to Rome and in a certain sense it is also described in the four books by Andrea Palladio (1508–1580). Until far into the nineteenth century it was the basis of the European road network, which underwent a massive expansion during the Napoleonic era and provided the foundations for the system of national trunk roads in the Netherlands. The autonomous road is characterised by long, straight sections and monumental avenues of trees planted on either side.

Huizinga's 'spatio-scenic approach', the Dutch successor to the parkway and the *Autobahn*, has proven to be the connecting thread in the aesthetics of Dutch motorway design, running from its origins in 1920 to the present day. The design for the A1 near Naarden is exemplary for the parkway. The parkway has found its rural counterpart in the autonomous motorway, of which the A6 between Lelystad and Almere provides a fine example. The aesthetic and sublime *beau idéal*s were, however, consigned to their grave by their urban counterpart, the motorway in the major city: the diabolic motorway. The *Boulevard Périphérique* in Paris provides a perfect example of the diabolic motorway, while in terms of Dutch motorway design, the A10 West – the western quadrant of Amsterdam's orbital motorway – provides a striking example.

The description of the three cases employs the terms tectonics and ornament. The tectonics is the 'body' of the road, the route, the material form and its function as a carriageway. The ornament is the surface to which the

ornament can be appended, while the ornament is the make-up or costume that makes the road scenic.

4. HISTORY

At the first Nederlandse Wegencongres (Dutch Road Congress) in 1920 it was the architect A.H. Wegerif (1888-1963) who drew attention to aspects related to the aesthetic values of roadways. His advice was recorded in a report entitled 'De schoonheid, in het bijzonder 't natuurschoon, in verband met beloop, beplanting en kunstwerken van en aan den weg' (The beauty, in particular the scenery, in relation to the course, planting and engineering of and around the road). In his elaboration he drew a distinction between road and furnishings, which should be understood as everything that is placed on, in or near a road or carriageway that is not a component of the road proper.

The engineer G.A. Overdijkink had worked as a forester for Staatsbosbeheer since 1929 and was involved in the introduction of plants along national trunk roads. In 1915, Cornelis Lely (1854-1929), as minister responsible for transport and public works, approached Staatsbosbeheer to serve as a permanent advisor to Rijkswaterstaat, with the intention of fostering greater unity in views about the integration of infrastructural projects into the landscape.

Initially the effect was minimal and that must also have been why Bond Heemschut, a heritage conservation organisation, established a permanent committee under the name 'De weg in het landschap' – The road in the landscape – in 1933. The committee was tasked with ensuring the proper landscaping and better care of roads and their surroundings. In 1935 this committee published an eponymous brochure, 'De weg in het landschap', in association with the Nederlandse Wegencongres organisers and the ANWB (Royal Dutch Touring Club), with Overdijkink serving as one of the editors. The intention, some 14 years after the publication of Wegerif's report, was to propagate interest for what was termed 'the road question'. The brochure's publication reveals how difficult it proved to attain the unity sought by Lely and to give aesthetics a permanent place in motorway design.

It was the landscape architect J.T.P. Bijhouwer (1898-1974) who, even before the war, broke a lance for the parkway in his contribution to the Commissie Wegbeplanting (Committee for Roadside Planting), which was established by the Nederlandse Heidemaatschappij, a nature development organisation (Andela, 2011). The cover of the 'Wegbeplanting' report features a drawing of a road that organically meanders, elegant and joyous, through the landscape. Road and planting had to be tailored to the surroundings wherever possible. Overdijkink's ideas clearly resonate in this. Bijhouwer produced a schema of landscape types and appropriate plants, complete with varieties, which was

added to the ‘Wegbeplanting’ report as an appendix. It was intended as a practical design manual, and shortly thereafter he put the advice into practice with his planting proposals for Rijksweg 52 (1940) between Arnhem and Nijmegen, and for Rijksweg 12 (1941) between Utrecht and the German border (Andela, 2011: 72–73). This is remarkable because such advice was the preserve of Staatsbosbeheer.

In 1941, two years after the release of the ‘Wegbeplanting’ (Roadside planting) report, Overdijkink published *Langs onze wegen* (Along our roads) in a series of books published by the Bond Heemschut cultural heritage agency. The aesthetic principles it mentions continue to serve as a guideline for road design. Decisive aspects in his discourse are the planting, the positioning within the landscape, direction, width, elevation, layout and character (figure 1).

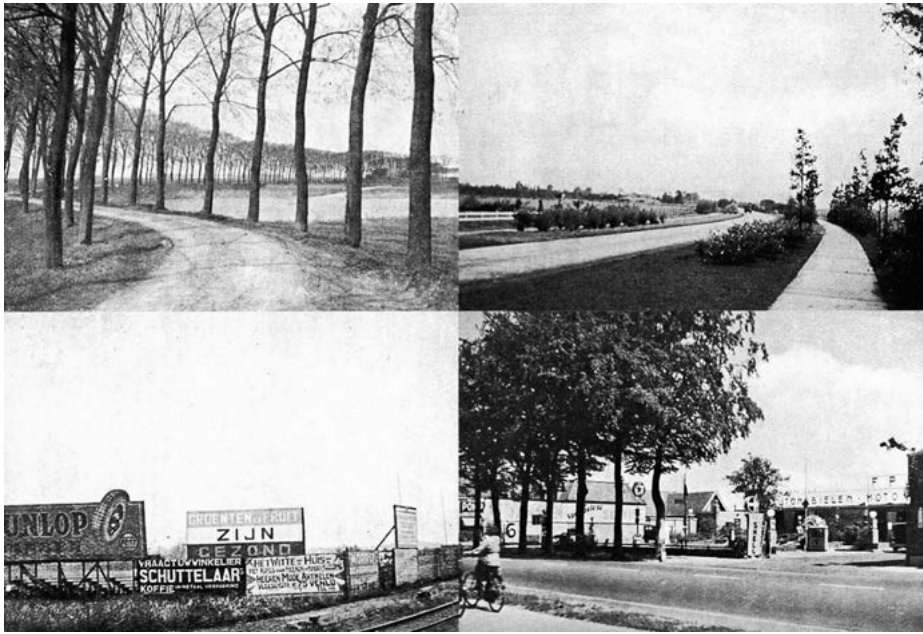


Figure 1 Right and wrong. From: ‘de Weg in het Landschap’, in: *Wegen*, 1936 (source: Archive ANWB)

Overdijkink advocated the regionalist approach. The planting must correspond with the character of the landscape that the road travels through. The character of the region must be expressed in the road design. This adaptability paradigm does not substantively differ from the directives that were drawn up for the *Autobahn* in Germany. For example, a 1934 article in the *Reichsautobahn*’s periodical *Merkblatt* states that the roadway must possess a beauty in keeping with the surrounding landscape and that the planting should include

only those species that would also grow and flourish somewhere naturally in accordance with their phytosociological make-up (*Merkblatt*, 1934).

After the war Overdijkink gained the support of the engineers H.P. Bakker, A.E.J. Nap and K.E. Huizinga. The latter in particular became a champion of the regionalist approach, which he later referred to as the ‘spatio-scenic approach’ (*ruimtelijk beeldende benadering*). Overdijkink, Bakker and Huizinga formed a close triumvirate who went on an excursion to Germany every two years. The first time was in 1952, at the invitation of Lorenz and Seifert, who visited the Netherlands in the alternate years. The civil engineer Hans Lorenz (1905–1996) and the landscape expert Alwin Seifert (1890–1972) worked for the Organisation Todt in the 1930s (Seidler, 1986), which partly explains why these contacts with Germany were kept quiet.

Alwin Seifert had already adopted a stance against the rectilinear nature of roads, advocating a more organic alignment – *Schwingungen in der Linienführung* – in 1935. The renouncement of straight roads as a functional and economic principle was a significant shift. With regard to *Nurautostrassen* – car-only streets that were composed of straight sections of road, in 1936 he commented: ‘These roads may well be at home in the steppe, but they are foreign to the German landscape and alien to the German soul. [...] Curves in the roads, similar to the course of rivers, would be more proper to the German landscape.’

Seifert also referred to Hermann Fürst von Pückler-Muskau’s 1834 manual for the landscaping of parks (Pückler-Muskau, 1834), *Andeutungen über Landschaftsgärtnerei* (Hints on Landscape Gardening). In a discussion of how to lay paths he mentions that the straight road divides the space and places the observer on that road between two spaces, while the curve unfurls an ever-changing perspective, giving the observer the feeling of travelling through space. In the pre-war years a strip of land at least 40 metres wide was set aside on either side of the *Autobahn* for the planting of trees and shrubs. These generous roadside verges, which were used to create the illusion of the German *Wald*, were called *Pücklerstreifen*. With the introduction of the German *Autobahn* it seemed it would be possible to transform Germany into a huge national park, reinforced by moving ever onward through the illusion of the German forest.

5. THE PARKWAY

Bijhouwer published an article with the title ‘Autosnelweg of Parkway?’ (Motorway or Parkway?) in 1949: ‘In the regimented manmade landscapes of the West as well as in the picturesqueness of the Veluwe and East-Utrecht, the speedway remains an alien, tough and impliable element that bores through

the land like a chute for traffic. The predominance of technical insight, the influence of the technical norm, is so strong that it would barely be possible to find roads that are more dignified or more fitting to the landscape's character (Bijhouwer, 1949).¹ This is once again a championing of the parkway in which the words of Alwin Seifert resonate and the work of Robert Moses for New York is cited as a shining example, and for which Giedion's *Space, Time and Architecture* probably served as a source of inspiration.³

In the development of the American parkway from the 1920s on, Giedion saw a new urban element born of the vision of the new era. Giedion tied in his parkway with the notion of space-time (i.e. dynamic observation, as developed in futurism and cubism), which he situated over against the central perspective of the Renaissance and the *rue corridor*. In order to save the idea of the city from the metropolis threatened with demise, Giedion argued that the first priority was to abolish the *rue corridor*, 'with its rigid lines of houses and its intermingling of traffic, pedestrians, and houses' (Giedion, 1954).

'Hausmann's endless streets belonged not only in their architectural features but also in their very conception to the artistic vision born of the Renaissance: perspective,' Giedion continues. 'Today we must deal with the city in a new aspect, dictated originally by the appearance of the motorcar and based on technical considerations, and belonging to an artistic vision born out of our period – space-time.' Nature seems to stream in spontaneously through the street frontage's broken-open perspective. Traffic and housing should be separated from each other by liberating the house from the street profile and accommodating it in large complexes set in open, natural surroundings. According to Giedion, the reason was that 'man demands for his existence quietude and the companionship of growing things'.

An exhilarating effect is ascribed to the parkway. The road Gideon describes in his *Space, Time and Architecture* could be described as sublime. (The effect of the angel is exhilarating, a theme also explored by Rilke and Benjamin.)

For Giedion, who envisaged the parkway as a component of the city of the future, its essence is to be found in the separation of motor traffic from pedestrians, which reclaims the freedom that is implicit in the unobstructed circulation for both functions: 'Out of this separation has come the fundamental law of the parkway – that there is to be unobstructed freedom of movement, a flow of traffic maintained evenly at all points without interruption or interference. To secure this steady flow, no direct crossing is permitted, nor do the owners of abutting property have the right of direct access; at intersections the conflicting or converging lines are disposed separately through the use of overpasses with their cloverleaves of intersecting roads.' (Giedion, 1954: 728). In contrast to the laying of railways or straight roads, the parkway is much more humane. Inserted between green hills, it follows the

contours of the landscape. Between the carriageways runs a central reservation that is planted with trees. Here the ideal is the total convergence of the road with its surroundings: the road becomes part of nature. The scale that is specific to the parkway is so at variance with the existing city that its whole structure would have to be reconsidered.

Huizinga's spatio-scenic approach is imbued with the scenic effect and the motorist's experience rather than the implications for society and urban development (figure 2).

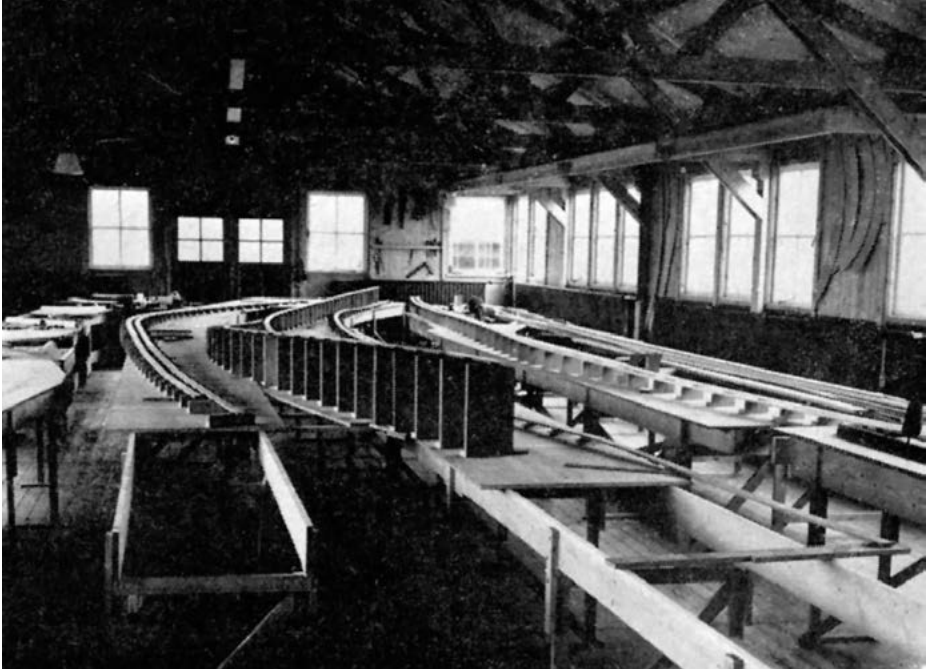


Figure 2 Model research of alignment ca. 1970, by Ir. K.E. Huizinga

An attractive road is a fine road when the embellishment, the scenic entourage, has a calming effect. His maxim: 'A road must fascinate, without causing tiredness.' The beautiful road harmonises with the landscape and merges with it. It is a road that seems 'self-evident' and looks natural there, as if it was not made by human hands. This calls to mind the *Bodenständigkeit* – groundedness or autochtony – that was propagated by Alwin Seifert, as well as the expressionist theme of productive nature. The underlying idea is that there is a structural kinship between technology and nature, which are acted on by a similar force. Humankind is merely the vector through which the object assumes a form that is organic and dictated by nature.

In the spatio-scenic approach the planting of avenues of trees is forsworn and replaced by elements within the depths of the landscape that match its scenic structure. The aim is to produce an experience of freedom, similar to that of the *Wanderer* in German Romanticism. The landscape must continue in the roadscape and the motorist must have the exhilarating feeling of being in the midst of the landscape. It is important that the eye should roam. No obstacles, but space for the unfettered gaze. No harsh lines, but vague contours that cause the road to integrate into the landscape (figure 3).



Figure 3 Parkway, RW 4, Zoeterwoude 1958 (source: Archive ANWB)

The A50 near Renkum, the A58 between Bergen Op Zoom and Vlissingen and the A1 near Naarden are among the most successful examples of the Dutch parkway. The landscape architects A. Elffers (of Staatsbosbeheer) and J. Nieuwenhuizen (of Rijkswaterstaat) stated that they were able to exercise plenty of influence over the A1's tectonics and ornamentation (figure 4). They had the opportunity to make decisions about the width of the verges, the

alignment and the integration into the landscape. They acquired land that penetrated deep into the surrounding countryside in order to offer the motorist the desired aesthetic experience.

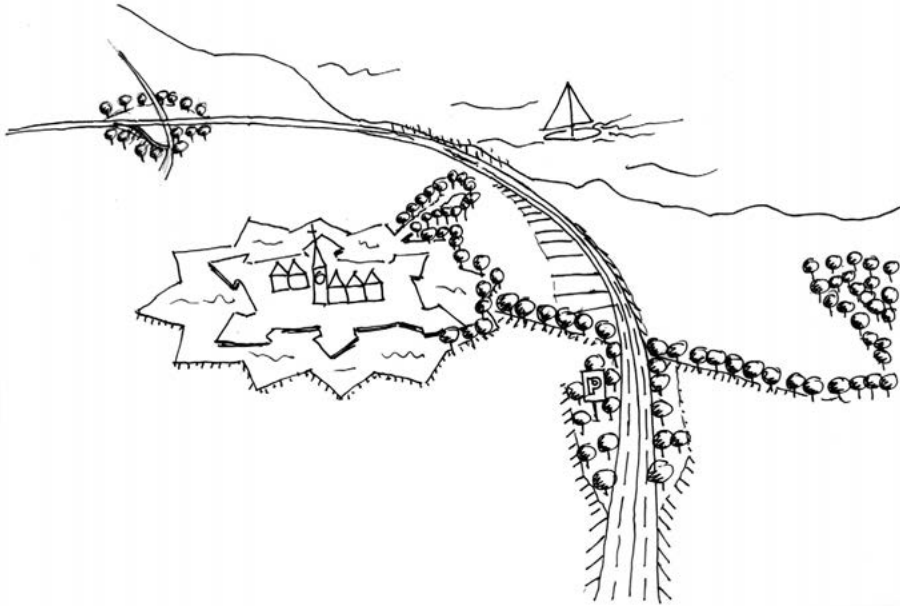


Figure 4 Icon Parkway: RW 1 Naarden (illustration: J. Beljaars)

The earliest designs for the A1 were produced in the late 1930s, but the decision about the route was not reached until the 1960s. The northern route, running between Naarden and the Gooimeer lake and wetlands, was preferred on Huizinga's advice. Travelling from south to north, after the northern Bussum exit the motorway curves gently towards the left, towards the Oostdijk. Here the road is raised on a dike. After the Oostdijk the road describes a sweeping arc around Naarden. What is unusual about the tectonics here is that the roadbed descends and narrowly skirts the Gooimeer lake. The designers created a very gradual incline in the western inside bend, in order to draw the surface level and the fortress town of Naarden into the field of vision (figure 5). The road then rises again and where it passes the marina it again runs along a dike embankment. After crossing the Naarder Trekvaart, the road continues parallel to this waterway towards Amsterdam.



Figure 5 Panoramic view Naarden, 2007 (photo: Piet Rook/Robert Nagelkerke)

The ornamental layout is intended to surprise the motorist. Trees were planted to the south of the Oostdijk to connect the rest area to the road in an aesthetically pleasing manner. On the Oostdijk itself there are rows of trees set square on either side of the road, thus forming a coulisse. The motorist approaches a semi-closed frontage, and on breaking through it a resplendent panorama opens up across the Gooimeer lake and the gently rolling, elegant curve of the road that unfurls itself within that panorama.

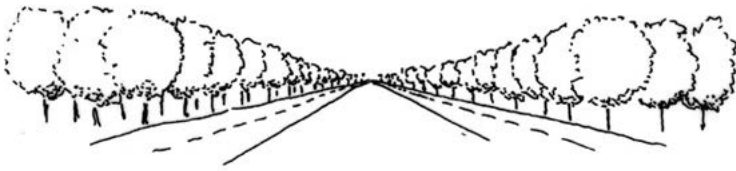
The design is a renaissance of the idyllic concepts from the 1930s, in line with G.A. Overdijkink's regionalist approach. The aesthetic surprises tumble into the field of vision of the unsuspecting motorist. It is like racing along in a great sweeping curve, in a centrifugal movement that is counterbalanced by a centripetal force. It resembles a gravitational field with the fortified town of Naarden at its magnetic core.

The motorist is repeatedly involved with the surrounding landscape in a scenography that alternately turns the gaze inward and outward. The parkway as a *paysage parlante* connects the motorist with the surroundings.

6. THE AUTONOMOUS MOTORWAY

The autonomous motorway is a type that makes the road independent of the surrounding landscape. It is a monumental approach that involves striv-

ing after a strong visual form, which can be explained from the road itself rather than from the surrounding landscape (figure 6).



(RW6 / Lelystad)

Figure 6 Icon Autonomous Motorway: RW 6 Lelystad (illustration: J. Beljaars)

Notable examples include the A2 near Boxtel, which in part follows the historical route of the Napoleonic highway, and the A6 near Lelystad.

The A6 is an interesting case because it was conceived to traverse newly created land and sparked heated debate. Its design was by N.M. de Jonge and was supported by Elffers. The idea was to treat the A6 between Lelystad and the A1 as a gateway to the northern part of the Randstad conurbation. This could be achieved by creating an avenue-like corridor with six rows of oak trees. The trees would be set 14 metres from the edge of the road, four metres further away than the 10 metres that was deemed safe, so that the motorist would be able to appreciate the whole tree in its full glory. This idea marks the return of the time-honoured socialist ideal of overcoming the antithesis of countryside and city, in this case by turning the route between the ‘new land’ of Flevoland and the Randstad conurbation into a metaphorical monument for the connection of city and countryside. For the designers the priority was to treat the Rijksweg 6 as an autonomous body, as an urban umbilical cord, a road that would be without precedent.

However, the designers encountered Huizinga along the way. On Overdijkink’s retirement from Staatsbosbeheer, Huizinga had transferred to Rijkswaterstaat with the intention of assuming overall control of the aesthetic treatment of roads. In informal discussions Huizinga dismissed the design as too fascistic, overly monumental and too static because of its long straight sections. He managed to thwart the plan with arguments about a lack of safety, criticising aspects such as the ‘wall effect’ and ‘tunnel effect’.⁴ He also had a negative opinion of the supposedly limited view of the surroundings. The

minimal variation would cause a slackening of the motorist's concentration and driving past rows of trees at high speed would have a restless stroboscopic effect. "An avenue-like planting along Rijksweg 6 kept as regimented as possible. Where possible consisting of seven rows of trees set 8 x 8 metres apart and approximately 20 metres from the side of the carriageway means that road users, especially the drivers, many thousands per day, will for fifteen to twenty minutes, depending on their speed, be able to observe practically nothing but trees and more trees – besides the road, the wide verges and a little bit of sky. [...] The field of vision thus restricted by trees will have so little to offer visually that the attention quickly wanes and any initial appreciation for the monumental form of the roadside planting will presently turn into boredom. [...] There is nothing else for it but to wait until the passing of the trees is brought to an end by one reaching one's destination."⁵

Huizinga's safety-based arguments meant he was able to settle the dispute to his advantage, so in the end just one stretch of motorway near Lelystad was executed as an autonomous design (figure 7).



Figure 7 Autonomous Motorway, 2007 (photo: Piet Rook/Robert Nagelkerke)

While planners debated and fought out the general introduction of the 'spatio-scenic approach', in the field totally different questions arose to which no answer was found: the birth of the diabolic motorway.

7. THE DIABOLIC MOTORWAY

Until the 1960s the motorway system in the Netherlands served roughly two purposes: providing a connection between major cities and opening up the hinterland. The route came to an end at the municipal boundaries of a major town or city. The local council was deemed responsible for an effective handling of traffic within the municipal boundaries. This system could not cope with the explosive increase in road traffic in the early 1960s, and during the 1960s these sections of motorway that were interrupted as they approached the cities were interconnected.

Construction of the West Axis, which constituted part of an orbital road for motor traffic around Amsterdam, was begun in the early 1960s. However, in 1968 the minister responsible decided that the ring road would become a *Rijksweg*, a national trunk road, with far-reaching implications for its position within the urban fabric.

It was designed by the engineers A.H.C. Kandelaar (of Rijkswaterstaat) and W.A.G. Blom van Assendelft (of Amsterdam City Council). In the history of Dutch motorway design it is an exemplary route, because for the first time the concept of the ring road was applied to the routing of a motorway and because in part it cut straight through existing urban areas.

The design of the motorway in densely developed urban areas is, as we shall see, of a different order and significance to the urban thoroughfare that received more attention from the 1960s due to publications such as Kevin Lynch's *The View from the Road* and Robert Venturi's slightly later *Learning from Las Vegas* (Appleyard, Lynch & Myer, 1964; Izenour, Scott Brown & Venturi, 1972).

During studies into fixed cross-channel connections for Amsterdam's North Sea Canal, Rijkswaterstaat had preferred a link near the Hembrug and Schellingwoude, set on the city's periphery as envisaged in the *Algemeen Uitbreidings Plan* (AUP, or General Extension Plan). The city authorities preferred the more easterly position, using the spatial reservation for *Ceintuurparkweg*. This was the first time that a concession was made to the motorway, which can be neatly laid down in Holland's panoramic landscape, where it is subject only to the logic of its own internal laws, such as those of the 'spatio-scenic approach'. According to Rob Nas and Jan Nakken (who were both employed by Staatsbosbeheer) we should not understand the insertion of the West Axis as an exercise in landscape architecture. There was simply no space for it and there was a lack of aesthetic resources with which to approach the task. Considered from the perspective of engineering theory and the aesthetic paradigms of integration with the landscape, the A10 West can only be described as a failure. Here a successful insertion literally meant that it fitted.

Let us cast our minds back to Sigfried Giedion. The parkway – his parkway – as the backbone of a new urban disposition gives the motorist the invig-

orating feeling of calm and freedom. His parkway heralds the demise of the concentric city. The Renaissance perspective is supplanted by space-time in which there are objects interconnected by the parkway. The A10 West displays the hallmarks of those separate streams of traffic. On the A10 West there is no calm and everything is coincidental. It is a motorway that is challenged by a severe shortage of space, overly confined slip roads and plenty of traffic filtering in and out (figure 8).

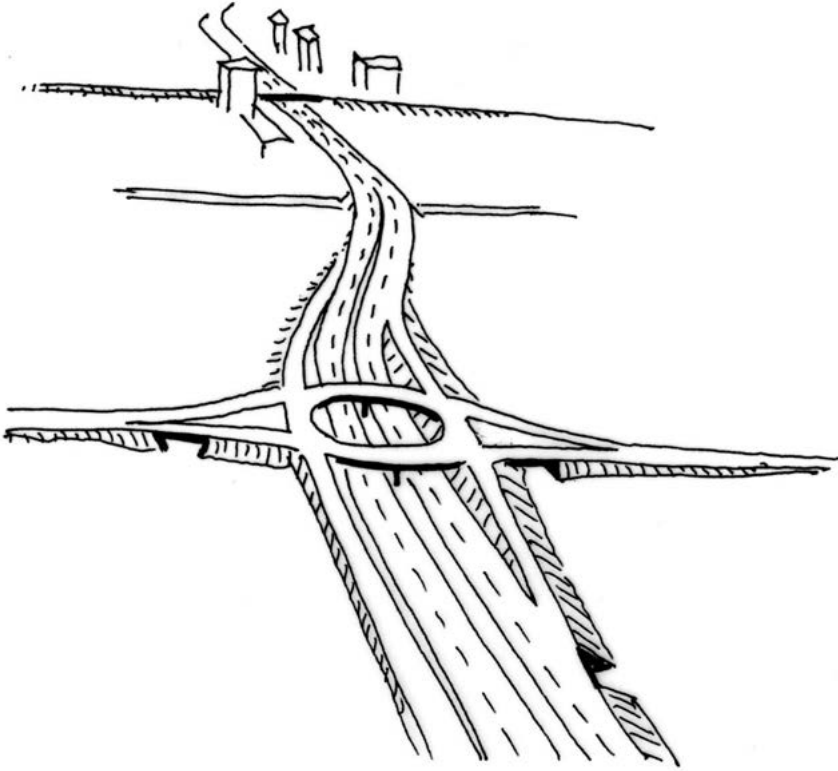


Figure 8 Icon Diabolic Motorway: RW 10 West, Amsterdam (illustration: J. Beljaars)

With his design for Ceintuurparkweg, Cornelis van Eesteren wanted to reconcile the modern motorway, Giedion's parkway, with the city. The road runs between the ring-line railway and the existing city like a thin spindle. Van Eesteren designed various profiles with the intention of making Ceintuurparkweg alternately narrow and wide (figure 9).

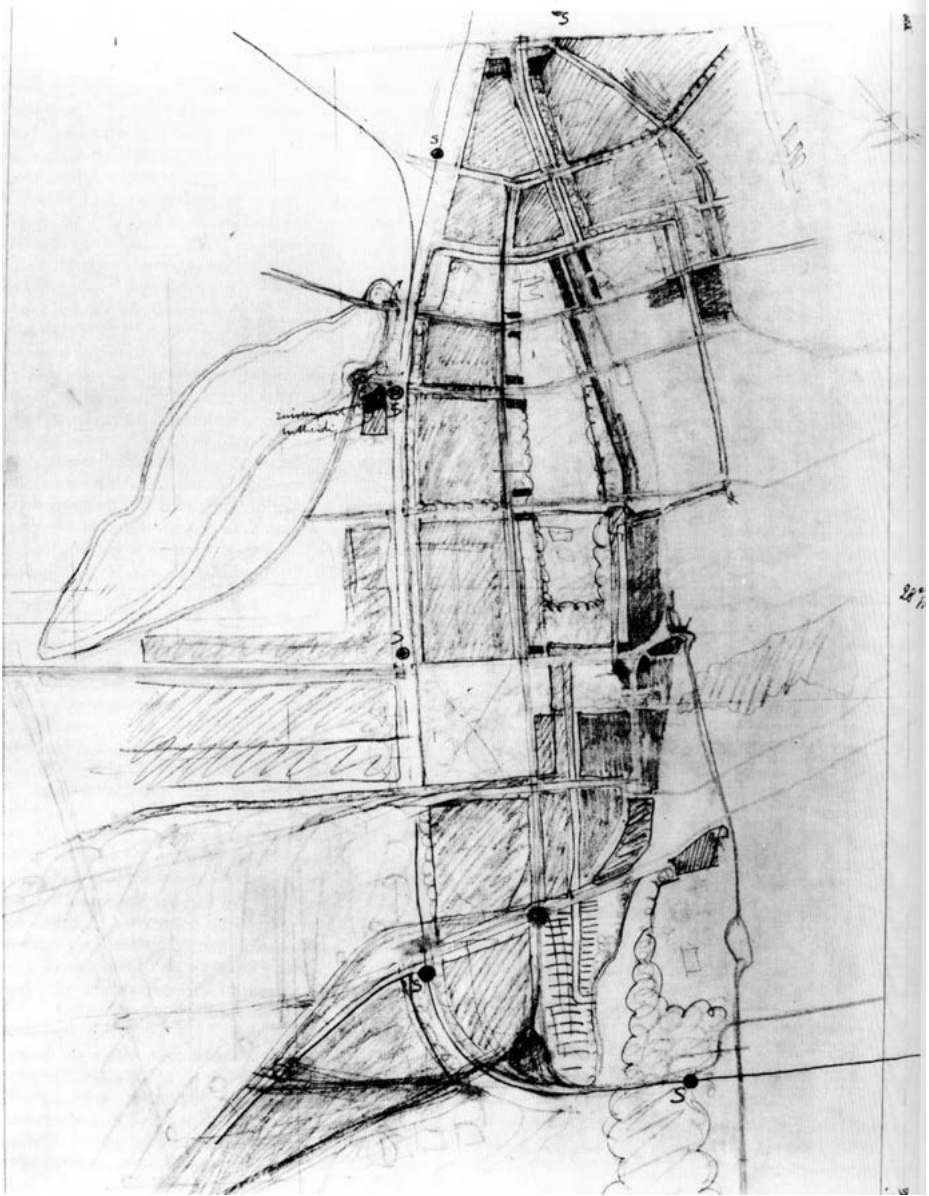


Figure 9 Scetch Cornelis van Eesteren Amsterdam West, 1929 (source: Gemeente Archief Amsterdam)

Through to Heemstedestraat he planned a relatively enclosed profile, with buildings ranged along the building line, while to the north of this the profile is open, with vistas to urban chambers in the west and the marina in the east. In Rembrandtpark there are four rhythmically placed high-rise blocks and here the profile becomes park-like in character. Further north Ceintuurparkweg describes an arc as it enters into the residential district of

Bos en Lommer. From the bridge across the Erasmusgracht canal as far as the intersection, the road's perspective is once again hemmed in between edifices. Van Eesteren's Ceintuurparkweg ended at this monumental junction in Bos en Lommer. His design was a deliberate attempt to choreograph the cityscape as it is dynamically perceived in motion. However, this design met with its ruthless demise during the road's transformation into the Rijksweg 10 orbital motorway.

The projection of the West Axis of Rijksweg 10 onto the route of Ceintuurparkweg prompted no modification to the AUP's urban composition, as if the designers were insufficiently aware that here the motorway was entering into a totally different world. The road surges onward, traversing slow-traffic routes and passing beneath the radial urban thoroughfares. It is an interlacing of motorway and local roads that run perpendicular to it. The motorway's undulating grade, which at no point converges with the surface level of the surroundings, divorces the road from the urban context.

The Rijksweg's indifference to the surroundings turns the Bos en Lommerplein into a spatial chaos. Sections of this symmetrical plaza were adapted to the turning curves or disappeared altogether (figures 10 and 11).

Plan Bos en Lommer 1935



Plan Bos en Lommer 1961



Figure 10 Bos en Lommerplein, 1935 & 1961 (source: Stadsarchief Amsterdam)



Figure 11 Bos en Lommerplein North direction, ca 1969 (source: Stadsarchief Amsterdam)

The road occupies its own space, separate from the surroundings. As seen from the city, the road is concealed behind buildings and amid greenery.

This involved the projection of a foreign element that, because of its idiosyncratic patterns, could not be inserted into this composition as an urban element, at least not in terms of a controlled and orderly urbanity. An object has ended up being laid across the grid of the “*functional, aesthetically pleasing and hygienic city*”, an object that is indeed interwoven with the city in terms of road and traffic engineering, but aesthetically speaking it placed a bombshell under the idea of marshalling the cityscape. They are two relatively autonomous systems, two ‘worlds’ that have been brought into each other’s proximity by superposition, and are subsumed in their mutual negation and rejection (figure 12).



Figure 12 Bos en Lommerplein superposition of two 'worlds', 2007
(photo: Piet Rook/Robert Nagelkerke)

It is the obtrusive, pre-existing urban conditions that determine the road's course rather than its immanent logic. There is no calm and everything there is coincidental. It is such states of mind that distinguish the hybrid urban motorway from the motorway in rural areas, beyond the parkway of Giedion, Bijhouwer and Huizinga, and beyond the autonomous highway of De Jonge and Elffers.

It is typical of the arguments of Giedion, Seifert and Huizinga that they strove after the continuity of the network and the cohesion of the road system as a whole. For them it was about the eradication of barriers by means of the parkway, and about the motorist's experience of speeding along – an experience that speaks directly to the heart, without the intervention of the conscious mind.

The aesthetics of the future recognises just one important parameter: the elimination of anything that impedes. In the post-war years Giedion's modern aesthetics of space-time dissolved into panoramic vastness. Brasilia, the only city that has managed to absorb the speed harmoniously, attests to this.

It is the outcome of a sought-after model, the embodiment of a pre-existing idea. Its soporific scalar excess and unfolding of functions has been carefully preserved by designating the city as a protected monument and fixing its population at 500 000. 'Shadow cities' where two million people live in an improvised infrastructure have developed around this utopia.

In urban areas it is a matter of maintaining control of the tectonics. There one finds a paradoxical relationship between the road and the environs, that we cannot describe as harmonious, nor can we wholly disregard it as if it were non-existent. Consider, for example, the Kleinpolderplein near Rotterdam or the Utrechtse Baan in The Hague, hemmed in by the obtrusive mass of the city, but an independent space nevertheless. Or take the freeways of Los Angeles: superimposed on the city, they nevertheless form a separate world. The lack of space means that the usual landscaping resources are inadequate and unforeseen effects arise there.

8. IN CONCLUSION

According to the French philosopher Alain Badiou, the twentieth century has been dominated by paradoxical connections that he calls 'disjunctive syntheses' (Badiou, 2006). The surrealists created disjunctive syntheses by conjoining objects from different worlds, without striving after an overarching harmony or idea. Coincidence and semantic interferences detach the component parts from their usual identity.

Something similar occurs with the diabolic motorway. City and roadway are linked but remain autonomous, the embodiments of two worlds. The relationship between city and motorway is a disjunctive synthesis. Its identity is not the product of the establishment of a harmonious ensemble, but is shaped by a memory of a hellish experience. The friction of coincidence and the wonder of inadvertent effects are hallmarks of the disjunctive synthesis. A dichotomy that refuses to resolve into unity is something in which the devil must have had a hand.

Tectonics and ornamentation can feed upon this disjunctive synthesis, meaning that things can stand face to face without any similarity, provided that this does not hamper movement or the experience of racing along.

In Europe it is the French architect Paul Andreu who has demonstrated that stark juxtapositions of distinct worlds can offer exciting design solutions. In his design for Roissy-Charles de Gaulle Airport he merges road and building, for example at Terminal 2, where the motorway crosses the TGV station.

By comparison with the tectonics, the ornament can behave freely. Who would want to rein in the bad taste and the supposed shambles of the *Boulevard Périphérique*? The metropolitan experience that the road offers is its very

identity. Using the technique of disjunctive synthesis, the ornamentation could be radicalised even further into a magnificent motorway in the big city. The motorway of the future lies in urban territory and the diabolic motorway is its guiding principle.

ENDNOTES

- 1 This essay is an adaptation of the study conducted by Wim Nijenhuis and myself. Nijenhuis, W. & Winden, W. van, (2007) *De Diabolische Snelweg – over de traditie van de mooie weg in het Nederlandse landschap en het verlangen naar de schitterende snelweg in de grote stad*. Rotterdam, Uitgeverij 010.
- 2 Crowe's introduction notes that England lags behind when it comes to the design task of integrating motorway and landscape. The book primarily refers to parkways in the USA and Germany.
- 3 Bijhouwer often used this book for teaching purposes. The quote is taken from G. Andela (2011): 127.
- 4 Interview with the engineer K.E. Huizinga in 1998 at De Bilt.
- 5 From an internal memorandum by Huizinga in the archives of Stichting VIA.

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A bridge with a view, a view with a bridge

Identifying design
considerations for
bridges to strengthen
regional identity

JORIS SMITS, FRANK VAN DER HOEVEN

Abstract

This paper discusses design considerations for creating high quality infrastructural artefacts with an emphasis on bridges. The authors pursue a design study and analysis approach to highlight the specifics of infrastructure design for regional identity, based on their own work on a bridge ensemble in the Dutch Zaanstreek region. Two highlights of this work, the award winning Juliana Bridge and the wildlife crossing in Rijssen, are used to illustrate how to create good infrastructure design in sensitive contexts, without making use of neo-vernacular methods.

KEYWORDS

regional identity, architecture, bridge, wildlife crossing; Zaanstad; Dommel Bridge; Highway of the Future; Hoogtij Bridge; Zuidelijke Randweg Bridge; Butterfly Bridge; Prins Bernhard Bridge; Zaanbridge; Juliana Bridge; Rijssen wildlife crossing

1. INTRODUCTION

In *A view from the road* Donald Appleyard states: “ugly roads are often wrongly taken to be the price of civilisation, like sewers or police” (Appleyard, Lynch & Myer, 1964). The boring, chaotic, disorientated roadscape seems to be the natural habitat of that useful but awkward monster, the automobile. Most infrastructural artefacts that we pass on our daily journeys through our landscapes seem to have little or no connection to the landscape they traverse, be it urban or rural. This anonymity of infrastructural artefacts along the highway leads to animosity among the users. This article analyses in depth the design decisions regarding a key infrastructural artefact in our infrastructure landscapes: bridges. Its point of departure is that designing bridges as part of an urbanised landscape should be a self-evident matter.

In this context this paper addresses the question: which design considerations allow us to design bridges that fit our social and cultural requirements? What does it take to make bridges contextually aware? How can bridges be designed in such a way that they are appreciated by their users as well as those who live nearby while contributing positively to the identity of place and region?

The second paragraph of this paper addresses the importance of strengthening regional identity by means of infrastructure design, and more specifically by means of infrastructural artefacts such as bridges. Different approaches to designing bridges and other infrastructural artefacts within a landscape, be it rural or urban, are discussed.

The third paragraph demonstrates the contribution of a regional approach to the identity of an area through some of our projects in the Zaan region, in the Netherlands. Together these bridges form an ensemble that provides a sense of regional belonging.

The fourth and fifth paragraphs analyse two of our projects to illustrate the outcome of the design approaches that are presented in this paper. Both projects differ in terms of typology, context and design approach. The Juliana Bridge responds to a world heritage site, while the wildlife crossing in Rijssen deals with an ecologically sensitive area and with differences between two landscape types in the Netherlands.

2. STRENGTHENING REGIONAL IDENTITY THROUGH MEANS OF INFRASTRUCTURAL DESIGN

The on-going process of European integration seems to downplay the role of nation states while allowing regions to play a stronger role than before. The subsidiarity principle of the European Union states that no unnecessary centralisation should take place and that tasks should be delegated if possible to lower tiers of government. This leads to a trend in which decisions

on for instance spatial planning or infrastructure planning are increasingly delegated to regional authorities while in the past such decisions were taken nationally. This process strengthens the power of regional authorities and in parallel creates a need to develop or emphasise a newfound regional identity. While maintaining the socio-cultural characteristics of a region, administrators and politicians feel at the same time a need to underscore the economic value of their 'brand'.

When it comes to strengthening the identity of a region at the interface of infrastructure and (urban) landscapes, architects and engineers hold strong tools. Hundreds of thousands of travellers and commuters pass our local roads and highways daily. Users of bridges, roads and tunnels outnumber the number of visitors of our city halls, museums and music centres by a large margin. That is why the road with all its bridges, viaducts, tunnels and noise barriers can become a means to bestow character and identity to a region, if not standardised across the country.

As early as 1941, the Dutch designer ir. G.A. Overdijkink wrote in his book *Langs onze wegen* ('Along Our Roads'), that the character of a region must be expressed in road design (Overdijkink, 1941). By road design he meant the alignment, the planting, the width and lane configuration of the road. This adagio should be extended to include the infrastructural artefacts underneath, above and next to the road. If architects and engineers succeed in bringing across the feeling that a design is tailor made for a specific location, then ultimately these infrastructural artefacts can contribute to the sense of pride and dignity that ties people to their region.

Of all infrastructural artefacts along a road or highway, bridges are the main highlights in the route design. The presence of a bridge enhances the sense of orientation and gives an idea of the kind of place you are going through. A bridge is one of the few objects along a road or rail line that manifest itself to the traveller as an elevation with a facade. Traditionally the facade is the architectural element that articulates the design of the building, sometimes even becoming monumental like the front facades of cathedrals. Bridge design can be approached in a similar way, as an act of culture, bestowed with an identity that is contextually aware.

When we look at the literature we can find many books and papers that treat the design of mobility on the larger scale of the highway and its surroundings (Overdijkink, 1941; Appleyard et al., 1964; Boekhorst, et al., 1986; McCluskey, 1992; Schöne et al., 1997; Buijs et al., 2003; Houben et al., 2003; Nijenhuis, et al., 2007). However, the subject of the design of individual infrastructural artefacts such as bridges is hardly subject of research. This is why the following theories are based on our own experience in our projects and on our observations in the field.

There are several approaches for creating infrastructure that is contextually aware. By and large we can say that there are two opposite ends in the appreciation of infrastructural artefacts and the subsequent design approach.

First there are those who are alarmed by the ugliness of the highway. They preach the repression of vice; their adagio is to hide infrastructure or to melt it into the landscape. Scars of construction should be camouflaged by planting. In the best of cases the genius loci is interpreted as an elaboration on the historic idiom.

On the other hand there are those who believe in the power of the design as a weapon against mediocrity. This calls for a more contemporary approach and a less literal interpretation of the characteristics of the place and the people that live there.

In *The Joyless Economy* Tibor Skitovsky states that an excess of standard goods, for example non-exceptional goods, will lead to increased social dissatisfaction, because the goods are devoid of real sensory stimulation for human beings (Skitovsky, 1976). If that is the case we must provide people with a satisfactory sensory and at the same time pluralistic experience for their everyday mobility. What better way than to raise the quality of design of our infrastructure. Can bridge design be an act of culture that creates value in the eyes of the beholder? There is little discussion about turning the highway experience into a positive account. Show it off with pride, design it! Just as the polder landscape was designed (Houben & Calabrese, 2003) (figures 1 & 2).



Figure 1 The Dommel Bridge. The identity of the city of Eindhoven (the Netherlands) as the cradle of both the Philips light bulb industry and the Design Academy is expressed in this bridge (source: Joris Smits)



Figure 2 Sustainability through innovation is the theme that stands at the base of the highway of the future in Oss (the Netherlands). Through this strong positioning Oss distinguishes itself in a self-confident manner as a pleasant place to live, work and recreate (source: Joris Smits)

3. BRIDGES IN THE ZAAAN REGION, THE NETHERLANDS

The award winning Juliana Bridge in the Zaan region by Joris Smits, demonstrates best practice in strengthening the regional identity through means of infrastructural artefacts. What elements constitute the regional identity of the Zaan region and how is this reflected in the bridges that we designed and built in this region? This chapter describes how the character of the Zaan region was captured in the bridge design, through the use of local elements.

The Zaan region has always been a very industrious part of the Netherlands inhabited by a very industrious people. It was in the Zaan region that the first signs of industrialisation appeared along the river Zaan. That is why traditional values and state of the art industry have always gone hand in hand in the Zaan. The traditional wooden houses, spotlessly clean in shades of white and green, stand alongside the massive silhouettes of silos, among which the famous 36 meter tall Lassie silo that was Netherland's first concrete silo, built for the shipping of rice, cacao and coffee to and from the rest of the world. Nowadays the industrial heritage of the Zaan region is an important asset for tourism in the Zaan. We must not forget that the famous line-up of windmills at the Zaanse Schans was not designed for tourism but to process the wheat and the barley for the food industry. This region and its people have core values that reflect tidiness as well as a strong belief in modern technology.

How does one reflect such a regional identity into the design of a series of bridges? Some architects believe the answer lies in a neo-vernacular approach, a semi historical style with a very caricatural reference to an architecture of the past. This belief is most strongly advocated by the Dutch architect Sjoerd Soeters. Two of his recent designs in Zaanstad for the city town hall and an adjacent hotel are much discussed and quite controversial. We on the other hand believe that in the Zaan region contemporary solutions are needed that fit in with the industrious character of the location. In the design of the series of bridges for the Zaan region this approach is demonstrated.

In a period of ten years, beginning in 2001, the architectural office of Royal HaskoningDHV was responsible for a series of six bridges, five of which have now been built (figures 3 to 6).



Figure 3 The Hoogtij Bridge for cyclists in the Westzanerpolder, 2005 (source: Joris Smits)



Figure 4 The pedestrian bridge in the Zuidelijke Randweg, 2005 (source: Joris Smits)



Figure 5 The 'Butterfly Bridge' for buses spans road and water, 2003 (source: Joris Smits)



Figure 6 The Prins Bernhard Bridge a multi-layered bridge with access to the river quays, 2007 (source: Joris Smits)

Although they are all individual projects on different locations and designed for different authorities, there is a visual bond that ties them together and makes them belong to this region. For lack of a better word we will call this regional identity. All five bridges are modern in appearance and reflect state-of-the-art design. They have a consistent look and feel and are constructed from slender steel shapes. The use of steel reflects the many industrious cranes along the shores of the Zaan. The gentle curved shapes and arches mean that these bridges are not the iconic statements that modern bridges so often are: dominating shapes with a focus on their own presence and little relation to their surroundings. Rather the elegant arched silhouettes emphasise their binding function in the urban fabric, manifesting a strong connection with the ground level from which they emerge: rather earthly than stretching towards the skies.

All five bridges have a uniform colour scheme in the local shade of white called 'Zaans wit' or Zaan white, a well-defined off-white, with a touch of another local colour: Zaan green. This specific colour scheme makes these bridges blend in harmoniously with the local architecture and with the green and blue colours of the Dutch landscape without them being neo-vernacular.

4. THE JULIANA BRIDGE

The setting of the Juliana Bridge is unique. Adjacent to the UNESCO world heritage site of the Zaanse Schans, the bridge design has been kept rather modest: undoubtedly a contemporary design, but one that respects its historical surroundings. The design is light-footed and transparent but also unpretentious. It offers plenty of space for tourists and cyclists by providing them with their own bridge deck. Maximum attention has been placed on experiencing the landscape, both from on the bridge and underneath the bridge. The panorama deck offers unhindered views of the Zaanse Schans to the north and the industrial heritage to the south. Even the shape of the lampposts, emerging from the void in between the two bridge decks, puts the emphasis on the outward view. The following section describes the design considerations that have been implemented to make the Juliana Bridge a fitting design in this delicate context.

4.1 Rhythm and harmony

The most manifest design decision was to ensure that there was not a strong presence of any structure above the deck level, be it a lifting structure or a load bearing structure such as an arch or a cable stay. The Juliana Bridge is an opening bridge in a busily navigated channel, with an eighteen metre opening clearance within a total bridge length of 200 meters. Most lifting bridges in the Netherlands are of the traditional drawbridge typology (figure 7).

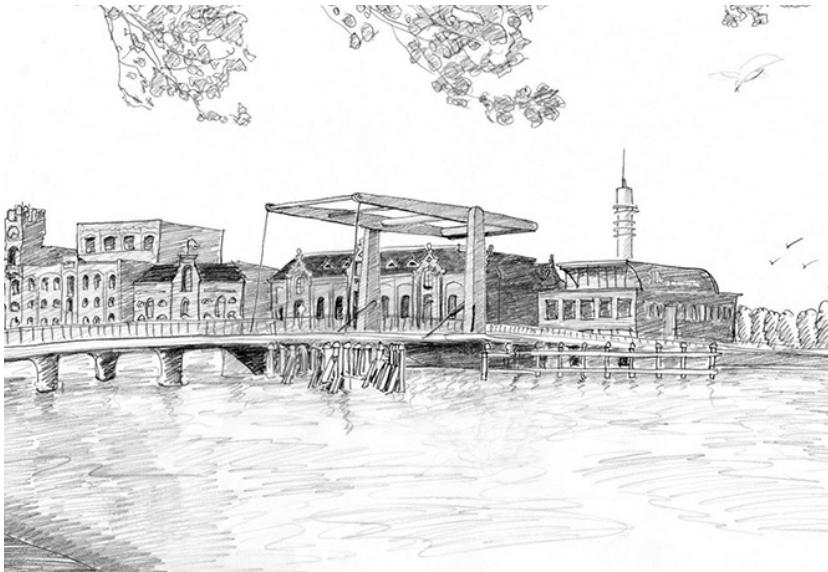


Figure 7 The Zaan Bridge in Wormer is of the traditional drawbridge typology. Approach spans and drawbridge form two different entities (source: Joris Smits)

But having such a prominent structure with towers and an overhead balance plate would start to compete with the windmills of Zaanse Schans and would make the design fall into three parts: two approach spans flanking a lifting part. Instead, we decided to go for a more harmonious approach (figure 8) and to have the counterweight integrated and almost invisible underneath the deck and to incorporate the span of the moving part into the rhythm and materialisation of the approach spans.



Figure 8 The opening part of the Juliana Bridge is in harmony with the approach spans
(source: Joris Smits)

By making ten spans roughly twenty meters apart we ensured an undisturbed rhythm of piers across the Zaan. Integrating the lifting part and the counterweight into this sequence was the next challenge. The lifting part is operated by a series of vertical hydraulic jacks that have been integrated into the actuator pier. For this reason the actuator pier needed to be much thicker than the other piers that are only supporting the approach spans. A solution was found in making each consecutive pier grow a little in size, until the required final width of two meters was reached in the actuator pier. This ‘growing’ of the thickness of the piers is accompanied with an increase in height, thus respecting the proportions of every individual pier. The result is a natural sequence of supports that reaches its crescendo in the middle part

of the bridge. The absence of an enclosed bascule volume and the resulting transparency underneath the bridge is much appreciated by the inhabitants of the historical housing on the shores of the Zaan. To quote one:

“What a beautiful bridge! So light and transparent; sitting on the sofa in my living room I can actually look right through it and see the landscape behind the bridge. The combination of modern design in a historical context works really well.” (Nieuwburg, 2011)

4.2 Layering and partitioning

Another decision taken early on in the design process was to untangle the hectic flow of motorised traffic from the more easy-going flow of pedestrians and cyclists, including the thousands of tourists that pass through every year. The old bridge was infamous for the frequent accidents that occurred when tourists stepped into the path of motorised traffic to take photographs of the Zaanse Schans and the general scenery. Considering the new bridge as a wide balcony with a panoramic view was a first step, and allocating pedestrians and cyclists a bridge of their own was the next (figure 9).



Figure 9 Pedestrians and cyclists have a bridge of their own. A void separates them from motorised traffic (source: Joris Smits)

The spatial consequences of splitting a rather wide deck into two slender decks and a void are significant. From the point of view of the traveller on the bridge, the visual contact with the landscape and the river is increased. As you are always close to an edge with a view of the water, people experience the bridge much more as a bridge. The void between the decks adds a dynamic quality to the experience of travelling across the bridge, offering exciting views of the sequence of piers emerging from the river. From a landscape point of view, the difference is perceptible in the amount of daylight underneath the bridge. Even though the actual width of the total structure increases with the extra width of two more edges with parapets, the amount of shadow on the water and on the piers decreases and the bridge is experienced as less of an obstacle. This has to do with the factor of ambient light that has access to the space underneath the bridge from all sides. This diffuse light supplements the direct sunlight and gives the substructure a less obscure and more pleasant feeling (figure 10).



Figure 10 Ambient light underneath the bridge increases by the use of a void between the decks
(source: Joris Smits)

4.3 Manifestation and articulation

There are two basic elements in the design of a multi-span bridge that determine the scale and the inner harmony of the bridge design. The first of these elements is the deck that manifests itself as a horizontal element of a

larger scale level. The other element is the pier, or the series of piers, that are basically vertical elements of a smaller sub-scale.

In the design process the architect can choose to make the position and manifestation of the piers dominant over the deck, thus reducing the tectonic scale of the design to the size of each individual span and accentuating the vertical rhythm (figure 11).

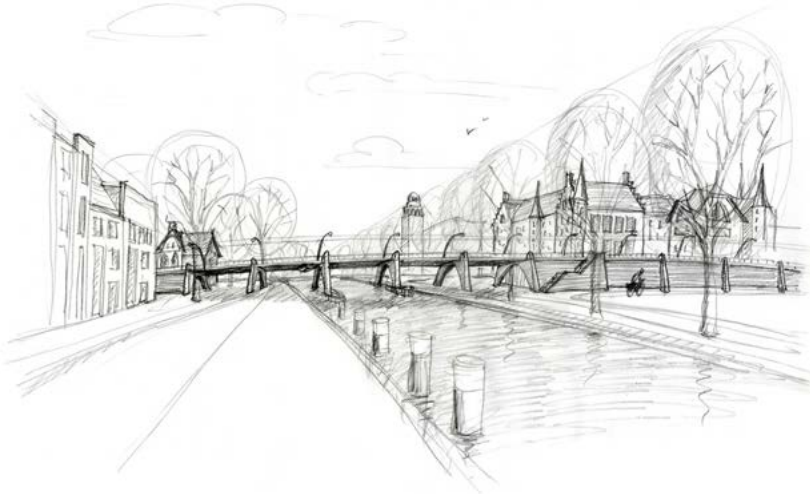


Figure 11 Vertical accentuation of the piers in the authors' design for the new Sebastiaans Bridge in Delft, 2012 (source: Joris Smits)

This first approach lends itself to an enclosed and dense urban setting where lots of visual stimuli and vertical elements predominate. The second approach would be to give the deck a more prominent position, thus accentuating the horizontality and the total length of the design in the larger scale of a landscape (figure 12).

In an open landscape with wide panoramic views the second approach is more suitable. The vertical line tends to blend in with the horizon in a calm way. Consequently the designer chose the second approach for the design of the Juliana Bridge. We designed a series of twin piers that emerge from the water underneath the central void, then cantilever sideways to support both decks. We gave the piers a setback from the edge where the pier meets the deck, thus putting the emphasis on the continuous line of the edge. This edge was manufactured out of fibre reinforced polymer segments in Zaan white, a well-defined local shade of off-white, with a touch of this other local colour Zaan green.

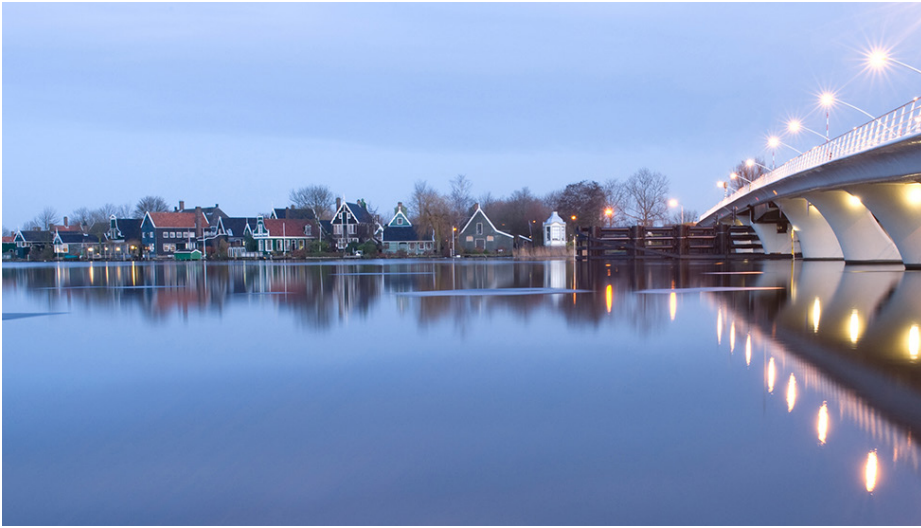


Figure 12 The vertical manifestation of the deck with set-back of the piers puts the emphasis on the larger scale and blends into the landscape (source: Joris Smits)



Figure 13 Light masts define the space and viewing directions. They emerge from the void in order not to obstruct the outward view (source: Joris Smits)

4.4 Defined space and orientation

On the level of the deck the Juliana Bridge is free of structure. The only appearance from the traveller's perspective is the prominent sequence of curved light masts (figure 13). These are positioned along the inner void. Research by Schöne and Coeterier (1997) on the way that drivers experience the

highway demonstrates that drivers have a restricted field of vision. As they are largely preoccupied by watching traffic in front and behind, their field of vision is largely limited to the right side of the road. In the case of the Juliana Bridge the best views are experienced outwards, to the right of the driver. As the Juliana Bridge is foremost a bridge with a view, we did not want to obstruct that view by a repetition of a mast along the edge of the bridge. Rather we chose to let the masts define the space on top of the deck by opening up towards the panorama, thus directing the view outward. In a way the central position of the mast enhances the dynamic experience of the void between the two bridges. If you look closely you will see that the curve of the masts is a continuation of the inner shape of the piers.

To conclude regarding the design of the Juliana Bridge, we must remember that a bridge is foremost a facility for the people who use it or live nearby. During the construction of the bridge, and also after the completion of it, we had the chance to talk to many of them. It is worth noting that, when pressed to give their opinion on the aesthetic qualities of the design, most people living near this bridge are full of praise, with most mentioning the curved masts. Maybe it is a good sign that the bridge itself is so natural and uncontroversial in its presence that it is not notable to the public.

4.5 Awards

The Juliana Bridge won both the Betonprijs in 2009 and the European Concrete Award in the category civil engineering in 2010, issued by the European Concrete Societies Network (ECSN, 2010), demonstrating the value of this design approach. These awards are a clear recognition that the design work is outstanding and contributing to the body of knowledge in the field of civil engineering. Final praise came from the Dutch Ministry of Infrastructure and the Environment in the form of the 'Routepluim 2011', an award granted for exemplary integration of infrastructural artworks into their context.

5. WILDLIFE CROSSING IN RIJSSEN

If the design of a bridge in a historical urban area is all about capturing the character of the place and of the people who live there, then the design of a wildlife crossing is more a matter of listening to the scale, the morphology and the character of the landscape. How can we translate the intrinsic function and nature of a wildlife crossing in its design? And do the fragmented landscapes of Essen and Kampen require a different design approach than the open heathlands?

5.1 Experiencing a wildlife crossing

When we ask ourselves what the visual and emotional impact of a bridge design, or more specifically a wildlife crossing, implies in the eye of the beholder, we must distinguish three aspects: perceiving, experiencing and appreciating (Boekhorst, Couterier & Hoeffnagel, 1986; Buijs & Kralingen, 2003). The first step, perceiving, is quite obvious. An overhead structure of this magnitude results in a perception that cannot be denied, nor do we have many means to influence the perception as the structure cannot be hidden or softened. It is in the second step, in the experience that our structure offers, that we as designers can offer something more. If we do our job well we can be rewarded by the appreciation of the people who pass our design or who live adjacent to it.

When seen through the eyes of a driver travelling along a road in a relatively open landscape, the passing of an overhead structure marks an important event in the trip. The structure will attach itself as a visual beacon in the awareness of the driver, marking a specific place along the route. The psychological impact of passing beneath an overpass, such as an ecoduct, is notable. On the visual and emotional impact of passing underneath an overpass when driving through a landscape, McCluskey states in his book *Roadform and Townscape*: “A notable event relating to contrasts occurs when the route encounters an overpass. The approach embankments to the overbridge block the view on either side of the main road and after passing through the gap spanned by the structure a feeling of release is enjoyed on sighting the uncontained view.” (McCluskey, 1992)

In the case of Rijssen the challenge for us, as the designers of the wildlife crossing, was to turn the event of passing underneath into a pleasant rather than an eerie experience.

5.2 Typology

The wildlife crossing in Rijssen (figure 14) stands apart from the vast bulk of wildlife crossings where the road is the ruling principle and the crossing itself is designed as a functional straight viaduct. Rather, the wildlife crossing in Rijssen stands in the tradition of that other notable wildlife crossing in the Netherlands: the ‘Woeste Hoeve’. Both crossings are primarily designed from the green perspective; here it is nature that has the supremacy, in the form of soil and vegetation, the road is just a perforation of the earth, a guest that is temporally tolerated underneath it (figures 15 & 16). Such a grand gesture places nature above technology even though it is evidently a manmade structure (Nijenhuis & van Winden, 2007). The wildlife crossing in Rijssen is therefore a token of vigour, not so much of Dutch policy-making but more as an act of our ecological movement.



Figure 14 The wildlife crossing at Rijssen. On the foreground the open heathlands landscape, behind lies the fragmented Essen and Kampen landscape (source: Joris Smits)

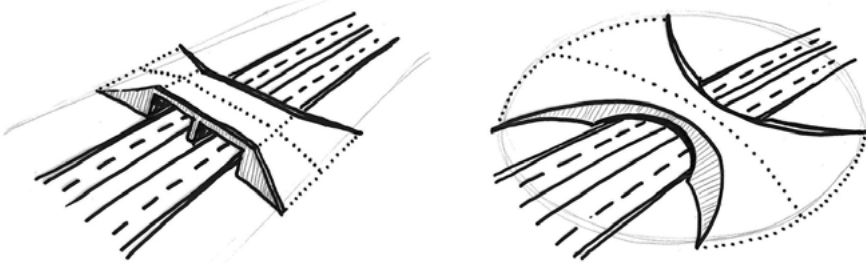


Figure 15 The highway as the ruling principle with a functional crossing (left), or nature as the ruling principle (right) (source: Joris Smits)



Figure 16 The wildlife crossing at Rijssen. Nature has the supremacy, in the form of soil and vegetation; the road is just a perforation of the earth, a guest that is temporally tolerated underneath it (source: Joris Smits)

5.3 Design approach

Having said that the landscape has the supremacy over the highway where they cross, that still does not answer the question of how to make the design fit into the landscape, or better, be a part of the landscape. After doing an analysis of the two types of landscape that are traversed when driving from Rijssen to Wierden, we decided on a twofold approach: on the larger scale we manipulated the overall shape of the wildlife crossing to react in an asymmetric way to the two very different characters of the two landscapes on either side of the crossing. And on the local scale we integrated the shape of the wildlife crossing to the extent that the alignment and the edges seem to come forth from the landscape in a natural way, reacting to existing lines in the landscape such as tree lanes and watercourses.

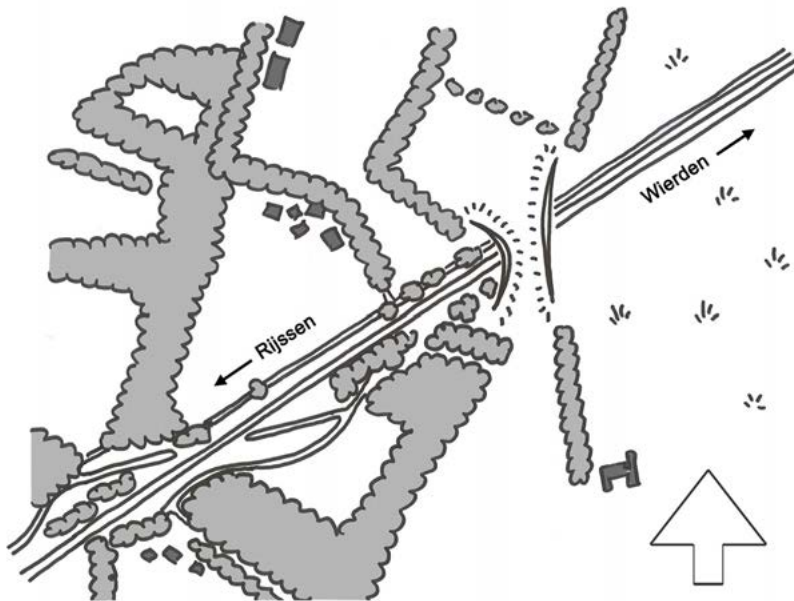


Figure 17 The asymmetric shape of the wildlife crossing reacts to the two different kinds of landscape on either side; a confined Essen-Kampen landscape to the west and an open landscape to the east (source: Joris Smits)

On the larger scale we distinguished two types of landscape (figure 17). On the west approach to the wildlife crossing we travel through a small-scale 'Essen and Kampen' landscape, a scenic landscape with an arbitrary sequence of smaller open spaces, patches of woodland and green lanes lined with trees. This landscape offers the driver a confined experience with restricted views

and without any vistas. The wildlife crossing reacts to this landscape by capturing the driver into a crescent shape on the west approach as he nears the overpass, thus containing the view.

On the eastside the landscape is very different. Here we have a much younger and rational landscape consisting of heathlands and large land exploitations. The wildlife crossing therefore marks a boundary between those two landscapes: the confined versus the open. The eastern edge of the wildlife crossing reacts to this open landscape with a much wider opening that offers the driver a full panorama of the entire open landscape.

On the local scale the alignment of the edges of the wildlife crossing was carefully fine-tuned to match existing lines in the landscape such as tree lanes and watercourses. As it turned out this approach of reacting to the structure of the landscape also proved to be the best approach from the wildlife point of view. Animals have a strong tendency to move along lines in the landscape such as the edge of a wood or a brook. Thus having our funnel shape in line with those natural elements proved to match wildlife patterns.

From a drivers point of view the funnel shape of the wildlife crossing seems to come forth from the landscape in one fluent motion, as a green carpet that is locally lifted up to make room for traffic, then blends back into the landscape on the other side. Instead of retaining fences along the edges of the crossing we designed green ridges, steep on the inside to retain wildlife within the passage, but green and slanted on the outside were they that form the dominant gesture as they sweep across the road.

Last but not least the experience that the wildlife crossing bestows on the traveller is determined by the actual event of passing underneath the structure (figure 18).



Figure 18 'Lifting the carpet' leaves a slit-like opening underneath the green structure. The low parts of the slit are filled with solid abutments with a set back from the edge. They are materialised in a dark grey colour in order to blend with the ground rather than with the crescent edge. This results in the impression of one long continuous edge (source: Joris Smits)

To turn this experience into a pleasant one we looked at the size, the shape and the partitioning of the overhead structure. The design approach of ‘lifting the carpet’ leaves a slit-like opening underneath the green structure. To reduce the span and the costs of the concrete deck, the low parts of the slit had to be filled with solid abutments. These abutments are set back from the edge of the carpet, and are materialised in a dark grey colour in order to blend with the ground rather than with the crescent edge. This results in the impression of one long continuous edge. To further increase the sensation of a single arch spanning the road, the soffit of the deck follows a vertical curvature just like the crescent edges and spans both lanes in one span. Inclined abutments further emphasise the dynamic gesture of an arch. Also notable in the design is the absence of the traditional middle pier. The use of a middle pier inevitably has a negative effect on our experience of spaciousness; the view of the beholder is partitioned right through the middle and the focus is diverted to this odd element rather than to the surrounding space. Using a middle pier is in that way comparable to building a pillar in the middle of the central nave of a church. Therefor the absence of a supporting structure in the middle turns the act of passing underneath into a spacious and panoramic experience with an unhindered view to what lies beyond (figure 19).

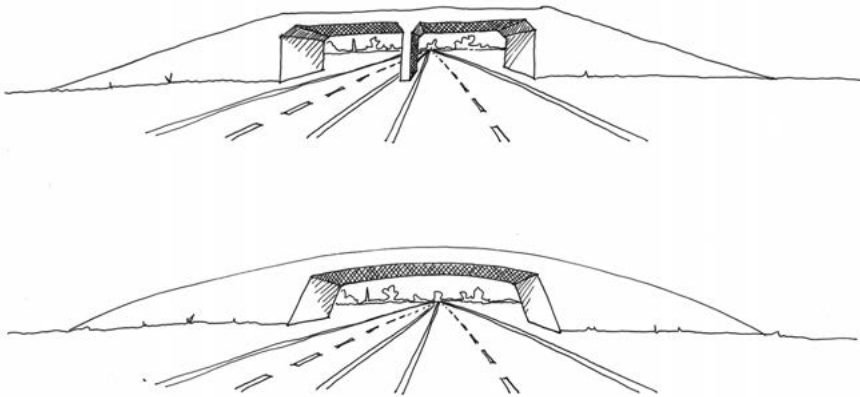


Figure 19 The use of a middle pier inevitably has a negative effect on our experience of spaciousness; the view of the beholder is partitioned right through the middle and the focus diverted to this odd element rather than to the surrounding space (source: Joris Smits)

6. CONCLUSION

This paper discusses ways to strengthen the regional identity through means of infrastructural artefacts such as bridges. It is our experience that the best approach to designing bridges within a landscape is to start from the context without making use of neo-vernacular methods. Bridges are worth our attention as designers and give us powerful tools to strengthen the local identity. This adagio is demonstrated through some of our projects in Zaanstad and in Rijssen. Properties as scale, orientation, rhythm, articulation, layering and partitioning of the design are our tools to make a design fit the context. To accomplish this we need to think from different perspectives, both literally and figuratively. The obvious perspectives are that of the driver, the cyclist, the pedestrian, the skipper or the badger that passes on or underneath our designs. But on a more abstract level we need to think from the point of view of the genius loci, the commissioning authorities, the tourists and most important of all, the people who live nearby. The proof that this is a fruitful approach lies in the many positive reactions that we get on all of our projects. This varies from the carpenter who complains about the difficulty in making the formworks but at the same time stresses how proud he is of being able to show his craftsmanship, the alderman who likes to show off with 'his' brand new bridge, or the lady who sees the improvement on the view from her backyard. This is the reason why we have such a rewarding profession.

ACKNOWLEDGEMENTS

Designing a bridge is always a matter of teamwork. Often there is more than one author responsible for the architectural design and in some cases the landscape design. Joris Smits is the designer of the projects discussed in this paper. He would like to acknowledge his (former) colleagues for their valuable contribution to the design of the various projects that appear in this paper. In chronological order: Alessandro De Santis is co-designer of the Dommel Bridge for which Corine Zwart is the landscape architect, Richard van den Brule is co-designer of the Highway of the Future, Obbe Norbruis is the landscape designer for the Hoogtij Bridge, René Rijkers is co-designer of the Zuidelijke Randweg Bridge, Syb van Breda and René Rijkers are the designers of the Butterfly Bridge, Syb van Breda is co-designer of the Prins Bernhard Bridge, Sven Spierings is co-designer of the Zaanbridge, Syb van Breda and Alessandro De Santis are co-designers of the Juliana Bridge, Sven Spierings is co-designer of the wildlife crossing in Rijssen of which Carien ten Cate is the landscape designer. We would further like to acknowledge Steffen Nijhuis for his valuable advice on writing this paper.

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A road trip on European highways

Considering the spatial qualities of E75 and E50

A phenomenalist approach in the observation of spatial qualities of the E75
Barentsz Sea – Crete and E50 Brest – Makhachkala

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Abstract

This paper takes the reader on a road trip, travelling the longest highway routes of the European continent and drawing conclusions based on a methodology of practical observation. The paper introduces a phenomenalist approach to highway design research, based on using photos and observations as a source of evidence in its own. The research is based on twelve weeks of driving, shooting photos, sleeping along the road, eating only in road-side restaurants and interviews with waitresses and shopkeepers. There used to be a lot of attention for the scenic experience and spatial quality of highways. In contemporary designs, however, highways are regarded more and more as sewage systems: something not to be seen, heard or smelled. Functional aspects such as noise reduction and traffic capacity prevail above spatial design. This paper shows how different countries are coping with these conflicting issues. It shows best practices and how these relate to the contemporary practice of highway design in the Netherlands. The paper argues that a technocratic and economically driven approach to highway design is a poor and vulnerable strategy. The paper further demonstrates that contemporary design policy in the Netherlands, with a strong focus on the aesthetics of built structures, neglects aspects that have much more impact on the spatial experience. The paper zooms in on five aspects that heavily affect the spatial experience of a highway: the sense of travelling on one continuous route, the sense of surveillance and state control, the sense of being part of a high quality public space, the existence of educating elements along the road and the level of technology. The paper draws conclusions based on methodologically collected observations and translates these into recommendations for designers.

KEYWORDS

highways; European highways; E75; E50; public space; transport infrastructure; highway design; phenomenology

1. INTRODUCTION: THE DECLINE OF THE SCENIC ROUTE

There used to be a lot of attention on the scenic experience and spatial quality of highways. The American parkway concept was based on a scenic route, with the 1940 Meritt Parkway in Connecticut as a bright example (Giedion, 1941). The same goes for the German Autobahn, heavily influenced by the scenic guidelines of the German landscape architect Hermann Fürst von Pückler (1785–1871) (Nijenhuis & Van Winden, 2007). In the Netherlands, the design of the first highways was based on similar intentions and was a co-production of state engineers and state landscape architects (Heesen, 2011a). Until the 1960s, there was an optimistic feel about highways. City dwellers even used the road shoulder as a place to relax: a picnic alongside the highway, watching cars and trucks roll by (O.M.A., 2006).

In the 1970s, the dark side of the highway concept emerged. The first traffic jams, deathly accidents, noise and pollution, the oil crisis and the alerts by the Club of Rome made clear that there were limits to the concept. The optimism of the early days vanished. The spatial intentions became less important than functional and administrative aspects, such as safety, capacity and noise reduction. Highways became canals for cars, isolated by sound-baffling screens and hidden by bushes. For example, since the introduction of the 1979 ‘Wet Geluidhinder’ (law on noise reduction) in the Netherlands, the view upon the landscape along more than five hundred kilometres of highways has been blinded by sound-baffling screens (CBS, PBL, 2007).

Highways became like sewage canals: something merely functional and preferably invisible, not to be heard, nor smelled. The climax of this approach is currently under construction in the meadowlands between Rotterdam and The Hague: highway A4. After sixty years of discussion, the construction of this stretch of seven kilometres of highway was finally accepted by the stakeholders, under the condition that the new highway would be invisible, not to be heard nor smelled (Peijs, 2006).

Being involved as an architect in this project and in a long-term design strategy for the entire route of highway A4 between Amsterdam and Antwerp (Heesen & Top, 2005), a number of questions arose. First of all, how are other countries coping with the design of highways and how do these practices relate to the design practice in the Netherlands? The contemporary Dutch design policy on highways is largely based on technocratic and economic aspects. Spatial aspects of the design are reduced to an aesthetic upgrade and transformation of the network into uniquely identifiable routes, clearly distinguishable from other routes by means of architecture (Patijn et al., 2001). Is this a meaningful design strategy? Is it imaginable that a highway has the high level of spatial quality and attention to detail of, say, an Italian piazza, with the spatial and social quality of what Jürgen Habermas calls the public sphere (Habermas, 1962)? And what are best practices in this? And finally, what can architects and landscape designers learn from all of this?

2. PHENOMENALIST METHODS: A ROAD TRIP ON THE LONGEST EUROPEAN ROUTES

During the initial desktop research on the differences in highway design in different countries, a practical problem arose: in many countries, it is virtually impossible to interview an expert. For example, calling the local road authorities in the Ukraine and asking who has been responsible for the architectural and landscape design of highway E50, is a dead end street. Yet, the intention was to compare different practices in different countries. Instead of the expert approach of collecting and analysing data, a more practical method was used, based on observation: a phenomenalist approach. This method of ‘research by observation’ is a common method in the field of environmental psychology, where photos and observations are considered to be a source of evidence in its own.

In order to introduce a framework for our observations, the following research method was agreed upon: we would travel one designated route and make an obligatory stop at every public space along the route, for example picnic areas, parking places, gas stations and roadside restaurants. Additionally, sleeping accommodations and food supplies were solely confined to motels and roadside restaurants along the route. During stops, the ‘inhabitants’ of the E-road, for instance shop keepers and waitresses, were subjected to interviews (figure 1).



Figure 1 Food and the inhabitants of the E75

Local memorabilia related to the route was collected, such as postcards showing a bridge or brochures for new residential areas. Every hundred kilometres on the odometer, a picture was taken of the surrounding landscape. Whenever one of the members of the research team considered a certain aspect to be significant, a stop was implemented. And finally, the use of electronic route navigation was not allowed, following the traffic signs was to be considered part of the experience.

The first road trip took place on the E75, the longest southbound E-route in Europe (figure 2).

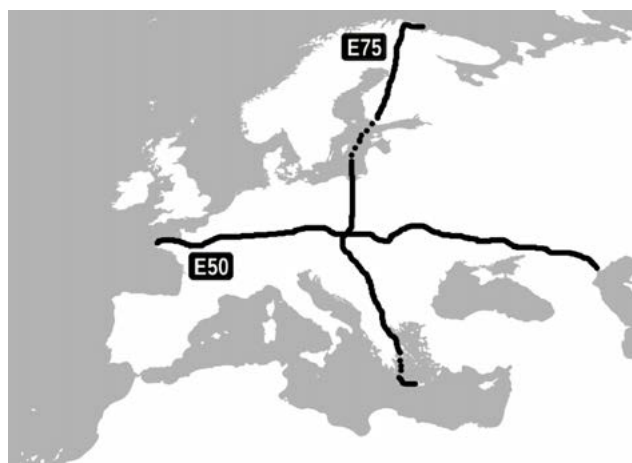


Figure 2 European routes E50 and E75

The E75 is part of the European international system of route designations, originally envisaged as a grid of highways comparable to the US Interstate Highways (United Nations, 1950). The network measures over 150,000 kilometres and includes every regionally important road. The most significant routes have numbers ending with a five (direction north-south) or a zero (east-west).

The E75 starts in Vardø, a Norwegian fisherman village on an island in the Barentsz Sea, located east of St. Petersburg. The route runs approximately 5,700 kilometres across the continent, ending in the harbor of Sitía, a small village on the Greek island of Crete. It runs through nine countries, linking Norway, Finland, Poland, the Czech Republic, Slovakia, Hungary, Serbia, the Republic of Macedonia and Greece. Part of the E75 is a dotted line crossing the Baltic Sea. This part of the route is a seasonal ferry connection between Helsinki and Gdansk.

Including the trip from the Netherlands to the northern tip of Norway and the route back from Crete, the E75 road trip accounted to approximately 12,000 kilometres. The plan was to analyse the spatial characteristics of the E75 in the same way as one would analyse an Italian piazza: by documenting both the physical elements and social, historical and cultural aspects related to public space. In order to document the E75 in a professional way, Hans Stakelbeek, a Dutch documentary photographer and cameraman, accompanied the research team during the whole trip.

After spending one-and-a-half months on European highways for the E75 trip, we decided to expand our research with another six weeks on an eastbound route. We decided to go for European highway E50, a route of approximately 6,000 kilometres between the French harbour city of Brest, located on the western edge of continental Europe and the city of Makhachkala, located on the western shore of the Caspian Sea.

Our method of research and documentation remained largely the same, except for some slight changes based on the previous experiences along the E75. We skipped the obligatory stop at every 100 kilometres: the material gained by this method was not that interesting. In addition, we decided to halt at a number of local cultural organisations (galleries, embassies, universities and so on) in order to collect more information on social and cultural aspects. The biggest difference with the E75 trip, was that on this occasion we would not be able to drive all the way to the end of the route: the final stretch of the E50 runs straight through the war zones of North-Ossetia-Alania, Chechnya and Dagestan.

Experienced journalists advised against trying to drive as far as we could. Instead of hoping not to become a hostage in the Caucasus, we decided to bend south and travel back to the Netherlands on the E90, passing Istanbul. The road trip on the E50 brought the overall distance of the project to 25,000 kilometres.

3. OBSERVATIONS ON THE E75 AND E50

During our research on the E75 and E50, many different aspects related to the design of the highway were registered. Observations of five significant aspects that affect the spatial experience of the highway are described below.

3.1 One unique and identifiable route or just consecutive roads?

In the Netherlands, a governmental policy document on architecture and landscape design aims at transforming four international highways into uniquely identifiable routes. The primary aim of the vision is to prevent urban sprawl and degeneration ('verrommeling') (Fabrique, 2005). The oldest

Dutch highway, the A12 between The Hague and the border with Germany, is the pilot project of this vision. The route has been labeled ‘A12 Regenboogroute’ (rainbow route), derived from the observation that this motorway cuts through a variety of landscape types: meadowland (light green), forest (dark green), city (orange) and urban sprawl (purple).

In order to improve the aesthetics of the highway, an industrial design office created a set of geometrically related elements, ranging from a modular design for sound-baffling screens to specifications for new light poles, road crossings, bicycle tunnels, wildlife crossings and so on. As a kind of logo on this long-term project, each single light pole in the route has already been marked with a sticker showing a rainbow in orange, purple and two shades of green. A similar design strategy of transforming consecutive stretches of highway into one uniquely identifiable route is now implemented for the Dutch part of the route Amsterdam–Palermo (highway A2/E25) and Amsterdam–Paris (A4/E19) (Heesen, 2011b). Driving on the E75 and E50 we wondered if the same applied to the E-routes. Are they more than just consecutive stretches of road through consecutive regions and nations?

As a source of evidence, we decided to ask the ‘inhabitants’ of the E75 and E50 (such as shop keepers, waitresses and border patrol) where the route that we were driving on actually ended. Nowhere along the E75 did we meet anyone who had any notion of the fact that this route links the arctic circle with the Mediterranean Sea, that it is an international route between Santa Claus and the sunny beaches of Crete. There was one exception to the rule: on the island of Crete, we were able to buy a postcard showing a photo of a topless girl on the beach and a photo of a reindeer in the snow, separated by a thermometer. The text on the postcard stated: “While I am sun tanning in Greece, you are freezing up north” (figure 3).



Figure 3 Postcard collected on the island of Crete (Greece)

Sometimes, it was even hard to find the E-route at all. The best feeling of one route was in countries where the E-number shares its route with a national long distance connection. In Finland, for example, where the E75 is called E75 all the way to Helsinki, the road serves as the main and sometimes only southbound route. Up north, where the E75 is occasionally transformed into a landing strip (figure 4), the route even feels like the European version of Route 66.



Figure 4 Landing strip in the E75 in northern Finland

Albeit there is no slogan (Get your kicks on Route 66), the road itself is branded as a tourist destination and lined with shops and Bed & Breakfasts.

In many countries though, the E-route is hard to recognize as one continuous route. In France, the E50 runs on eight different highways, all with a different look and feel, ranging from oldschool national highways to the diabolic Paris Peripherique and state-of-the-art toll roads like the A6. Albeit the main international routes have been given names, for example ‘Autoroute du Soleil’, there is no such label on European route E50. On the other hand, the lack of border control on the E75 gave us a strong feeling of travelling in one system, on one international route linking regions and nations. We managed to pass twenty national borders and board five ferries in a rusty old Benz without carrying the legal papers of the car (which the Dutch police had

confiscated during a routine check of the mechanical condition of the car in the week prior to the start of our trip). Often, the border between nations was only visible because of a slight change in the lay-out and appearance of the highway such as different asphalt and different colors of lining and signing.

In this aspect, the E50 was not as relaxed as the E75. The further east, the longer it took to pass the imaginary lines between nations and regions. From the start of our trip, we already knew that it would be virtually impossible to cross some of the borders in the Caucasus. A prelude to this region was the border between Russia and the Ukraine, which took half a day to pass. Besides physical aspects associated with border control (barriers, gates) and red tape (passports, visa), it turned out that there were also invisible borders in other administrative aspects, such as car insurance. During the trip, we had to switch insurance companies, because the Ukraine and Russia were not covered by some. When the engine of our W123 300TD research vehicle broke down in Germany, we were not allowed to take the replacement car offered by the insurance company into the Czech Republic. Our only option, was to drive all the way back to Rotterdam and pick up another research vehicle (a W124 250TD).

3.2 A sense of personal freedom or state surveillance?

Park your car on the hard shoulder of a motorway in the Netherlands and within ten minutes, the police or a service vehicle of the national road authority will arrive, the adjacent highway lane will be closed by means of a digital red cross and your car will get towed away for safety reasons. The cameras along Dutch highways are able to detect any object larger than 50 centimeters. The software is programmed in such a way that anything out of the ordinary is being registered, for example, a vehicle that is not moving.

One of the striking aspects of travelling on the E75 and E50 was that in many countries we were able to park our vehicle anywhere, at any time without any authority or road assistance service showing up. The absence of surveillance led to a great sense of personal freedom. It meant for example, that whenever we saw a nice panorama, we were able to stop and immediately take a photo. Or two. Or three. Except, of course, for the Ukraine and Russia. The main roads of the Ukraine are a source of income for the local police squad: they typically place a 30 km/h traffic sign in such a way that it is almost invisible from the road (behind a tree, for instance), point a laser gun at all approaching luxury vehicles and start collecting penalties. Occasionally, the man pointing a laser gun turned out to be made of cardboard, placed by inhabitants to bring down the speed of passing vehicles.

In Russia, especially in the Caucasus, local policemen did not even pretend to collect a fine. They simply made all luxury vehicles pull over and pay. According to some of the locals we interviewed, the required fee depends:

locals pay less than foreigners, who pay less than Northern European foreigners, who pay less than Moscow citizens. The further we travelled east, the worse it got. The highest fee paid during our trip was 4,000 Russian ruble (about 120 US dollars). The number was written down with a pencil and erased immediately after. The local policeman enforced the payment of this fee by commanding me to sit down on the passenger's seat of his blinded Lada and pointing a machine gun at me. Then he showed the photos of my children that he had found in my passport and told me how my car would be confiscated and I would be thrown in jail until Christmas. It sounded so ridiculous that I felt like negotiating, which brought the fee down to 50 US dollars. The consecutive rip-offs by local policemen had a negative effect on our spatial experience: whenever a village or roadside restaurant came ahead, we were no longer enjoying the landscape. In order to avoid our foreign licence plate to be spotted from afar, we tailgated Russian Kamaz trucks.

Halfway into the Republic of Kabardino-Balkaria, the practice of collecting fees suddenly seemed to have vanished. In fact, there seemed to be no police at all. On a roadside market, we noticed how people were trading without paying, bartering onions for coleslaw. Facing the steel canopy of the border with the Republic of North Ossetia-Alania, we decided to contact experienced journalists, who advised to make a U-turn: this sounded too much like the eye of the storm. A beautiful landscape is hard to enjoy in the vicinity of danger. And then again, despite the fact that there was a nasty taste to the bribery practice in the Ukraine and Russia, the whole thing turned out to be relatively inexpensive after all: the total amount of 'fines' and 'fees' added up to less than the toll levied on the E50 in France. One kilometre on the average P  age, the French network of toll roads, costs about 10 Eurocents.

3.3 A truly public space or Eurodisney?

If you take the exit to a Dutch 'verzorgingsplaats' (fuel station) along one of the state owned highways, you are likely to observe the following layout: the highway exit leads to a junction where you will have to choose between the actual fuel station with shop or a picnic area behind the fuel station. The picnic area is equipped with wooden furniture and has either no pedestrian route to the fuel station or a dead-end route, leading to a fenced collection of garbage cans and a back door with smoking employees. You will probably also notice differences in the materials used. The picnic area is owned, maintained and operated by the state, which generally results in grass and asphalt. The fuel station with shop is leased by an oil company, usually for a period of ten years. The relatively short time for return-on-investment stimulates them to use the cheapest available pavement on their parcel.

Now, compare the described Dutch layout to the general spatial concept of a French 'Aire de repos' (literally: rest area). The French space is structured

like a backbone: with the bones being the parking places and the spine a kind of pedestrian boulevard, a clearly distinguishable path leading to the back entrance of a shop or restaurant. Along this pedestrian route, you are likely to find services like a playground or a bouncing castle for your kids.

France has over 8,000 kilometres of toll roads maintained and operated by private companies. It is big business with increasing revenues that exceed inflation. In 2011, the top three of corporations (Vinci Autoroutes, Eiffage and Sanef) levied 7.6 billion Euro (Cour des Comptes, 2013). The privatisation of the French motorways has had an effect on their physical appearance.

The first stretch of the E50, the N12 running through the Brittany region in France, is a toll-free highway. This part of the route has been designed by the Germans during World War II and is clearly a road from another era: some of the buildings along the road are located extremely close to the asphalt, the public spaces look worn out and they are monofunctional: fuel stations without a picnic area, picnic areas without a shop.

A different experience is travelling on the E50 between Paris and the border with Germany (Autoroute A4), a toll road operated by Sanef: this is a well-maintained highway with public spaces that offer a high service level, where picnic areas, fuel stations, restaurants and 'traveller's wellness' are combined in one stop. The upside of this corporate exploitation is the abundance of convenient things like massage chairs, excellent Italian espresso and clean toilet seats. The downside of it is that these franchised spaces feel very much like Eurodisney or the food-court in a shopping mall: a highly serviced private space with the appearance of being public space, where the traveller is invited to become a consumer, an example of the *non-lieux* described by Marc Augé (1992).

Another aspect of the corporate highway is that there is no escape from fast food. Roadside restaurants in France, Germany and the Czech Republic are often part of the same chain, serving the same food. The imaginary line between 'international food' (such as refrigerated triangular sandwiches) and locally inspired food is drawn somewhere in the vicinity of Bratislava, the capital of Slovakia. Order a sausage here, and you will be served a bent piece of meat, smiling at you in a pool of gravy and mustard. In this aspect, the E75 and the E50 are quite different. The shops and restaurants along the E75 offer an incredible variety of food, albeit hardly any vegetables and fruits. The menu gradually changes from Scandinavian food (such as reindeer sausage soup and minced reindeer meat with mashed potatoes and blueberries), via Central European food (cooked potatoes, onions and hash meat with lots of gravy) to the Mediterranean kitchen (grilled lamb, olives and bread). Ordering a coffee gets you anything between an Italian style espresso and locally inspired 'cappuccino' (for example: coffee with whipped cream, three table spoons of sugar, an ooze of lemon syrup and cacao powder).

The climax in the privatisation of highways was observed in the Czech Republic. There, not only all roadside restaurants are part of the same franchise concept, also the road shoulders and structures crossing the highway are loaded with advertisements. In fact, we made the observation that every single concrete structure crossing the E50 carried one or more advertisements. Instead of a scenic route, a cinematic experience of the landscape, this part of the route felt like one continuous commercial.

3.4 A functional road or a way of educating the people?

In the Netherlands, brown-and-white signs along the highway mark the existence of culturally significant landscapes such as national heritage landscapes or reclaimed land. Highway A6, for example, is a route running on reclaimed land and is equipped with signs showing the level of the highway relative to sea-level. The signs were a gift from the 'Algemene Nederlandse Wegenbond' (ANWB), a private association that has historically been involved in traffic signing and breakdown service in the Netherlands. They were inspired on a similar system of brown-and-white signs in France and Germany, where people are educated on history (for example on the vicinity of a battle field), culture (the vicinity of heritage buildings, wine regions, famous cheese) and on technology (the span of a bridge).

Another way of 'educating the people' in the Netherlands, is by means of art. For example, highway A27 starts in Almere, where Tom Claassen designed a herd of elephants in a concrete jungle. The highway ends in Breda, where Joep van Lieshout created Big Funnelman, a polyester figure lying on his back. The artworks were part of a regulation on art ('percentageregeling beeldende kunst'): if a building initiative financed by the national government exceeded 1 million Euro, 1% of the budget had to be spend on visual arts.

During our road trips on the E75 and E50, we observed many 'educating elements'. Often in the shape of signs pointing out heritage and historical facts, occasionally a work of art. In the Ukraine, educating elements are found inside the concrete bus stops along the E50, where mosaics of tiles propagate healthy athletes, cornfields and other aspects of the utopian communist life-style. When we mentioned the beauty of the bus stops during a lecture in a bookshop in Kiev and pitied the lack of maintenance, people in the audience were surprised that we saw beauty in the old mosaics. They valued the mosaics first of all as part of the former totalitarian regime, as part of a dark episode in history, not as cultural heritage.

3.5 A simple stretch of asphalt or a highly serviced piece of technology?

In the Netherlands, safety and capacity measures have a great impact on the spatial experience of motorways. The main routes are nowadays wide planes of asphalt with four to five lanes in each direction, crash barriers, au-

automatic speed detection, light poles, route and traffic flow information, traffic jam detection, emergency harbours, fog warning, dedicated carpool lanes, rush hour lanes and so on. Every 600 meters, the highway is spanned by a steel construction carrying traffic signing equipment.

In an international context, the Dutch high-tech highways, with meticulously levelled planes of asphalt, turned out to be exceptional. At the other side of the spectrum was the E50 in the Ukraine, where the potholes in the road surface were sometimes deep enough to absorb an entire wheel. Near Donetsk, we observed road construction workers equipped with dust blowers, removing sand and mud out of large potholes before refilling the holes with asphalt. On several occasions cars were observed trying to make it home with three wheels or a broken axis. Our own vehicle was no exception: the suspension broke down.

The bad quality of the roads had an effect on our scenic experience: travelling 30 km/h on a road that looks like a battle field is a very different experience from gliding on a meticulously levelled plane of fresh, black, rain directing, noise reducing, highly maintained tarmac with glow-in-the-dark striping.

Our mechanical trouble also showed the difference in service level between different parts of the E50. In Germany, where the worn-out engine of our first research vehicle broke down, we were towed away to the nearest Mercedes-Benz workshop and offered a taxi to our destination, some 60 kilometres away. Calling the insurance company from the Ukraine however, their call center employee was unable to find a single workshop in the database. The next day, after we had found a workshop ourselves and were already back on the road, the insurance company called back: *“We have found the nearest Mercedes-Benz workshop: it is located in Charkiv.”* The city of Charkiv was about 420 kilometres from where our suspension broke down.

In countries like Slovakia, the Ukraine and Russia, the whole concept of a service system with insurance and tow away service seemed to be nonexistent. Although in the Ukraine, there is help to some extent: the government has equipped parking places with concrete roll-on/roll-off structures, on which you can repair your vehicle or truck. The absence of services was one of the reasons why we had chosen a Mercedes-Benz research vehicle. As American investor and traveller Jim Rogers states in his book ‘Adventure capitalist’, even in the worst failed states, there is at least one workshop with Mercedes-Benz spare parts, since the dictator usually drives one (Rogers, 2004).

4. CONSIDERATIONS FROM THE OBSERVATIONS

We came home with many new questions, some on the design of highways, many on the future of Europe. In 2020, will we still be eating a smiling sausage in a pool of gravy or will all road side restaurants have been franchised? Will it become easier or even harder to travel the E50 in the Ukraine and Russia? We also found answers to our initial research questions.

One of our questions was: how are other countries coping with their infrastructure and how does this relate to the design practice in the Netherlands? The start of the answer to this question is: it depends on the stretch of asphalt that you're looking at. How old is it? Who has designed, build and financed it? Who operates and maintains it?

Traditionally, European long distance roads have been designed, built, financed, maintained and operated by the state. From the Via Appia and the other paved streets in the network of the Roman Empire to the Dutch network of 'rijkswegen' (main roads), initiated by Napoleon. In all European countries, the design and construction of highways was a state-run business, with state employed engineers and landscape designers. Only the actual construction was often outsourced to private companies. In some countries, this tradition is continued: in the Scandinavian countries, for example, and in Russia. In many countries though, not only the construction, but also the design, engineering, maintenance and often even finance is outsourced to private companies or public-private partnerships, for example in France, Poland, the Czech Republic and Slovakia (figure 5).



Figure 5 Built by Design & Construct: the new E50 near Prague (Czech Republic)

These kinds of contracts, based on Design, Build, Finance, Maintain, Operate (DBFMO), have got momentum: the initial costs do not show up as a deficit in the state budget. Also in the Netherlands, where private-public partnership used to be limited to farmers mowing the road shoulder and keeping the grass as a reward (1950s), the latest highway projects are all based on Design & Construct (D&C) or DBFM-contracts.

The new contracts affect the spatial experience. The contracts often highly reward functional and economical aspects, such as traffic flow. Spatial quality is qualified as a 'risk' that has to be 'managed' (the risk of not getting a building permit for aesthetic reasons).

Albeit these public-private partnerships have led to highways with a high service level, clean toilets and comfortable restaurants, these places also lack the feeling of being a truly public space: they feel like airports or Eurodisney, like consumer space, not public space in the sense of what Jürgen Habermas calls the public sphere.

Traditionally, the landscape design of highways was to some extent influenced by landscape architects, whereas the design of steel and concrete structures was merely a civil engineering job in which architects were not involved. On the German Autobahn, for example, curves and panoramic views celebrate the qualities of the landscape, whereas the structures crossing the highway are pure and simple, not crying for attention.

In the current practice however, 'landscape design' is often reduced to the area of the road side shoulder. Part of that has to do with modern demands in terms of noise reduction. The E75 running through Hungary, for example, is almost continuously accompanied by wooden sound-baffling screens. Where the landscape has become invisible, and therefore also the orientation on these landscapes, the designers have fallen back on architectural means. In Slovakia, for example, the exit to every city along the elevated E75, is marked by a different color scheme (figure 6). On some highways in the Netherlands, designers have introduced the same architectural vocabulary, for example a yellow color scheme on the highway A2 through the city of 's-Hertogenbosch. This focus on architectural means seems to neglect more meaningful aspects of the spatial experience, such as the experience of the landscape, the public character of the space and the impact of technology.

Why are architects focusing on color schemes when a scenic view of the surrounding landscape could also tell the driver where he is? Instead of creating strong architectural identities for sound-baffling screens, why not making them out of glass, offering an unhindered view of the landscape and of cities and industrial areas? Then, the role of the architect would not be to create a new identity, but to stress existing qualities by designing the highway in such a way that all the functional aspects do not degenerate the scenic experience.

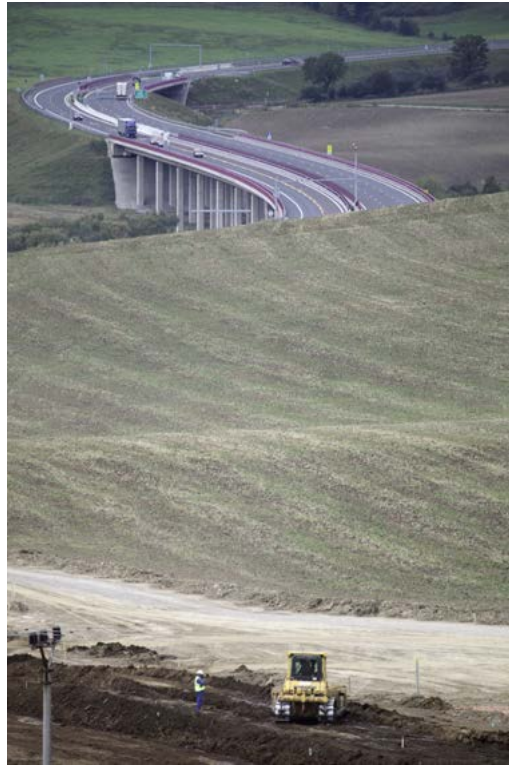


Figure 6 Purple color scheme in the new E50 near Presov (Slovakia)

Finally, we wondered if we were able to find a highway with the high level of spatial quality and attention to detail of an Italian piazza. I used to think of the German Autobahn as the climax of infrastructure designed as a public space: a highway owned, maintained and operated by the state, open and accessible to everyone, where no entrance fee is required, no toll is levied and speed limitations are the exception. A social space that is part of German culture and acclaimed in songs, for example in the 22 minute long hit single *Autobahn* by Kraftwerk: “*Wir fahren, fahren, fahren, auf der Autobahn...*”. (Hütter, Schneider & Schult, 1975)

Albeit trucks are now obliged to pay *Maut* (toll) in Germany and there is political discussion on levying toll on foreigners, the Autobahn is still very much a truly public space. A symbol of this is the *Autobahnkirche*, a nationwide network of churches located in the vicinity of the highway and visited by over a million people a year. The small churches are the religious version of a roadside restaurant: located next to the highway and filled with convenient religious fast food, such as electrically powered candles and small take-out booklets with prayers suitable for trips. Instead of complaining on the temperature of the French fries in the guest book, the traveller can write down

the names of victims of traffic accidents: enlisting them in the book will lead to extra prayers by the reverent. The whole concept shares resemblance to an Italian piazza: a public space with a high level of spatial quality and attention to detail, a place of social significance, even equipped with its own church.

The social significance of the Autobahn was equalled by an experience on the E50 in central Ukraine. We pulled over at a huge concrete landmark: a word in Cyrillic script signifying the administrative border of the Khmelnytskyi Oblast (province). The sign itself was not that extraordinary: many regional borders in the Ukraine are marked by a large chunk of concrete from the communist era. Extraordinary was the fact that a couple of newly weds was blocking the road, urging passing vehicles to pull over (figure 7).



Figure 7 Newly weds collecting gifts on the E50 near Chmelnytsky (Ukraine)

After drinking champagne and swallowing a snack of cholesterol rich animal parts, we were allowed to move on. Fastening our seatbelts, we watched a family member climb up the concrete landmark, trying to put an empty bottle of champagne as high up as he could.

This place in central Ukraine felt even more like a ‘classic’ public space: engineered around a central monument, a social space, commonly shared by the community, open and accessible to the people. A space with explicit rules (Don’t drink and drive) and implicit rules (Drink! It’s our wedding!). This was

where European highway E50 truly became a piazza.

It is hard to imagine that the current practice of DBFM-contracts, with their focus on efficiency, functional and economical aspects, will lead to the same kind of spatial quality and social significance. In this sense, the older examples offer a lot of inspiration. To all architects and landscape architects: get out there, it's inspirational and free of entrance.

Have a nice trip.

ACKNOWLEDGEMENTS

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GREEN INFRASTRUCTURES

City pig farm

A design-based
research on urban
livestock farming

ULF HACKAUF

Abstract

Over the last centuries, the global food system has managed to provide a growing global population with more and better food. Yet, the system is criticised for its negative effects, like increasing food miles, monocultures, a lack of transparency and poor animal welfare. The recent trend to farm more food in and around cities (urban and peri-urban farming) seems to provide an alternative to the existing system. Urban and peri-urban agriculture (UPA) comes with many potential benefits, from reducing food miles and improving local urban climate to supporting social coherence in local neighbourhoods and improving personal health. At the same time, the field of UPA is very diverse and not each project addresses each of the potential benefits. This paper addresses urban livestock farming as a specific form of UPA. "Livestock farming" is hereby defined as raising domesticated animals, such as cattle, pork, poultry or fish for the production of food. Each of these types of farming has different needs and implications when included in the city. This study specifically looks into pig farming in an urban setting. It states that design-based-research is a useful research strategy to explore the possibilities and probabilities of this type of UPA. It draws on the design-based study 'City Pig', conducted at The Why Factory (2009), Delft University of Technology. The results of this study can be evaluated in order to get a grip on the possible benefits of this specific type of urban livestock farming. An important limitation is that it concerns virtual, un-built design proposals. As built, productive examples of UPA are still scarce in the Netherlands and beyond this design-based-research method could fill a gap and help gathering knowledge for future projects. Therefore, this paper not only evaluates a specific type of UPA, but also tests on whether research-by-design studies, can form a useful tool to further develop UPA in general. The aim of this paper is therefore two-fold: What are the potential benefits of urban pig farming and how can un-built design projects help to answer that question for future 'real' projects.

KEYWORDS

urban agriculture; urban farming; food production; food system; green washing; design-based research

1. INTRODUCTION

In recent years, interest in growing food in cities has increased (Mok et al., 2014). In the Netherlands a number of studies have been published giving an overview of built and planned projects in the Netherlands and beyond, for example: *Stadslandbouw* (Veen, Breman & Jansma, 2012), *Stadsboeren in Nederland* (Van Bergen et al., 2013), *Food for the City* (Van der Sande et al., 2012). Projects like the restaurant *Uit je eigen stad* in Rotterdam, where food is grown next to where it is served, show how farming can become an interesting and attractive part of the city (Van Bergen et al., 2013). This type of farming within or in proximity to the city is known as “*Urban and Peri-urban Agriculture (UPA)*”. Veen, Breman and Jansma (2012) define UPA as follows: “*the production, processing and marketing of food and related products and services in urban areas, making use of urban resources and waste*” (p. 4). This definition implies that UPA can comprise of a wide variety of projects, from the beehive on a private roof over a neighbourhood garden run by a local community, to a high-tech farm with stacked fields in a closed building. De Graaf (2013: 40) elaborates:

“[UPA projects] differ in their relation to the soil and the built environment, their relationship with the essential flows of the city, and in the impact they have on public space socially and aesthetically. Thus they offer different benefits to the city, and respond to different opportunities.”

In the Netherlands however, urban and peri-urban agriculture today is still in its infancy (Veen, Breman & Jansma, 2012) and a number of questions around the topic have to be addressed. Where can it be applied, how can it be financed and importantly, what can it actually provide? How can we study the possibilities of UPA?

Examining examples of UPA in the Netherlands is interesting beyond the context of the country itself. The Netherlands has a long tradition of innovation in agriculture. Although relatively small and densely populated, the country is a globally relevant food producer. The combination of close proximity of farming and cities together with the knowledge in innovative and productive farming could lead to new solutions of UPA, which are relevant in many other countries.

This paper addresses urban livestock farming as a specific form of UPA. Livestock farming can be defined as the raising of domesticated animals, such as cattle, pork, poultry or fish for the production of food. Each of these examples of livestock farming has different needs and implications when situated in the city. This study specifically looks at pig farming in an urban setting. It uses design-based research, which is a useful research strategy to explore the possibilities and probabilities of this type of UPA. It draws on the design-based study ‘City Pig’, conducted at The Why Factory (2009) as part of Delft University of Technology. The results of this study are evaluated in order to get a grip on the possible benefits of this specific type of urban livestock

farming. An important limitation is that it concerns virtual, un-built design proposals. This implies that many relevant parameters are not known and the actual performance of the pig farms and their effect on the surrounding cannot be measured. But built, productive examples of UPA are still scarce in the Netherlands. This design-based research method could fill this gap and help gather knowledge for future projects. In that sense, this study is not only an evaluation of a specific type of UPA, but also a test as to whether research-by-design studies can be a useful tool to further develop UPA. The aim of this paper is therefore two-fold: What are the potential benefits of urban pig farming and how can un-built design projects help to answer this question and contribute to future 'real' projects.

In order to address these research questions this paper elaborates on the concept of urban and peri-urban farming in a Dutch context and its possible benefits. Then design-based research is explained as a research strategy, exemplified by the work of The Why Factory. The City Pig project is an important research outcome, which will be described and used as case study for urban livestock farming. Based on these research outcomes it is possible to reflect on the benefits of urban livestock farming as well as on the design-based research methodology and its implications on future UPA projects.

2. URBAN AND PERI-URBAN FARMING IN THE NETHERLANDS

Introducing agriculture into cities may initially seem paradoxical. It was the separation of harvesting and dwelling, which made cities possible in the first place. In a process that took between five and ten thousand years (Fresco, 2012), humans began harvesting grain and slowly developed agriculture. As a consequence they had to stay at one place rather than travel in search of food. And as agriculture slowly became a reliable source of food, there was time to concentrate on things other than food: specialisation became possible, language evolved, health improved and culture became further developed.

The development of agriculture and cities remained dependent on each other for the next few centuries. For a long time, the size of a city depended on how much food could be grown in its vicinity and how quickly this food could be transported into the city:

"Given the physical difficulties of getting food into town, it is hardly surprising that most pre-industrial cities were compact by modern standards. A day's journey by car, a distance of around 20 miles, was the practical limit for bringing in grain overland, which limit the width of the city's arable belt. The simple laws of geometry meant that the larger a city grew, the smaller the relative size of its rural hinterland became, until the latter could no longer feed the former." (Steel, 2008: 70)

Cities located on a river or the sea had an advantage here. Transport via sea has always been cheaper than land transport. A close connection to the sea made it possible for cities like London, Antwerp, Venice or Ancient Rome to grow more quickly by receiving a supply from a larger hinterland (Steel, 2008). The rise of railways in the nineteenth century reduced this dependence on sea transport. Innovations in preservation and refrigeration eventually led to today's global food system, one where production and consumption are distributed worldwide.

Yet contrary to this movement towards a globalised food system, there is a long history in developed countries of local food production, based on small productive individual and collective gardens (Mok et al., 2014; Kimmeler, 2011). The main aim of these gardens has changed over the years. The early focus for urban farming was on food production. The German 'Armengärten', which dates back to the late 18th century or the 'Victory Gardens' in the UK during WWII are examples of UPA with the aim to ensure food security (Mok et al, 2014). Later, recreation and health became important, as in the German 'Schrebergarten', which developed in the 19th century. Today, multiple social aspects play a role in contemporary UPA, such as social cohesion and placemaking. Also the ecological effect of local food production has become an important potential benefit of UPA. Hynes and Howe (2004) illustrate how the aims of UPA has changed over time:

"Community gardens and small farms in U.S. cities are not altogether new. However, their purposes today – neither short-term welfare during periods of recession, nor philanthropic charity to uplift 'the masses', nor patriotic war relief, all of which catalysed earlier urban horticulture movements [...] – are new. Their goals include teaching inner-city children ecological literacy and diverting them from the streets; cleaning up overgrown neighbourhood eyesores and pushing out drug dealing, that, like weeds, overtakes neglected vacant lots; growing and preserving food from seed to shelf; restoring nature to the industrial and post-industrial city using heirloom plants and bird and butterfly gardens; and bringing the farming tradition of the rural South to northern industrial cities. These are but a handful of the reasons that urban gardeners have given when asked why they garden." (Hynes & Howe, 2004)

The possible benefits of UPA have to be seen in relation to the disadvantages it has compared to traditional farming practices. Land prices in and around cities are generally higher in urban areas than rural areas. Traffic and industries can cause more pollution in air and soil and therefore make urban areas less suitable for food production. Shadows of buildings can limit the sunshine hours. Farming is not easily implemented in cities, but there are a number of potential benefits that could balance the disadvantages and make it worthwhile to include agriculture in urban areas. Mok et al. (2013), Visser et al. (no date) and Veen, Breman and Jansma (2012) provide a systematic over-

view of these potential benefits, which can be summarised as individual benefits, economic benefits, social and cultural benefits and ecological benefits.

2.1 Individual benefits

UPA can increase the aesthetic attractiveness of a neighborhood, withholding the citizens of moving to other places (Hynes & Howe, 2004). When children are introduced to growing food, it can have a positive effect on their eating habits in later years (Veen, Breman & Jansma, 2012). Green spaces can also be a place for recreation. Physical activity in green areas can have a general positive effect on health, well-being and recovery. This can play a special role in health care and day care, such as so-called 'care farms' (Veen, Breman & Jansma, 2012).

By providing knowledge on food and how it is being grown, UPA can be seen as culturally important. UPA projects as part of the education of children at schools can provide practical insight in farming, and farming your own food can contribute to satisfaction and self-esteem (Veen, Breman & Jansma, 2012). A closer contact between food producers and consumers can create new opportunities for food, which are not available in the traditional food chain: for example ethnic vegetables for a specific local community or fragile fruit, which is not suitable for long periods of transit (Veen, Breman & Jansma, 2012).

2.2 Neighbourhood benefits

UPA can increase the aesthetic attractiveness of a neighbourhood, lessening the likelihood of citizens of [or: withholding the citizens of] moving to other places. UPA has the potential to mitigate outside temperatures and retain rainwater, thereby improving the local climate and reducing the urban heat island effect (Veen, Breman & Jansma, 2012). The maintenance of green farming areas can replace the maintenance of public green areas or the landscape around the city. UPA on vacant urban sites can prevent degradation of the adjacent neighbourhood (Veen, Breman & Jansma, 2012).

If a UPA project involves local inhabitants, it can support community building and social cohesion in the neighbourhood. It can offer people from different social and ethnic backgrounds the chance to work together; food can be an easy topic to connect otherwise separate social groups. Collaborating on an UPA project can get local inhabitants 'involved', supporting their identification with the neighbourhood (Veen, Breman & Jansma, 2012).

2.3 Economic benefits

UPA can provide new job opportunities in the city, whether directly related to farming or to visitors coming for recreation and education. The localised production of food can also provide economic benefits. This could be

in the form of selling directly to the consumer, without a costly distribution chain, which can make the food cheaper. On the other hand, distinct products with a local connection can be sold for a higher price, providing a better income (Veen, Breman & Jansma, 2012). The attractiveness of UPA beyond its direct economic model can also increase the attractiveness of the neighbourhood, resulting in higher land prices. It can be a way to make productive use of otherwise unused areas or buildings. And eventually, UPA can be a place for individual development. For example, UPA can offer chances for the long-term unemployed to re-integrate into the regular labour market by providing certificates and training competences (Veen, Breman & Jansma, 2012). By offering the consumer insight into how his food is grown, farmed and processed, UPA can help to re-establish trust in the food system. If the consumer becomes involved in the quality and origin of the food he buys, this can provide leverage for food coming from traditional sources (Veen, Breman & Jansma, 2012).

2.4 Ecological benefits

Crop and livestock farming can extend the habitat for wildlife in the city, thereby contributing to biodiversity. If local or rare crops are farmed, UPA can add to agricultural diversity.

By connecting to nutrient, waste, water and energy streams of the city, UPA has the potential to connect or close different resource cycles. UPA projects can collect and retain rainwater and make use of urban wastewater. When wastewater and GTF (abbreviation for: Green, Garden, Fruit) waste are used as fertilizers in UPA, the depletion of minerals and production of artificial fertilizers can be reduced. Different types of UPA projects can make use of excess heat from other urban programs, return heat from greenhouses or bring energy from biogas installations to the city (Veen, Breman & Jansma, 2012).

UPA can have a positive impact on the reduction of greenhouse gasses (GHG). A shorter distance between producer and consumer can reduce the transportation of food and the related GHG emissions. UPA also allows for carbon sequestration. Finally, by raising the awareness of seasonal availabilities, it can stimulate a more sustainable and ecological diet (Veen, Breman & Jansma, 2012).

As stated before, these are all *potential* benefits of UPA. As the diversity of possible types of UPA projects implies, not each project will come with all of these potential advantages. A community garden run by volunteers for example may not sell any food and therefore may offer no direct economic benefits, but it could greatly contribute to the social cohesion of the neighbourhood. A series of private rooftop beehives could have no measurable impact on the food miles of the local population, yet playing a vital role for the local ecosys-

tem. And a closed aquaponic farm could become a thriving business, without bringing the social benefits of a participatory project.

Eventually, more built and running examples are necessary to provide more insight into the positive (and negative) effects of the different types of UPA:

“The development of urban agriculture in the Netherlands is surrounded by a multitude of claims and questions, which in many cases are not or insufficiently supported and answered. [...] All in all, this means that while our gut feeling says that urban farming can contribute to social, economic and ecologic sustainability, there is still little hard (scientific) proof for these claims.” (Veen, Breman & Jansma, 2012: 37)

It is with this background that design-based research offers interesting possibilities. Unbuilt design proposals could help to clarify some of the mentioned claims and questions in order to prepare the ground for more built projects. This was one of the drivers behind the ‘City Pig’ project of The Why Factory.

3. DESIGN-BASED RESEARCH AS A RESEARCH APPROACH

The examined study explores the implications of urban pig farming as one kind of UPA in a general, not site-specific sense. Although sited on a given location, it aims to gain insight in urban pig farming beyond the local context and make the findings applicable on other locations and potentially inform other possible UPA programs. The study uses spatial and architectural design as research method. The presented approach is what Nijhuis and Bobbink (2012: 252) describe as ‘design-based research’: *“designs (or the process of designing) are used as a vehicle to make spatial problems visual and spatial (‘framing’) and to generate solutions.”* The study is in line with both aspects of this definition: it makes the implications of urban livestock farming visual and spatial and it aims to provide general solutions of how an urban pig farm can be integrated into the urban fabric.

A design-based research approach has been used in a number of projects as part of The Why Factory. The Why Factory is a chair at the Faculty of Architecture and the Built Environment at Delft University of Technology and was set-up in 2008 by Professor Winy Maas, principal and co-founder of the Dutch architect firm MVRDV. Both institutions share an interest in visionary thinking about urban futures. As Winy Maas puts it:

“We produce models and visualizations for the cities of the future. Our ultimate mission is to reveal through bigger projects the mechanisms of thinking about, and ultimately producing a series of critical alternatives through images.” (Maas et al., 2011: 13)

For the production of these visions and models, The Why Factory combines education in the faculty's Master of Science (MSc) program with research activities. The Why Factory's MSc design studios are based on on-going research projects and are set-up as systematic design explorations. Two elements are important in this set-up: a guided solution-finding process and a generalisation of the process. The first element means that the students need to work on complementary strategies, for example choosing different scales or exploring different technologies. The aim of the group work is not to get a few good solutions, but to cover a wide spectrum of diverse possible solutions, which can be analysed in relation to each other. The second element implies that the assignment should not be site specific, to allow general conclusions on the given topic. Often, the studios explore a topic with a 'model city' as a base, developed under one guiding aspect: for example mobility, bottom-up planning or automation, and without geographical context. Klaasen (2007) states that a degree of context-less design is inherent to a research-by-design approach in urban design:

"In the case of urban design a scientific approach involves the dissociation of objects of design from a specific design context, i.e. the designing of theoretical models – resulting in designs that in spatial-ecological and/or socio-cultural and/or economic-technical terms are independent of a specific situation. By leaving aside characteristics of specific contexts one can focus on essentials – from simple ones like universal spatial organisation principles to more complex ones that include some contextual characteristics, and therefore might not be universal, but certainly are non-localised."

While MVRDV works towards built architecture and applied urban plans, the design-based research of The Why Factory results in visual representation of data and of imagined architectural and urban structures. The role of these visual representations is two-fold: that of visual thinking and visual communication.

"Visual thinking implies the generation of ideas through the creation, inspection, and interpretation of visual representation of the previously non-visible (knowledge discovery), while visual communication refers to effective distribution of ideas in visual form." (Nijhuis & Stellingwerff, 2011)

Examples of such projects include *Sunny Water Lilies* (2010), a proposal for a solar thermal energy plant to improve the spatial qualities of green infrastructure (figure 1), *Vertical Village* (2011), a model for evolutionary vertical urbanism that combines social and physical 'village' qualities with urban densification (figure 2) and *Transformer* (2014), a scenario based on smart, transformable building materials and how these could change architecture and urban life (figure 3).



Figure 1 Sunny Water Lilies as geothermal power plants (courtesy: The Why Factory, 2009)



Figure 2 Vertical Village: Evolutionary vertical urbanism (courtesy: The Why Factory, 2009)

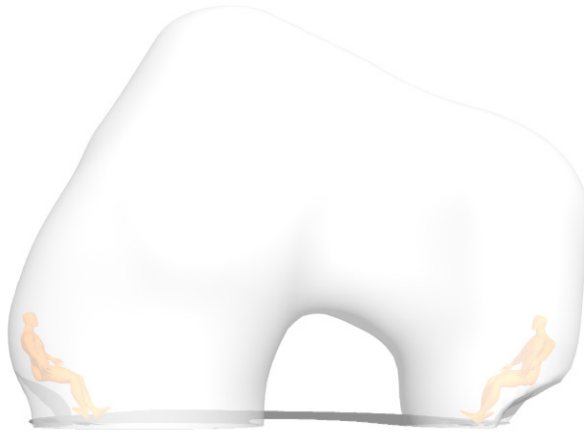


Figure 3 The Transformer: future building materials (courtesy: The Why Factory, 2009)

The City Pig project of 2009 stands out from the projects by The Why Factory, as the designer-client relationship for this project comes close to the process of ‘real’ architectural design, as it has a given plot and a building design assignment. The project was hypothetical and not meant for construction, but the realistic background makes it an interesting research-by-design case study.

4. CITY PIG FARM AS AN EXAMPLE

The chosen case study for this article is the ‘City Pig’ project, a series of pig farms designed for a location in The Hague in the Netherlands. ‘City Pig’ was a study commissioned by the Centre for Arts and Architecture ‘Stroom’ in The Hague as a contribution to the program ‘Foodprint: Food for the City’, which ran from 2009 until 2012. The Why Factory developed City Pig in a multidisciplinary team with designers and researchers from TU Delft, Wageningen UR and the ‘Innovatie Netwerk’. Students from the Why Factory’s MSc program took part in the development of the first proposals. The project was presented as an animation movie at the first manifestation of the ‘Foodprint’ program, a public exhibition in The Hague in the summer of 2009. Together with the other projects of the program, the project was later documented in the publication ‘Food for the City’ (Van der Sande et al., 2012)

The ‘City Pig’ study takes an unusual position in the field of UPA in two respects. Firstly, it is a proposal for an urban life stock farm, located within the city and claiming to be economically feasible. Most current examples for

UPA focus on growing crops, and livestock farming is the exception. Secondly, the case study is not a built project, but a hypothetical design, developed for an exhibition. The choice for this case study is a conscious one: the aim is to reveal the potential of urban livestock farming, while at the same time testing how far unbuilt design projects can serve as case studies in the field of UPA. As stated before, UPA in the Netherlands is still in its infancy and more examples will be needed to get insight into the effects and benefits it can have. If unbuilt projects can provide such insight, it can be beneficiary for the development of UPA in general.

The topic of the 'City Pig' study was proposed by Annechien ten Have-Mellema, who played the important role of the 'client' in this project. Owner of a pig farm herself, she initiated the project in her role as member of the board of LTO Nederland, the Dutch Federation of Agriculture and Horticulture. She joined the project to raise awareness on alternative ways for pig farming. The sector has a negative public image because industrial pig farming with large stables is generally criticized and not considered animal friendly by public opinion in the Netherlands. On the other hand, biologically produced pork has still a limited share in the Dutch market due to its higher price. A pig farm in the city would allow consumers to see how pork is produced and support biological farming. The scope of the study was limited. The focus was therefore more on presenting the design proposal in an accessible way to a wider public than producing a realistic feasibility study for a soon-to-built project.

The City Pig project consists of eight design proposals, presented as a narrative. After a general introduction on the theoretical implications of local food production, a functional pig farm with the main components is illustrated. Eventually the eight proposals are shown on their specific locations. The site for all eight farms is the 'Brinkhorst', a mixed, partly industrial area within the city proper of The Hague. The site was chosen as the exhibition took place here and as the area will be developed in the future.

The archetypical farm (figure. 4) illustrates basic requirements for a feasible pig farm. The size is large enough for about 200 sows at any time, producing about 4.300 pigs per year. A farm of this size is large enough to be feasibly managed by two full-time farmers. It includes stables of different size for the pigs, from farrowing to fattening. All stables are dimensioned according to the regulations for biological farming, thus larger than the standard industrial pig stables. Next to storage areas, the farm includes a biogas plant, where the pigs' manure is transformed to energy. A visitor centre and a restaurant for visitors are added. To avoid transportation of living animals, a small slaughterhouse is included in the design.

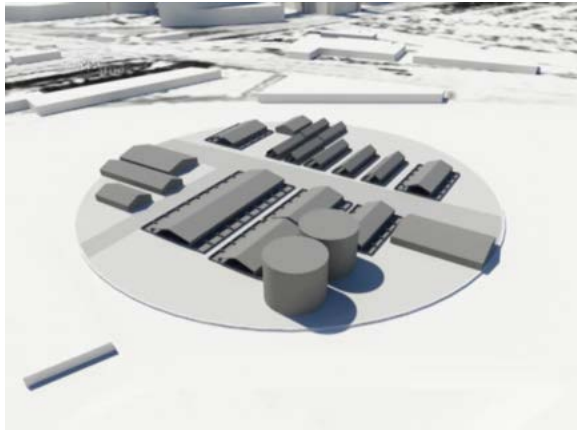


Figure 4 Archetypal Farm (courtesy: The Why Factory, 2009)

A major challenge for urban livestock farming is the required fodder. The footprint of the farm is limited, but a farm of this size requires about 1.400 tons of fodder per year, equal to about 2.2 km² of cropland (figure 5). In the City Pig project, the proposal is to connect the pig farm to the waste stream of the city and its surrounding. Instead of growing pig fodder – or importing it from other countries, as most current pig farms in the Netherlands do – waste from the nearby greenhouse industry in the Westland and residual products (GFT waste) from nearby food-industry, supermarkets and fresh markets are used. Pigs are omnivores and can therefore play an important role in the resource and nutrient flow of the city.

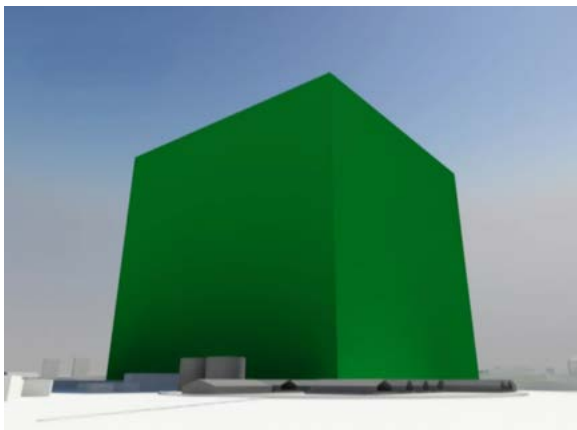


Figure 5 Spatial requirements of fodder production (courtesy: The Why Factory, 2009)

Not all GFT waste is suitable for pigs. Waste, which cannot be fed to the pigs, can be fermented in the biogas plant, together with the pigs manure (figure 6). With a capacity of about 50.000 tons of GFT waste and 5.500 tons of pig manure, the biogas installation would have the capacity to produce about 18.000 MWh of electricity per year, enough for about 5.000 households. The remaining residue could be used as fertilizer for crop plants (figure 7).



Figure 6 Biogas network (courtesy: The Why Factory, 2009)

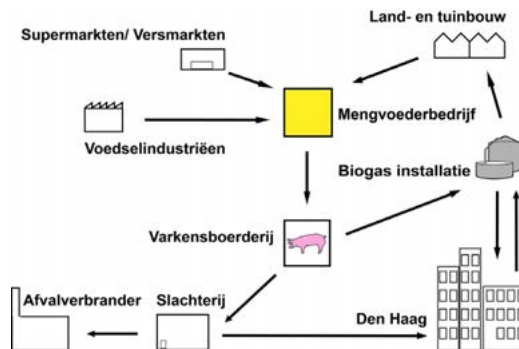


Figure 7 Resource cycle (courtesy: The Why Factory, 2009)

Placing the archetypical farm on this location reveals one large challenge for the project. Within an estimated radius of 400 metres, the stench of the farm would be too strong to have housing or offices in this area. In a dense urban area, a pig farm would need to be closed with a filtered ventilation system. For the archetypical farm, the closed system is visualized with a transparent cupola (figure 8).

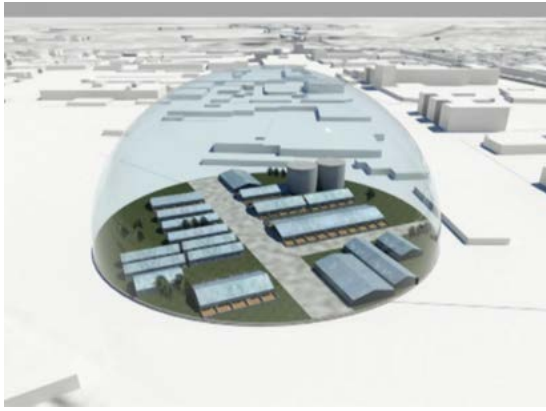


Figure 8 Snowball (courtesy: The Why Factory, 2009)

Based on the archetypical farm, eight designs were developed: The Snowball, The Stack, The District, The Balconies, The Terrace, The Bridge, The Office and The Strip (figure 9). Each design has a different location within the Brinkhorst and offers different ways to interact with the surrounding. However, all eight designs use the same program and the same surface areas as the archetypical farm. For this study, four of the eight designs are chosen as they represent the strongest difference in approach.



Figure 9 Eight typologies (courtesy: The Why Factory, 2009)

4.1. The Stack

This proposal stays the closest to the archetypical farm. To reduce the footprint of the farm, the different stables are stacked and connected with

ramps. This allows shrinking the dome as well. The result is a sculptural and iconic building (figure 10).



Figure 10 The Stack (courtesy: The Why Factory, 2009)

4.2 The Strip

Here, the pig farm makes use of a wide, empty strip of green between the four lanes of the central road of the area. All stables are arranged as one strip of one kilometre long, illustrating the cycle of a pig, from piglet to slaughterhouse. The rooftop is publicly accessible, allowing views into the winter gardens, which pigs can reach from their stables (figure 11).



Figure 11 The Strip (courtesy: The Why Factory, 2009)

4.3 The District

By spreading the stables out and embedding them in an intense green area with trees and shrubs, the stench hindrance can be reduced in a natural way. This design relies on additional strategies such as direct separating manure from urine in the stables to prevent the production of ammoniac. Here the aim is to integrate the farm with other urban programs, including housing and partly making use of existing buildings for storage, butcheries or restaurants (figure 12).



Figure 12 The District (courtesy: The Why Factory, 2009)

4.4 The Office

An existing vacant office building on the site meets the overall spatial requirements for the pig farm. The stables are integrated into the existing building, making use of the building's shell and the existing elevators. Ramps are added to the building to increase the capacity for vertical transportation. The former lobby is used as a slaughterhouse (figure 13).



Figure 13 The Office (courtesy: The Why Factory, 2009)

All of these proposals should be seen in the context of the exhibition for which they were designed. They lack detailing and they are exaggerated in order to inspire and to provoke discussion with a wider public. This may make them less suitable as case studies than a more realistic design proposal. However, the aim of this study is not to evaluate the immediate feasibility of the design proposals, but to gain insight into possible benefits on urban livestock farming and urban pig farming in general. For this aim, the exaggerated character of the designs is accepted in this study.

5. DISCUSSION: OUTCOME OF THE DESIGN STUDY AND POSSIBLE BENEFITS

In this paragraph, the previous examples are used to evaluate the potential benefits of urban pig farming. The four main categories from the second paragraph are used as ‘lenses’ to test potential benefit. Here the examples are treated as different variations of the same design intervention. They are discussed together, differentiating between proposals when necessary.

5.1 Potential individual benefits of urban pig farming

Individual health and well-being benefits are linked to the direct involvement with the production of food or to working outside in a green environment. Both aspects are very limited in all four proposals. The contamination of pigs is a serious challenge in pig farming. In a regular farm, visitors can only get in touch with pigs after following a strict safety procedure, including protective or entirely fresh clothes. This makes casual and occasional voluntary work, which may be possible in horticulture, difficult in a livestock farm.

From the four designs, The District could become 'recreational'. Also The Stack can be an attraction for visitors. However, compared to an open farm, the enclosed space of this proposal is more likely to invite one-off visits than to become a regular pastime.

By making livestock farming and meat processing visible and transparent, all four proposals have a cultural benefit. The proposals are also well suitable for the education of children and adults and have a positive effect on their diet: not necessarily by turning all of them into vegetarians, but by stimulating a more conscious consumption of meat. A wider variety in the farmed pig breeds could be supported through the choices of the visiting consumers. The iconic quality of all designs could add to the promotion of the produced meat and allow for relatively higher prices. Direct sales on the other hand could reduce the price and partly compensate for the higher cost of biologically farmed pig meat. Of course, the latter benefits have to be seen in relation to prices for land, ventilation and building, all of which would probably be much higher than a conventional farm building on a rural location. The possible benefit of satisfaction and self-esteem for the producer would in all cases be mainly limited to the farmers themselves.

5.2 Potential neighbourhood benefits of urban pig farming

The proposed City Pig farms would not have many of the potential neighbourhood benefits, which other UPA projects could have. All but The District work with a closed and controlled environment, which would not improve urban heat island or rain water retaining. As the projects do not include 'productive green', the synergy with municipal maintenance of public green cannot be found. Depending on the development of the area, the projects could have a positive effect on the use of otherwise vacant areas. The Office shows, how a vacant building could be re-used for livestock farming, but the necessary adjustments to the building would not make this approach feasible for short-term temporary use. The 'District'-project could make use of vacant single storey sheds and halls, with less need for adjustments. If the concept is applied in a non-residential area, where the stench is acceptable, it could become a feasible re-use scenario.

Generally, the proposed designs are not bottom-up participatory farms and would therefore not be able to provide the benefits of local collaboration and the related community building. Pig farming comes with strict regulations around hygiene and possible contamination. Where a fruit orchard could do well without daily maintenance, a pig stable has tight schedules. This may limit the possibilities of involving volunteers in the farming. It has to be said that the disapproval of pig meat in a number of religions might lead to a segregation of social groups rather than a support to mixing.

5.3 Potential economic benefits of urban pig farming

The transparent production of meat is a strong benefit in all four proposals. The consumer can see and judge the conditions of the pigs and get into discussion with the farmer. The iconic character of the project can lead to leverage beyond the direct consumption around the farm. As mentioned above, a local and transparent pig farm could promote special products which respect animal well-being, make use of the nutrients from the city and return sustainable energy to the city. Products could be sold for a higher price than traditional industrial pig products. A local butchery and a restaurant could be a spin-off of the actual farm and provide extra income and job opportunities. Again, this has to be seen in relation to the higher land prices technical requirements and general building cost of an urban pig farm compared to a traditional rural pig farm.

5.4 Potential ecological benefits of urban pig farming

As the proposed farms are fitted with a closed ventilation system, there is little exchange with the surrounding nature and therefore little support for biodiversity. Only the 'District'-farm would add to the natural habitat in the city. The choice of non-standard breeds however could increase agricultural diversity.

All four proposals show clear benefits on the re-use of urban (GFT) waste and the provision of (waste) energy, making it one of the strongest benefits of the project. Rainwater cycles are more difficult to include, due to the closed system and carbon sequestration cannot be realized without crop farming. Regarding the reduction of food miles this project illustrates that the topic is more complex than it might look in the first place. The actual volume of pig meat is small compared to the volume of the required fodder. Thus, the impact of transporting fodder can outweigh the benefit of locally produced food. This is also the case for traditional pig farming in the Netherlands, where much of the fodder is imported from other countries. The four proposals aim to avoid this by making use of local GFT waste. This however has to be collected and moved to the stables. The more collection points the GFT is coming from, the more individual traffic this is likely to cause. Based on the current state of

the project, it cannot be stated whether the project would reduce transport related GHG emissions.

6. CONCLUSIONS

Based on the previous discussion, this paragraph draws conclusions in two directions: how did the design-based research approach play out in the study and which benefits does urban pig farming potentially hold.

6.1 Design-based research projects as case studies

As stated at the start of this essay, the design-based research approach is used for two purposes: visual communication and visual thinking.

Visual communication in the design-based research study on urban pig farming

The study was commissioned for a public exhibition. It was therefore important to communicate not only the final results, but also the background of the study (urban agriculture and livestock farming) in an accessible way to a broader public. This was partly done by presenting the study as a movie with a clear narrative. But the study went further and engaged spatial design as a means of visual communication. At the beginning of the movie, the (theoretical) spatial requirements for local food production are shown as volumes, which were placed in the city, critically highlighting on the space requirements of food production. The requirements of animal fodder are illustrated in a similar way, emphasizing that it is crucial to include fodder in the discussion of urban livestock farming. The basic pig farm in the movie is presented as a spatial design, which at the same time acts as a diagram of a generic pig farm. The stench circle is first graphically visualized before it is translated into a spatial design, a large transparent globe, which creates a controllable local environment. All of these elements engage spatial design to illustrate inherent problems of urban farming to a broader public.

On the other hand, visual communication was an important part of the communication during the study within the research team. The expertise on pig farming present in the team was visualized and translated into a spatial design. Through the design, the requirements of an economically feasible, functioning pig farm were determined. Initial ideas, such as an open park with an idyllic mud pond were visualized and then dismissed during the discussion, as it created organisational problems. The design process here helped to create and visualize a detailed brief for an urban pig farm, which could be described as a new building typology.

Visual thinking in the research-by-design study on urban pig farming

In the second part of the study, the diagrammatic ‘basic’ urban pig farm was translated into a number of different typologies. Each design addressed a different problem or potential. The Strip for example used an existing vacant area. Spatial design was required to test the possibility (does the program fit on the location?), the implications (how can the farm be accessed by visitors or by trucks?) and in how far the proposal can stand in for a general typology (how many of this kind of vacant strips exist in the Netherlands?). The Office was approached in a similar way: how does the program fit into the given building, how can internal circulation be adjusted and in how far is the building representative for a larger amount of vacant office buildings in the Netherlands. It has to be said here that within the limited scope of the study and the foremost aim to illustrate the ideas in a public exhibition, the elaboration of the proposals is still limited. The ventilation of the buildings for example has not been addressed, nor has the necessary delivery to and from the building. These aspects can be addressed in a follow-up study, using the same design-based research approach.

The latter two examples show, how design-based research in this study explored technical and functional implications of the concept of urban pig farming. As important are aesthetic aspects, especially as the ‘attractiveness’ of the design plays a role in whether it would be acceptable for local inhabitants and thereby raise the quality of the neighbourhood. Attractiveness is also important for whether the farm would become a destination for visitors and therefore become a transparent farm where visitors become informed and empowered consumers. The ‘soft’ quality of attractiveness is harder to translate into a general typology, which is independent of the specific location, the applied materials and the tools of representation used in the study. On the other hand, elements like public terraces and open views to the stables can be part of a general, ‘inviting’ typology. One challenge here is the relation between transparency, cost and an attractive appearance. More transparency will allow for more insight of the visitors into the process, but will also require more glass and therefore higher building cost. Less glass will allow for cheaper construction, but also less interaction with the inhabitants.

6.2 Potential benefits of urban pig farming

As this analysis shows, the benefits can be found in the area of empowerment and transparency, and in the connection with the city’s resource cycles.

Transparency towards the consumer was the main motivation for the ‘client’ Mrs. Ten Have-Mellema to start this project. Most of the consumers today who buy pork in a supermarket or at a butcher don’t get to see the inside of a pig stable or slaughterhouse. The physical distance between the stable and the supermarket makes it easier to disconnect the consumer’s dis-

approval of industrial ‘mega-stables’ from the choice for or against biological produced pork meat in the supermarket. If pig farms expose the way the animals are kept, raised and slaughtered, this disconnection could disappear and more expensive but more ethic and sustainable choices could be supported. This effect is of course not limited to pig farms. The question here is if this transparency could also be achieved in peri-urban or rural settings, without the immediate problems of the proposed designs, such as the stench and high land and construction prices. It is worth noting that urban livestock farming, through its transparency towards the consumer can lead to increased animal well-being. This potential benefit has not been addressed in the sources of the previous chapters.

The synergy of nutrient and energy flows with the city is another large benefit, which urban pig farming could provide. Here lies a specific benefit of pig farming, which cannot be directly translated to cow or poultry farming. Pigs as omnivores have a special potential for making use of the cities GFT streams. Also for this aspect, it would be interesting to study how peri-urban or rural pig farms could achieve similar benefits without the disadvantages of higher cost and the stench.

Eventually, the productive, temporary re-use of vacant areas could be an interesting and surprising benefit of pig farming. The example of The Office is hereby more emblematic and provocative than financially feasible, as it includes substantial adjustments to the existing structure. The District on the other side could make use of existing vacant buildings with less investment. In areas that are far enough from other urban activities, such a temporary urban farm could function without extra technology to avoid stench. An otherwise unused area could be productively used, providing transparency in production, education, possible benefits for promoting and economically producing more biological and sustainable meat and become a temporary, attractive destination.

The study has shown potentials and challenges of urban pig farming. In a next research step, the given triangle of location (urban), content (pig farming) and project emphasis (transparent processes and resource management) could be opened.

One proposal could include a pig farm in a peri-urban or rural setting, which aims for the same main benefits. A similar design-research-study could be used to explore, how the same transparency could be achieved and how the pig stable could make use of GFT waste over a larger distance.

Another study could keep the location and the benefits, but employ different types of farming. The studies could explore how other livestock such as fish, poultry or insects could make use of organic waste and provide energy, and how the farming could be exposed to support informed consumer choices.

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For more information on The Why Factory and the background of the project, see www.thewhyfactory.com

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Representing nature

Late twentieth century green infrastructures in Paris

RENÉ VAN DER VELDE, SASKIA DE WIT

Abstract

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The appreciation of green infrastructures as 'nature' by urban communities presents a critical challenge for the green infrastructure concept. While many green infrastructures focus on functional considerations, their refinement as places where concepts of nature are represented and where nature can be experienced and understood, has received little attention in research and praxis. Contemporary urban societies entertain varied and distinctive ideas on nature and their relationship to it, themes explored in contemporary urban park and garden design. These projects can provide insights into the representation, comprehension and experience of nature in green infrastructures. This article expands on contemporary conceptions of nature in urban parks and urban gardens such as those realised in Paris between 1980 and 2000. The projects all display articulated expressions of conceptions of nature, reflecting both a return to the classical garden tradition, as well as elaborations of nature via the sensorial, 'abundant nature' and nature as process. These conceptions can be positioned within the theoretical framework of three forms of nature – first nature (wilderness), second nature (cultural landscape) and third nature (garden). In Paris, contemporary parks and gardens not only express new forms of nature, they also form part of a green infrastructure network in their own right. As a series of precise moments connected by rivers and canals, this network differs markedly from prevailing green infrastructure models. The network of parks and gardens in Paris represents a green infrastructural network made up of a layering of historical and contemporary elements connected in compound ways. The completeness of representations and elaborations of nature – gathered in the three natures – can be dissected and spread out over different constructed landscapes in the city, and it is up to the green infrastructure to unite them.

KEYWORDS

green infrastructure; conceptions of nature; three natures; urban gardens; urban parks; sensorial; context; natural processes

1. INTRODUCTION

The perception and appreciation of green infrastructures as ‘nature’ by urban communities presents a critical challenge for the green infrastructure concept. How do users – individuals, groups or collective urban populations – see and value green infrastructures? In his research on the concepts, perceptions and uses of green infrastructure in spatial planning, Ian Mell (2010) found that the perception of green infrastructures is informed by highly diverse factors determined by physical, psychological or social understandings of the environment. He also found that form and composition of landscape was central to positive perceptions, and that this perception was linked firstly to its natural or ecological composition and after that its social meaning. A precise definition of what natural and ecological composition is, was not given in the research. However his conclusions indicate that natural form is a principal driver of the perception and valuing of green infrastructures.

According to psychologists Stephen and Rachel Kaplan (1989) the perception of nature is so important because it provides ‘restorative experiences’ to recover from the fatigue created by mental effort, coping with hassles, and the everyday demands of living in the modern world. They identified four factors as being particularly important to the achievement of a restorative experience: the feeling of being away, fascination (effortless attention), extent (having both enough scope and enough coherence) and compatibility (in the sense of the environment being compatible with one’s abilities and desires); factors which all play a role in wilderness experiences. However they discovered that these factors can be found equally in nearby and ‘ordinary’ natural environments such as parks and gardens, suggesting them to be equally valuable as places where concepts of nature are represented and can be experienced. Consequently, representations and elaborations of nature in contemporary urban parks and gardens can be used to inform green infrastructure planning and design. These spaces are an important indicator of the way in which nature is interpreted, represented and articulated for urban populations and can provide insights and tools for the development of the representation and experience of nature in green infrastructures.

This form of investigation also has an historical rationale: the first green infrastructures – greenways – developed out of the nineteenth century municipal park tradition. Conceptions of nature were central to this tradition. Moreover, as constructed landscapes, parks and gardens offer important clues as to how urban societies conceive nature and express it through form. Green infrastructures are more than just preserved natural areas within developing regions, they are also invariably built, and cultivated. With a few exceptions, green infrastructures are thus not necessarily or exclusively natural areas but rather an interrelationship between ‘nature’ and ‘culture’. This interrelationship resides principally in design and management regimes, and

thereby embodies and expresses concepts of nature and landscape held by communities and society. The focus on technical or planning aspects in green infrastructures overlooks design and thus the importance of this cultural component. Ignoring this component may lead to a process that urban parks experienced in the course of the twentieth century. The rise of standardisation and normative thinking made its way into the design process and led to the standardisation of design solutions. The urban park was reduced to either a technocratic element for mass recreation, or a 'bio-cratic' element where nature was left to its own devices and human intervention was taboo (Kegel et al., 1983). As a result the attractiveness of the park declined; the appeal of a ubiquitous 'green' alone proved not enough to sustain its popularity.

The focus for this research is thus on evidencing contemporary conceptions of nature in designed parks and gardens. The projects examined in this paper include four Parisian parks and gardens: Parc de la Villette, Parc André Citroën, Jardin de la Bibliothèque nationale de France and Square des Bouleaux. We will look at how different images of 'nature' can be understood from the perspective of historical and contemporary perceptions and expressions of nature, as a framework for the understanding of the elaboration of nature in the designs themselves. Additionally we will consider the positioning of these new public open spaces within a network concept, with this paper concluding with a brief look at the network of green spaces in Paris in relation to the traditional green infrastructure model.

2. CONTEMPORARY INTERPRETATIONS OF GREEN INFRASTRUCTURES

Recent developments in research on green infrastructure have led to a breadth of interpretations of the concept. Early lenses and applications, which grew out of the historical greenways movement and held sway in the 1980s and early 1990s, saw green infrastructure as greenways: corridors of various widths, linked together in a network (Fábos, 1995). Subsequent attempts were made to develop categories of greenways, such as urban-riparian corridors, recreational greenways, ecological corridors, scenic and historic routes and comprehensive networks (Little, 1990). Later interpretations broadened the notion to include not just linear corridors but all manner of physically interconnected 'green' space ranging from nature reserves and urban woodlands to designated cycle routes, channelled rivers and parklands. Despite this broadening of interpretations, there is a common ground between the various understandings of green infrastructure, which can be summarised as a set of sustainability principles. These principles reflect the foci of the range of academic fields involved in green infrastructure. In the field of conservation and ecology, the emphasis is on safeguarding or developing

ecological networks and biodiversity (Benedict & McMahon, 2006). From the perspective of planning and urban development, green infrastructure is seen as a network for the provision and management of water resources, storm water and flood prevention, or as a means to locate alternative infrastructures for commuting. In recreation planning, green infrastructure is envisaged as a spine or framework of recreational facilities with a focus on their accessibility and connectivity for urban populations. Synthesised together, green infrastructure can be described as *“the connective features (physical and metaphorical) linking different environmental elements across the rural and urban landscape, thus providing multi-functional (ecological, economic and social) benefits for diverse populations”* (Mell, 2010).

This multi-functional approach is exemplified by the North Brabant ‘Streekplan’ (1992), which addresses the landscape and environmental problems created from the conflict between intensive agriculture, nature protection and encroaching urbanisation. The plan segregates developments and nature protection by proposing an ecological network in which nature may exist in a permanent and connected system. In principle it links larger habitat patches with others via a network of corridors, using a target species based approach, and supported by island biogeography and metapopulation theories. At the same time it attempts to integrate water management, cycling and walkways, and recreational facilities within its framework (figure 1).

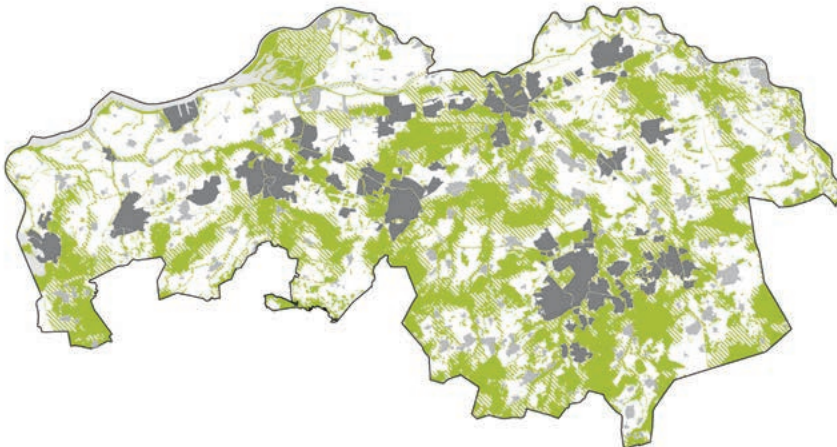


Figure 1 Functional and ecological approach of green infrastructure: North Brabant Streekplan (source: Structuurvisie Ruimtelijke Ordening, courtesy Provincie Noord-Brabant)

In terms of social benefit to urban communities, research and praxis has focussed on functional aspects such as sport and recreational amenity, and routing for connectivity, accessibility and health. The degree to which green infrastructures offer urban communities spaces that generate and reflect personal and collective notions of nature, has to date received little attention. Central to these goals is the perception of landscape and green spaces by individuals and groups, but despite the extent of research into environmental perception, little work has been done on the perception of green infrastructures.

3. THREE NATURES

How might the representation and elaboration of nature in constructed landscapes such as parks and gardens be approached? The classical analysis of ‘first, second and third nature’ (Hunt, 2000) provides a lens for exploring the conceptions of nature in parks and gardens. This reading of nature stems from the Renaissance, when a conceptual framework for the art of gardens was created for the first time. Yet this thinking is based on a much older text, *De natura deorum*, written in 45 BC, which circulated in many renaissance manuscripts. In this text the Roman writer Cicero distinguished different ‘natures.’ He described *first nature* – wilderness – as the realm of the gods, untouched by human hands, but also as the raw material for *second nature*: the agrarian landscape, encompassing meadows and ploughed fields, orchards, terraces and rural settlements. This arose out of a process of cultivation enacted on the natural landscape. Cicero wrote “*We sow corn, we plant trees, we fertilise the soil by irrigation, we dam the rivers and direct them where we want. In short, by means of our hands we try to create as it were a second nature within the natural world*” (Cicero, cited in Hunt 2000, p. 33). *Third nature* is the man-made nature of the garden, in which, however conscious or explicit, aspects of both the natural and the cultural landscape are also expressed. This is aptly represented in the diagrammatic drawing used as the frontispiece to the Abbé Pierre le Lorrain de Vallemont’s *Curiositez de la Nature et de l’Art (Curiosities of Art and Nature in Husbandry and Gardening)*, a popular book published in Paris in 1705 (figure 2). Here the garden is succeeded by agricultural fields, and the view is terminated with a lumpish hillside from the bottom of which gushes a natural spring. In the other direction – back towards the viewer – the sequence is similar: first the ordered garden, then a grove of regularly planted trees, then the wasteland.

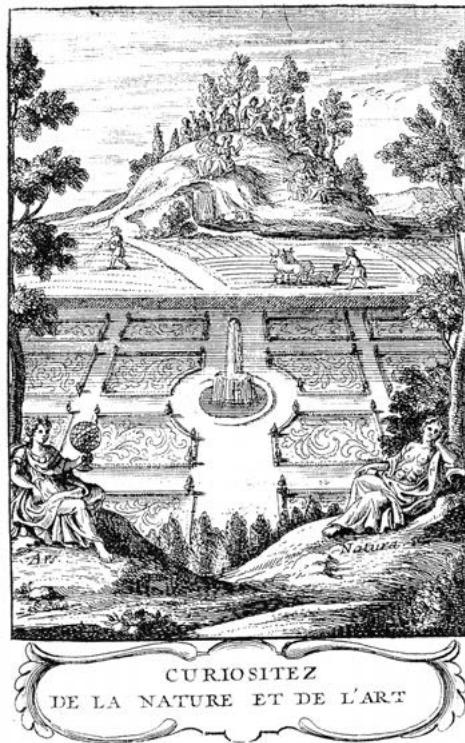


Figure 2 The three natures of wilderness, agrarian landscape and garden (Frontispiece Abbé de Vallemont, *Curiositez de la Nature et de l'Art*, 1705, courtesy SUB Göttingen)

The relation between urban parks and gardens and the *three natures* concept becomes explicit in the nineteenth century picturesque park, modelled on the English landscape garden. The presence of – and relationship between – the three natures was claimed as an important characteristic of these gardens. William Gilpin (1724–1804) and William Chambers (1723–1796) indicated three successive types of nature entitled ‘pleasing, enchanted and sublime’ and used the word ‘zoning’ to describe their configuration in gardens (Hunt, 2000).

In the transformation of the English landscape garden to the nineteenth-century urban park, these three natures were radically reconfigured within new composition schemes. Steenbergen and Reh unravel this transformation at Birkenhead Park in Liverpool (figure 3).

“The common zoning of the landscape garden, comprised of the ‘garden’, the ‘meadow’ and the ‘wilderness’, was essentially turned inside out. With their gardens and parterres, the area in front of the crescents and terraces, on the outside of the Park road, was now the ‘garden’. The pleasure grounds were comparable to the ‘meadow’ of the landscape garden, suitable for cricket and archery, then popular

sports for the more affluent. The planting along the inside of Park drive screened the open, slightly concave, sun-lit ‘meadow’ from the denser edge zone. The ponds, with their inaccessible, wild and thickly planted islands, in the centre of the park formed an inwardly focused transformation of the wild nature, the ‘wilderness’, which had lain on the periphery of the landscape garden.” (Steenbergen & Reh, 2011)

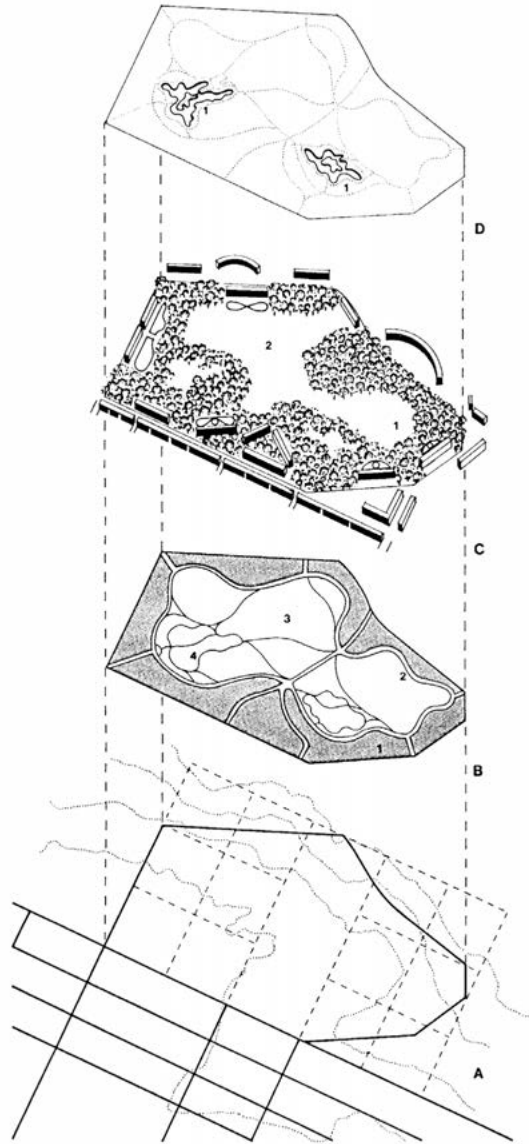


Figure 3 Three natures in Birkenhead Park (source: Steenbergen & Reh, 2011)

This three natures concept however, is not a consistent theme in park and garden design. Steenbergen and Reh chronicle the dissolution of the *three natures* schema in the functionalist parks of the twentieth century. They argue that the three natures of the nineteenth-century park scheme became isolated into separate elements of the functionalist city. “*The ‘wilderness’ was moved to the botanical garden, the ‘meadow’ became a rectangular, multifunctional playing field, and the ‘garden’ took on the guise of a recreational facility*” (Steenbergen & Reh, 2011). These developments can be said to adequately reflect developing conceptions of nature in urban societies in this period. Towards the end of the twentieth century however, a new generation of urban parks and gardens emerged in which the elaboration of nature returned as a guiding theme. This paper asks: how has the three natures theory fared in these projects?

4. REPRESENTATION AND ELABORATION OF NATURE IN CONTEMPORARY URBAN PARKS AND GARDENS

It is possible to examine the developments in Paris in the period from 1980 to 2000 as a case study as this period witnessed the designation and construction of an extensive series of new public open spaces in and around the inner city. These developments, together with parallel events in Barcelona and the Netherlands, are considered the beginning of a new period of landscape design innovation embodying emerging societal visions of nature and landscape (De Zeeuw, 1991). The dissolution and separation of the three natures in the functionalist period was contributory to the condition urban parks had reached in the lead-up to the period of construction in Paris between 1980 and 2000. The brief for Parc de la Villette for instance, went to lengths to lament this condition. “[...] *it can be argued that the ‘green’ of the city has been transformed into a mere accompaniment to the buildings: a planted décor, often without any imaginative power, which evokes not the slightest emotion nor stimulates any activities, in short, provides not the slightest pleasure*” (Etablissement Public du Parc de la Villette, 1982). The briefing documents thus actively promoted a return to the imaginative conceptions of nature embodied in historical examples. The reversal of this pattern in Parisian parks indicates an important shift in the envisioning of nature by contemporary designers, reflecting in turn shifts in conceptions of nature held by urban communities.

The establishment of the Atelier Parisien d’urbanisme (APUR) in 1974, was central to developments in Paris in this period, replacing modernist planning dogmas with a new urban architecture paradigm and the return of centralist thinking (Uyttenhove, 1991). Parks and gardens featured prominently in the APUR’s vision, describing, among other things, their importance as creative gestures to reconnect contemporary urban societies to their public open spaces. A review of public open spaces of the city of Paris drawn up by the APUR in 1981 criticised the technocratic nature of green space and

naturalness, echoing the formal French classical gardens in which nature was dissected into formal categories such as the *parterre*, *tapis vert* and woodlands (Steenbergen & Reh, 2003) (figure 5).

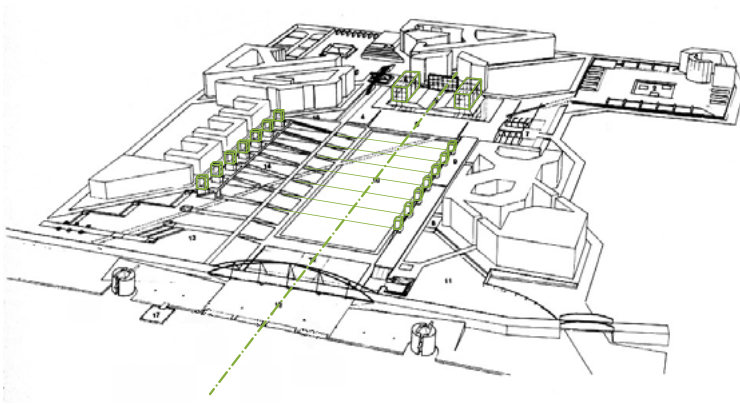


Figure 5 Formal representation of nature in Parc André Citroën.

At Parc de la Villette, the nodal geometry of the *folie* grid can be seen as a similar interpretation of nature from the classical garden tradition, in this case an abstraction of nature via numbers, dimensions and ordering developed in renaissance thought and artistry (figure 6).²

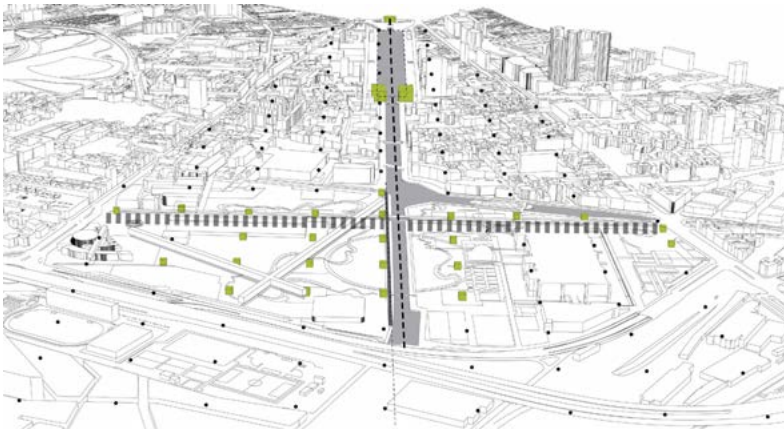


Figure 6 Rational representation of nature in Parc de la Villette (numbers, dimensions and ordering)
(illustration: René van der Velde)

This conception of nature is also evident in the figures of the Prairie du Circle and the Prairie du Triangle, two fields of similar size, forming together with the rectangular footprint of the Cité des Sciences an enormous diagram of elementary geometric forms.

Distinctive for Parc de la Villette is its additional incorporation of an Arcadian conception of nature in the composition. The curvilinear figure of a garden walk distinctly references the lines of nineteenth-century strolling parks such as Parc des Buttes-Chaumont nearby; a fact various commentators have independently (and wryly) commented on (Baljon, 1992; Meyer, 1991). The sweeping curves and parabolas are no spontaneously evolved hill-side pathway, but rather a wilful design act resembling the lines of a picturesque park (figure 7).

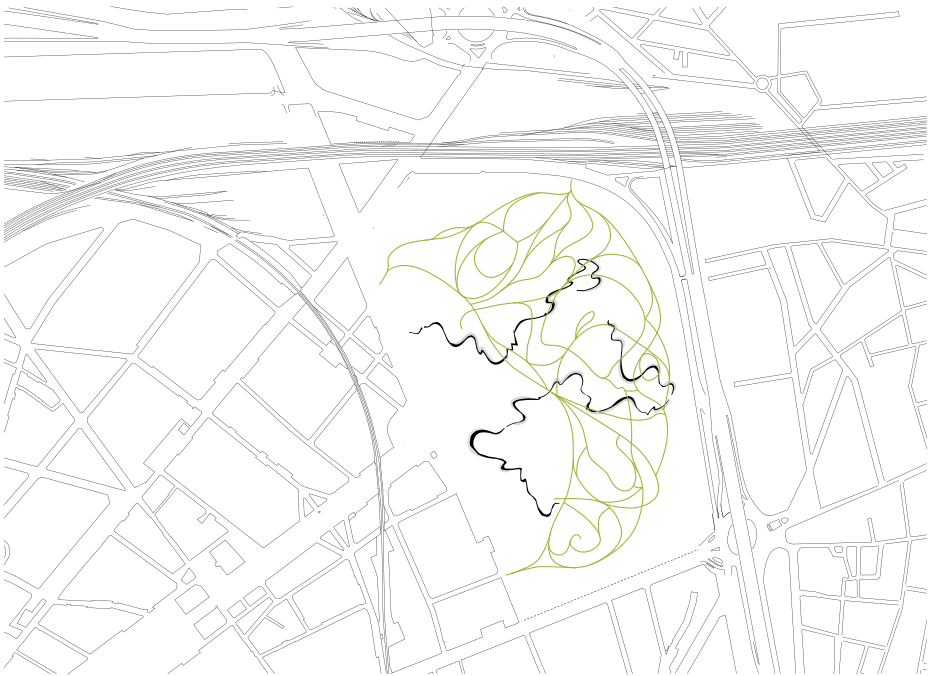


Figure 7 Picturesque representation of nature in Parc de la Villette. Overlay of the figure ground Parc des Buttes-Chaumont over Parc de la Villette (illustration: René van der Velde)

4.2 Emblems of nature

Metaphor and symbol used in the classical garden tradition also figure prominently in the representation of nature in these parks. The gardens in the Parc de la Villette evoke images of exotic or native landscapes, as for example the *bosco* of bamboo in the Jardin des bamboos evoking a primeval forest, or

the vines and climbing plants in the Jardin de la treille, referencing orchards or allotment gardens. Similarly, the gardens at Parc André Citroën symbolise the rich tradition of horticulture in France through elaborate planting designs and symbolic references.

This use of metaphor and symbols depicting nature had not been seen in urban parks for much of the twentieth century. In contrast to their use in nineteenth-century parks, twentieth-century parks were characterised by an increasing absence of expressive form. Planting design in parks for instance, changed dramatically. Whereas in the nineteenth-century park, planting had an independent role in the design, arising out of horticultural traditions and embodying pantheistic ideals about nature, it became progressively marginalised in park design, serving only to demarcate and organise park functions, or sometimes to simulate botanic communities for ecological purposes (De Jong & Dominicus-Van Soest, 1999).

4.3 The sensorial

Conceptions of nature in these parks however, go further than can be clarified through the lens of abstractions of nature from the classical design tradition. While the emphasis used to be on visual experience, in contemporary parks and especially gardens, multi-sensory perception dominates. In 1929 Johannes Granö defined two realms of perception, the *Fernsicht* and the *Nahsicht*. According to Granö, *Nahsicht* is the environment we can experience with all our senses; *Fernsicht* is the part of our environment we mainly experience by vision: the landscape, determined by the horizon (Granö, 1929). The relationship between distance and sensory information is relative to the reach of each different element of sensory information. In open space, sounds do not carry as far as light, and smell has an even narrower scope. Taste and touch can only be experienced upon direct bodily contact. Because weight, pressure, and resistance are part of our habitual body experience, we unconsciously identify with these characteristics in the forms we see. Proximity makes one attentive to the material reality of earth, plants and water, such as mass, grain, fragility, suppleness or fragility.

In Parc André Citroën, a large part of the park is taken up by a series of thematic gardens based on the sensorial aspects of nature. The edge of the park is divided into small, enclosed gardens, where colour, scent, sound and haptic stimuli are amply used, generating intense sensorial experiences. The individual relationship of the visitor with the gardens alters with each garden, one being viewed from a balcony, another from a path, and a third from a self-contained space seen from the inside. Different slopes and material underfoot address the sense of body balance, and plants have various textures and scents (figure 8).



Figure 8 Sensorial aspects of nature: tactile sensation
in the Orange Garden, Parc André Citroën

Similarly in Parc de la Villette the gardens lining the garden walk represent the introduction of nature in the park via sensory qualities of nature. The mysterious grove of spruce and birch in the Jardin des frayeurs enfantines (Childhood fears garden) is accompanied by sinister music. And as its name implies, the Jardin des ombres (Shadow garden) plays a skilful game with light and shadow, while the ninety fountains in the Jardin de la treille (Trellised garden) are a visual and audible sensation of water (figure 9).



Figure 9 Sensorial aspects of nature: visual and audible sensation
of water in the Jardin de la treille, Parc de la Villette

The most elaborate expression of a sensory garden in the Parc de la Villette, however, is the Jardin des bambous. Its designer Alexander Chemetoff lowered the garden into the ground to literally escape Tschumi's sequential imagery concept devised for the gardens (Aben & De Wit, 1999). More importantly, lowering the garden into the ground not only allows it to escape from the fleeting experience of sequential (visual) images above, but also creates an enclosure in which sensorial perception can be developed. When descending, the sound of cascades that accompany the monumental staircase gradually drowns out that of the outside world. The stairs lead to a circular room with high stucco walls, a break in between the active world of the park and the relaxation of the garden, with artificial frog sounds aurally enlarging the distance between the urban sounds of the park and the natural sounds of the garden. A narrow path on a steel grid under which one can hear (but not see) the water flowing, leads the visitor through the dense bamboo foliage while ducking under the sewer pipes running through the garden. It is warmer and more humid than above ground and the sound of flowing and rippling water is everywhere. There is so much bamboo that one cannot see the boundaries of the garden, an exotic wood that seems to go on forever. The Jardin des bambous presents itself as one of the visual images in the park: an abundance of bamboo, while the details remain hidden. Within the garden, however, there is no overview, and auditory and haptic stimuli complement the visual, with emphasis on the earthly aspects (figure 10). So it is within the scope of this garden that multisensory integration of nature is brought into play.



Figure 10 Jardin des Bambous (Parc de la Villette) exemplifies the multisensory experience, evoked by proximity in an enclosed space (illustration: Saskia de Wit)

4.4 The material presence of nature: abundance

The physical presence of nature was further elaborated in other projects of this period in Paris with the construction of the Jardin de la Bibliothèque nationale de France (National Library garden), designed by Dominique Perreault and completed in 1989. The library buildings were assembled around a large central garden, located in a sequence of large urban voids along the river Seine including Place de la Concorde, Champs de Mars, Invalides, and Parc de Bercy. In the garden everything is subordinate to the dominating image of a primordial forest. 250 mature Scots pines, birches, and oaks are planted in a carpet of heather and ferns. This image is achieved by transplanting a complete fragment of the Fôret de Bord in Normandy. The garden is sunk into a raised podium, from where escalators descend halfway into the garden. Here a platform, like a balcony overlooking the garden, allows for access to the library. From the lower level inside the building, the trees obscure the view to the facades, making the garden appear as part of an unbounded landscape space. The visitor, however, remains outside the garden, separated by a glass facade. The inaccessibility of the garden proper enhances the effect of wilderness, nature untouched by man (figure 11).



Figure 11 Abundance of nature in the Jardin de la Bibliothèque nationale de France

A similar iteration of nature can be found in the Square des Bouleaux, the central garden for a housing complex in the city centre designed by Michel Desvigne, constructed between 1989 and 1992. In the isolated space, a ‘living’ environment is introduced – rich, coherent and spectacular. The form

is entirely blurred for the benefit of the richness of its materials and texture. The birch forest represents an intensified version of nature, suggesting a primordial nature that has always existed on this location. It is a potent image: nature transposed to the urbanised context, with natural nature replaced by artificial nature, mimicking the natural processes. Nature is represented as a creative force for the city. It is the continuous change of natural growth that determines the design, not the design as a final product, as a *fait accompli* (figure 12).



Figure 12 Abundance of nature in the Square des Bouleaux

4.5 Nature as process

The elaboration of nature as process evident at the Square de Bouleaux can also be seen in specific parts of Parc André Citroën. Gilles Clément, one of the designers of the park, envisaged the park design chiefly as the “*dynamic management of spontaneous vegetation rather than a static visual order*” (Garcias, 1993). This radical vision was somewhat compromised in the realised park. Alain Provost, another designer involved in the design, stated that the scheme was intended to create a maximum number of natural elements and to merit its title of ‘park’ by being “*strong, wise, generous and poetic...based on the strong and indispensable presence of water, the controlled dynamism of the earth and the rhythm of vegetation*” (Provost, 1991). The realisation of Clément’s vision for the dynamism of nature was brought back to his design for the Jardin en Mouvement, a constantly changing landscape responding to abiotic, biotic and environmental processes, with a minimum of intervention or regulation

(figure 13). This garden lies at the edge of the park, next to the river, following the principle of a progression from natural (the river) to artificial (the city). In the garden the paths shift each year, adapting to a spontaneous spread of seeds, causing a continuous modification of circulation and vegetation.



Figure 13 Experiencing the natural processes in the Jardin en Mouvement, Parc André Citroën

5. DISCUSSION: THREE NATURES IN CONTEMPORARY PARISIAN PARKS AND GARDENS

We opened the paper with an introduction to conceptions of nature in urban parks and gardens through the classical analysis of ‘first, second and third nature’. How then does this view relate to our findings in the Parisian parks and gardens?

5.1 First nature

From the research, we can conclude that at Parc de la Villette, *first nature* is not intentionally articulated, while at Parc André Citroën a wilderness of sorts can be seen in the Jardin en Mouvement (Garden in Movement). This garden is conceived as a dynamic system of planting subject to the whims of nature and only occasionally interfered with by gardeners (Clément, 1995). The representation of first nature (wilderness) as a sacred, undisturbed entity is also embodied in the Jardin de la Bibliothèque nationale de France.

These last two examples reflect an emerging pattern of envisioning of nature with natural processes, and the representation of a nature in which humans are (literally) excluded. The conception of nature as wilderness via notions of process and ‘abundance’ developed rapidly in park design discourse subsequent to these projects. Understanding and articulating natural processes now forms the dominant theme of many contemporary park projects (Berrizbeitia, 2007; Pollak, 2007).

5.2 Second nature

The articulation of *second nature* of the agrarian landscape can be evidenced in the multifunctional lawns of the Prairies du Triangle and du Circle at Parc de la Villette and in the more architectonically articulated grassy planes of Parc André Citroën. The question remains as to whether these elements can be motivated as a representation of *second nature* or whether they are merely a continuation of the functionalist dogma of the *Volkspark* based on sociological principles. If however, as argued by Hunt, the historical extrapolation of *second nature* revolved around nature as a useful, productive landscape, then the vision for the lawns in these parks as a tableau for a diversity of activities and uses may still be seen as correlating to *second nature*. Additionally, the thematic emerging at Parc André Citroën in which many agrarian plants and techniques from the French horticultural tradition are used clearly embodies the idea of *second nature*.

5.3 Third nature

The articulation of *third nature* – that of the garden – finds its expression in a range of features in the Parisian projects. By referencing the main composition element of the nineteenth-century strolling park, the garden walk at Parc de la Villette is a clear iteration of *third nature* sourced from historical examples. More unequivocally, *third nature* is exemplified by the series of gardens realised in both Parc de la Villette and Parc André Citroën. In contrast to *first nature* and *second nature*, the critical characteristic of *third nature*, is that nature is brought into the realm of human perception. In historical examples such as Parc de Buttes Chaumont and Birkenhead Park, this was translated in the composition through the emphasis on the routing as a sequence of visual and spatial experiences. However, in the gardens in Parc de la Villette and Parc André Citroën a new aspect of human perception comes to the fore: multi-sensory perception. Sensory conditions are emphasised as attributes of the design to structure, serve and enhance perceptual awareness of nature.

6. PARISIAN PARKS AND GARDENS AS COMPONENTS OF GREEN INFRASTRUCTURE

The positioning of many of these new public open spaces within a network structure is of relevance to this paper (see figure 4). Despite its dense urban fabric, the city of Paris boasts more than 400 parks and gardens, configured within a network of green space which has developed over many centuries. From the sixteenth century onwards, chateaus had been built along the river Seine. In the seventeenth century the chateaus were enlarged and reorganised, dominated by the creation of spatial axes, connecting the gardens into an all-embracing system. When incorporated in the urban fabric, these gardens were transformed into urban parks, organised around the river as a backbone, and connected by avenues. Thus the basis was laid for the landscape identity of Paris in the seventeenth century, formalised in the system of avenues, gardens and parks. In the nineteenth century a new network was superimposed on this system, made up of urban avenues, promenades and boulevards, linked to a system of parks, public gardens, and green squares, and incorporating former hunting forests. The Seine – extended with the canals St. Martin, Bassin de l’Arsenal and Bassin de la Villette – remained the backbone of the system but the axial system faded away, replaced by a network of overlaps and confrontations between the seventeenth-century formal network and the contemporary urban network. The parks and gardens realised between 1980 and 2000 form part of this growing network of interconnected public open spaces.

The origins of Parc de la Villette and Parc André Citroën, as brownfield parks projected onto derelict industrial sites, was also repeated on a larger scale. With the canals losing their industrial function in the twentieth century, they were transformed into the threads of this extended green infrastructure. These new facilities each express nature in different ways, which, when viewed as a collection, address the range of three natures. The value of this green network in the city of Paris is not so much their interconnectedness, but the multiplicity of conceptions of nature they offer (figure 14).



Figure 14 The formal network and urban green spaces of Paris (source: Steenbergen & Reh, 2011)

7. CONCLUSIONS

7.1 A catalogue of conceptions of nature

A first conclusion we can draw is that in these projects nature is represented and articulated using abstract conceptions of nature from the classical garden tradition, evidenced in historic parks and gardens such as Birkenhead. Also derived from the classical tradition is the use of metaphors of nature. At the same time we can conclude that the nature is also articulated using elements dissimilar to historical precedents, such as the sensorial, abundance and natural processes, which can give an insight into conceptions of nature entertained by contemporary societies. In addition, we can draw from this brief overview that, unlike historical examples such as Birkenhead Park, *first, second* and *third nature* are not present in equal measure in the examples. In some, one of the three is lacking altogether; in others the emphasis is on

one, at the cost of the others. *Third nature*, when understood as the domain of nature relating to human perception, is the most prolific and articulated conception found in the examples, giving room for both classical and new conceptions of nature. This indicates a broader development of visions and articulations of nature in parks and gardens.

Contemporary conceptions of nature seen in these examples are diverse and rich. The application of these insights for the development of green infrastructures lies in their explication of conceptions of nature envisaged for urban communities. Although green infrastructure elements consist of more than parks and gardens, they are strongly related to them and as such can be expected to be subject to similar terms of reception and valuing.

A critical aspect of the research is the reception and valuing of these examples by urban communities. To what extent the presumed representation of conceptions of nature put forward by designers correlates to how people receive and value these spaces is an important question for further research. In addition, cultural differences obviously influence conceptions of nature and have had a clear effect on these projects. The articulation of the conceptions of nature in situations outside France deserves further attention.

7.2 The network of parks and gardens in Paris as a green infrastructure

The form of the network is also an important question, with the Paris network making an interesting case study. The network of parks and gardens in Paris represents a green infrastructural network made up of a layering of historical and contemporary elements connected in compound ways, but not necessarily always physically connected. This network deserves further study but does show that green systems are also valid even in high-density historic city cores such as Paris. The parks and gardens in Paris are an example of an architectural interpretation of a network that permeates the whole city. The different conceptions of nature from the classical design tradition not only determined the form of the parks, but also the way they were connected and interrelated within the urban system. The new parks and gardens of the late twentieth century each had a different focus, which, when viewed as a collection, address a range of conceptions of nature. The value of this green network in the city of Paris is an array of interpretations and representations of nature, all derived from human perception and use, and thus can be appreciated in different ways by urban communities. Where in the nineteenth-century parks the triangle of three natures determined the unity of the park, this does not need to be the case. From the Parisian case study we can see that the completeness of representations and elaborations of nature – gathered in the three natures – can be dissected and spread out over different constructed landscapes in the city, and it is the green infrastructure as a whole, which unites them.

ENDNOTES

- 1 For each of the three parks design competitions were drawn up by the APUR. Eventually Parc de La Villette was designed by Bernard Tschumi and built between 1984 and 1992. For the Parc André Citroën the two winning teams joined forces into a team consisting of the architects Patrick Berger, Jean Paul Viguier, Jean Francois Jodry, and landscape architects Gilles Clément and Alain Provost. The park was executed between 1986 and 1998. Parc de Bercy (which we will not elaborate on further in this paper) is made up of three gardens designed by architects Bernard Huet, Madeleine Ferrand, Jean-Pierre Feugas, Bernard Leroy, and by landscape architects Ian le Caisne and Philippe Raguin between 1993 and 1997.
- 2 Interpretations of nature through geometry first emerged in the Renaissance; whereas western medieval interpretations of nature viewed the terrestrial world as chaotic and exemplary of the fall of man, renaissance thinkers looked on the chaos of terrestrial nature as another form of divine order, albeit well concealed. In unravelling this divine order, they turned to classical thinking of Plato to understand and imitate nature via mathematics, expressed in the axiom 'Natura artis magistra est' and leading to the development of an ideal system of proportions, dimensions and ratios derived from nature. This system also had as its basis the human figure, which was perceived as the vessel of divine order in that it was created in 'the image of God'. In architecture, the proportions of the human body, articulated in Vitruvius's *De Architectura* (25-23 BC) were thus interpreted as diagrammatic of a cosmic nature, a metric diagram of the hidden order of nature.

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Infrastructure as landscape as architecture

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INFRASTRUCTURE AS LANDSCAPE AS ARCHITECTURE

Abstract

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FLOWSCAPES-DESIGNING INFRASTRUCTURE AS LANDSCAPE

In a critical review this chapter shows how the Yokohama Ferry Terminal by Foreign Office Architects crossed the three distinct realms of 'infrastructure', 'architecture' and 'landscape'. This key individual project dissolved disciplinary borders between the three disciplines and achieved new methodical grounds for design. It is a precedent in a general shift in the development of the design disciplines of the built environment. The single project shows how deep conceptual shifts affect the disciplinary assumptions that initially limited this task for architects—and how versatile the strategies of infrastructure and landscape are in architecture. While the Yokohama Ferry Terminal is at first sight simply a passenger terminal, it is also an infrastructural transport-related building, used most of the time as a garden-like public space. At first elaborating on definitions of the three terms 'infrastructure', 'landscape', and 'architecture', the article will question how plausible and useful these divisions between the categories are for designers, or if we should rather focus on the crossings of these divisions. A discipline that wants to be dynamic is to be explored at its edges as well as preserved in its core. Such crossings become especially relevant in ambitious projects. With this example at hand, this chapter explores the disciplinary framework and will touch upon design methodological definitions. The case study is valuable to show the full depth of field that architecture with landscape methods can have within contemporary architectural production and how landscape and infrastructure can merge in new kinds of public artifacts beyond object centered design. The themes that make the Yokohama Ferry Terminal's form or 'scape' can be summarised under the term 'flow'.

KEYWORDS

architecture as landscape; Yokohoma Ferry terminal; flowscape; infrascap

1. INTRODUCTION

The following paper is a critical review of a design project that crossed the three *a priori* distinct realms of infrastructure, architecture and landscape. In their Yokohama Ferry Terminal (constructed from 1995 to 2002) Foreign Office Architects integrated their task of designing a building as both infrastructural and landscape design, unravelling new methods for architecture.

Alongside highlighting some specific features from the three fields in infrastructure, landscape and architecture, this paper presents a single project that crossed disciplinary borders between infrastructure, landscape and architecture in a very distinctive manner. This key individual project dissolved disciplinary borders and achieved new methodical grounds for the architectural design of buildings, but also contains a disciplinary shift in the development of the built environment in general. The single project here is needed to show how deeply each of these conceptual shifts affects the disciplinary assumptions that initially limited the task at hand – and how versatile the strategies of landscape are in architecture.

The Yokohama Ferry Terminal ‘Osanbashi’ in Japan is a much-regarded work of architecture. Typologically it is simply a passenger terminal, an infrastructural transport-related building used most of the time as a garden-like public space. However, this project is remarkable in many respects – to begin, it has an astonishing structural design that integrates form, structure and space. And all the themes that make its form or ‘scape’ can be readily summarised under the term ‘flow’ (figure 1).



Figure 1 Yokohama Ferry Terminal (photographs by Daniel Jauslin)

The three terms ‘infrastructure’, ‘landscape’, and ‘architecture’ all seem to describe three clearly divided categories of objects and professional fields. ‘Infrastructure’ would be understood as public works designed by civil engineers, ‘architecture’ would be buildings designed by architects, and ‘landscape’ would be something a bit more difficult to define, but regarded more or less as settings for these others designed by ‘landscape architects’. In speaking generally about ‘landscapes’ we can say that there are roughly three kinds: the garden, the cultural landscape and the natural landscape. As extensively described by John Dixon Hunt (2000), each of these modes of ‘second nature’ represent nature in different ways or ‘stages of perfection’. In modern times gardens are designed by landscape architects, but their ambitions are now generally regional in scale. These designers do not want to be confused with gardeners anymore. Gardens, cultural and natural landscapes are creatively idealised by artists, poets and other more sensitive humans. In practice often this idealisation leads to overlapping between the three theoretical categories of landscape. For example, the urban community garden I am now designing in collaboration with my neighbourhood council is idealised by some of my neighbours to be a productive and beautiful garden, the site for group events in addition to a representative, functioning piece of nature in the city. Users and designers of projects alike are operating in between disciplines. Civil works, public buildings and designed landscapes are always attracting a great variety of interests. Infrastructures, architectures and landscapes literally become a projection of people’s own interests, narratives, long and short-term agendas, daydreams or life plans.

In modern and more economic terms – and in relation to urban settings – the practical uses or functions of built human environments are now often categorised according to the terms ‘infrastructure’, ‘landscape’ and ‘architecture’. Different economic concepts are contrived, creating value out of each. While utilitarian ‘infrastructure’ is valuable only within the network of connectivity, ‘architecture’ is often still valued as a precious object or real estate, and ‘landscape’ is an environmental setting, usually with less tangible value. Again ‘landscape’ is somehow more difficult to put into economic terms, unless explicitly in regards to real estate, resource extraction or food production. Leisure uses, for example, might conflict with landscape’s other functions for food production – and each of these will in some instances be in conflict with the need to maintain underlying ecological continuity. A good design will somehow allow for each of these in such a way as not to be exclusive of the others. Likewise, the activity of gardening often involves managing entropic processes of growth and decay in relation to seasonal oscillations; a natural landscape can become multifunctional, and the experience of it a product marketed as a brand for tourism. The Algarve, as one example, is the name of a landscape that has been declared a marketing brand: “*Visit the*

Algarve – Europe’s most famous secret” (Algarve, 2013). While it is a successful brand of major economic significance for Portugal, it also provides an example of how the priorities of the tourism industry can pose a high risk to natural landscapes (Nunes et al., 2009). With ten million visitors a year, successfully branded landscapes can become a threat to themselves.

However plausible the divisions between the categories ‘infrastructure’, ‘architecture’ and ‘landscape’ are, their usefulness for designers are questionable. For an innovative design agenda we would rather focus on the crossings between these divisions. A discipline that wants to be lively is to be explored at its edges as well as preserved at its core. It is a clear consequence of the life and dynamics of a professional and academic design discipline to work not only within decidedly common ground, but also to engage with the overlap of each discipline with other neighbouring disciplines. This becomes especially relevant in ambitious projects, sometimes referred to in martial terms as ‘avant-garde’, because the most ambitious designers fight on an imaginary frontline with an imaginary enemy.

If landscape architecture seems to have a more difficult, less defined place among the design disciplines, we might be better off starting with what it is not. Meto Vroom (1995) tried this when he said that landscape architecture is simply designed outdoor space. But his definition ‘ex negativo’ is at once hollow as a building block to theory and somehow sad as a perspective for practice. We could try to find a positive definition for each of the three categories. In all the three design disciplines we speak of a certain canon of types: typologies of structures, buildings and designed landscapes. Let’s briefly mention two for each.

- A pipeline or bridge would be a type of infrastructure.
- A temple or a theatre would be a type of architecture
- A garden or a park would be a type of designed landscape

So some good examples of the above six types could clearly each be assigned to a discipline at first sight. But if we look closely, many great works usually engage the boundaries. Finally, defining each discipline with excellent historic, canonical examples does not help in dividing into categories. But then, if we look at water supply infrastructure: for example, the Pont du Gard, the religious architecture at the Acropolis and the great gardens of Versailles, each of them a masterpiece and World Cultural Heritage (UNESCO, 2013), we must admit that each of these great works involves a transgression across the disciplines. Such masterpieces, even though of undoubted value, are not easily attributed to design disciplines. Still, let us try to explain the departure point of the three disciplines through these examples and their craftsmen: the ‘civil engineer’, the ‘architect’ and the ‘landscape architect’.

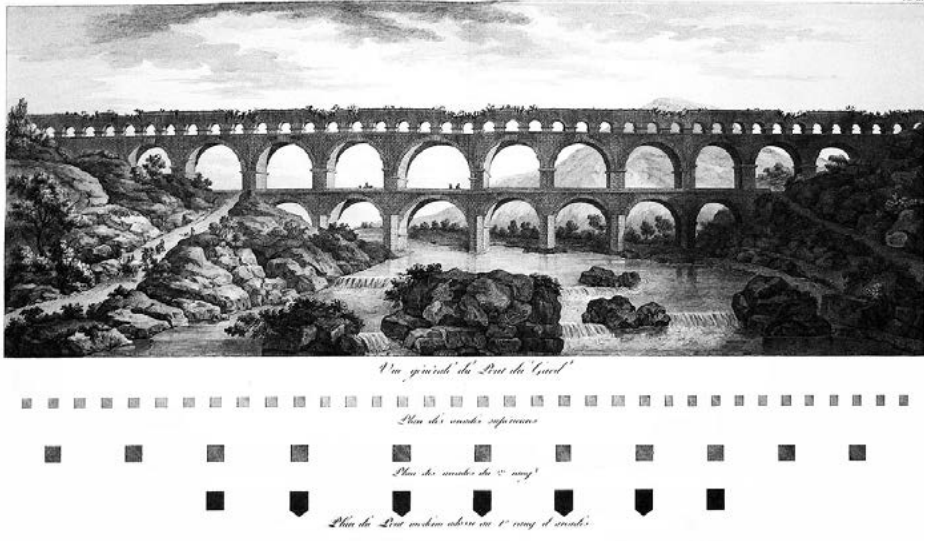


Figure 2 Pont du Gard, Gravure du Pont du Gard by C.-L. Clérissseau, 1804

Pont du Gard (figure 2) is related to water supply and thus infrastructure, notably a Latin word of Roman origin (in Latin *infra* means underneath, *structura* means fitting together). An infrastructure like this is the work of engineers (in Latin *ingenium* means talent) that uses scientific knowledge for building structures, engines and appliances. Both infrastructure and engineering come from military use, consequently ‘civil engineering’, the term still used today, was established as a discipline to distinguish the applications of engineering for civilian society from those intended for military use. The construction of Pont du Gard was also part of a military operation. It was probably initiated around 20 B.C. by Agrippa (64–12 B.C.) who had served as a general under Emperor Augustus at Actium. While Agrippa was situated in Gaul, he established taxation, road and water systems there. Agrippa was the founder and probably even designer of the first Roman Pantheon. The Roman Empire was then a military state at its highest power. Seldom is a brilliant man reduced to only one specialty: Agrippa was also a geographer and author of the famously lost *Orbis Terrarum*, a world map that represented the Roman Empire in the centre of a globe seen from below. It is not clear to us if Agrippa can really be called a designer, but at least he had a wide influence and versatile interest in scientific approach to measures and constructions of various kinds. All intelligence of the *Pax Romana* was used for control, and clearly infrastructure, like representation in buildings and maps, was vital to control of the empire. In French both terms are still used for the infrastruc-

ture of warfare (*génie militaire*) and of pacified societies (*génie civil*). The real power of the Pont du Gard however is not military or political but artistic. The real poetry develops in the interplay of the rhythmical arches of Pont du Gard, drawing a strong horizontal line onto the topography the wild fluvial landscape of the Gardon Valley.

The Acropolis of Athens is not simply architecture, but because of its many references from theorists and practitioners throughout architectural history, it is perhaps by now the most canonical of all building sites (figure 3).



Figure 3 Acropolis of Athens (photograph by A. Savin)

One of its most praised buildings, the Parthenon Temple devoted to Athena, was designed by Ictinus, an architect, around 450 B.C. Notably his profession is identified as the Greek word – *arkhitekton* (from – ‘chief’ and ‘carpenter’) still used today. The Doric style of the Parthenon and its architecture, the well-balanced tectonic composition of its facade, and the precise proportional measurements of its columns have been used by generations of authors and practitioners of architecture at such different times as those of Vitruvius (85–20 B.C.), Julien-David Leroy (1724–1803) or Le Corbusier (1887–1965); not to mention innumerable copies in classicist, colonial and postmodern architecture. It is not an exaggeration to call the study and representation of this single building one of the key representatives of the tradition and colonisation of western architecture as an academic discipline. But the many etches and prints and the replica of the Parthenon in Nashville, Tennessee, are all not nearly as powerful as the original, sited on top of four limestone

rocks of the Cretaceous ridge that have been joined in a landfill. Still today, ascending the Acropolis is the essential part of the artistic experience. And yet it is pointless to simply reproduce that one building. Its great power is deeply contextual: it is achieved by its unique position at the crown of the city of Athens, at the core of the powerful city-state.

The Versailles Gardens (among many others in and around Paris) were designed by André Le Nôtre (1613–1700), who carried the title of ‘Jardinier du Roi’ for King Louis XIV. Le Nôtre is undoubtedly a historical predecessor of modern professional landscape architects. The latter English term was propagated by Frederic Law Olmsted (1822–1903), who modernised the discipline in the United States alongside several of his contemporaries. The title of ‘architect’ should express a certain qualification, while the French modern word *paysagiste* does not need this ‘awkward’ expression (Hunt, 2000). The title ‘Jardinier du Roi’, was not only an appraisal but also an obligation. While Le Nôtre had worked for the Bourbon Kings since Louis XIII, he also served others, namely Nicholas Fouquet, a minister of finance to Louis XIV. Fouquet commissioned the building of his castle Vaux-le-Vicomte from the architect Le Veau, sculptor le Brun and gardener Le Nôtre (figure 4).



Figure 4 Castle and Garden of Vaux-le-Vicomte (photograph by Peter Bolhuis)

All together, the fireworks, dinner, water games, and a Moliere play evidently overstressed the king’s patience – in addition to the intrigues of his adversaries. The Affaire de Vaux – when Louis XIV ordered the incarceration of Fouquet and commandeered all the artists for his own court – established

the ‘monopoly of splendour’. Vaux is said to be the origin of Louis XIV famous saying “*le roi c’est moi*”, for the French even more important in political history than in art history. In reaction to Fouquet’s display of ambition, the king literally re-established his rule of power with the building and grounds of Versailles. Before the site of Versailles had merely been a hunting ground that the Bourbon Kings received from their Florentine friends, the Gondi. The mathematical and compositional mastering of nature of the vast lands behind the absolutist king Louis XIV’s giant new court, is of architectural order (Steenbergen & Reh, 2003). It is a manifestation of power in an artistic sense, overruling Fouquet’s Vaux with a giant mark of power and control in the landscape. Further, controlling all of the arts at one absolutist court was the ultimate sign of godlike power.

With these few examples we could possibly argue that the deliberate crossing of a discipline’s border is not limiting, but rather expanding the quality of a work. However, this might be an overly optimistic view; or the projects cited might just be some rare cases of outstanding artistic performance. The crossing of disciplinary boundaries can also possibly be interpreted as risking the loss of quality, or at least leading to some confusion about the potentials and influences of design practice on our environment. Let us discuss this blurring in the next section.

2. WHATEVER HAPPENED TO INFRASTRUCTURE, ARCHITECTURE AND LANDSCAPE?

Now, whatever happened to the division of the built environment into these three disciplines? As Marc Angélil and Anna Klingmann (1999) pointed out in an essay analysing the situation, the dissolving of boundaries between traditionally separated disciplines is the core element of Rem Koolhaas’ crucial essays ‘Whatever happened to Urbanism’ and ‘Generic City’ (1995); both of which are roundly critical of the production of urban space at the end of the twentieth century.

“If architecture is declared landscape, infrastructure is declared architecture, and landscape is declared infrastructure, the precondition is created to understand the phenomenon of the city otherwise” (Angélil & Klingmann, 1999: 20). The term Koolhaas uses for this new urban mass is ‘SCAPE©’, without a land-scape or town-scape prefix. In the late 1990s architects like Rem Koolhaas and Peter Eisenman connected the creation of space to the idea of the smooth space of Felix Guattari’s and Gilles Deleuze’s *Mille Plateaux* (1980, English translation: *A Thousand Plateaus*, 1993). In their critique of the Cartesian deterministic model, these post-structuralist philosophers used spatial metaphors of the ‘smooth’ and the ‘carved’ landscape as alternative thought models, as the nomadic is introduced in opposition to the settled or resident inhabitant of

the world. These thoughts, often in literal translation, have strongly influenced architectural discussion.

As Angéilil and Klingmann (1999) rightly observe, the form of the city is at stake here. The ‘SMOOTH©’ space, the ‘MORPH©-ing’ of disciplines is, in reality, a fluid continuum of interweaving systems. This is not always positive: while infrastructure is facilitating space and architecture is occupying space, landscape is suffering from loss of space. Of course there is also a positive side, and the relative forces of the three disciplines taken together can be seen as constructive for an urban structure. Such an argument can be regarded as a generally accepted aspect of current, although maybe less heated, disciplinary dialogues.

In the mid-1990s, however, architects – maybe in a ‘fin de siècle’ delirium – could not escape the idea that ‘what ever happened to urbanism’ is the loss of something. Something is broken. ‘The City as Scrambled Egg’ is another image, introduced by Reyner Banham (1959) as a counter concept to Le Corbusier’s image of the medieval city as an egg. It is illustrated by Cedric Price’s sketch (2003), often understood as a cynical or joking remark (figure 5).

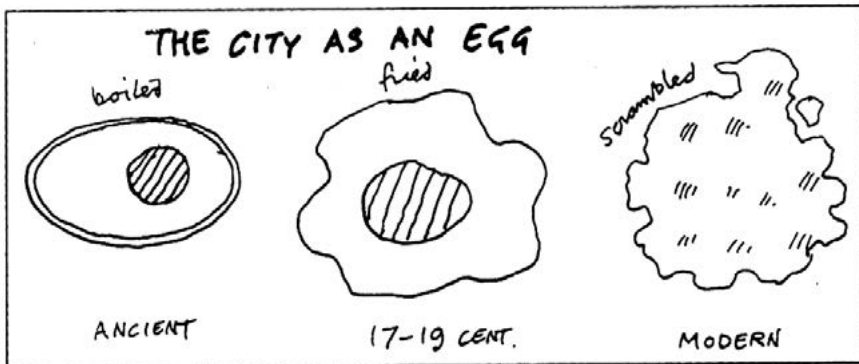


Figure 5 The city as an egg by Cedric Price, ca. 2001
(courtesy Cedric Price Fonds, Canadian Centre for Architecture, Montréal)

In his essay Banham may really have seen the scrambled egg as an image of loss. He quotes science fiction writer Isaac Asimov with “a highly mechanised garden city spread evenly over a whole planet, its well-bred citizens communicating with one another electronically, not person to person” (Asimov, *The Naked Sun*, 1957). Does this not evoke our current life in social media networks in the twenty-first century, more than 50 years after it was science fiction?

Architects and urbanists do seem too often deplore current urban situations, using negative images and dystopian imagery. Current economics can lead us all to be pessimistic about the role of architects; Rem Koolhaas is also arguing that the understanding of architects (in their profession) has not developed since medieval times, stating: “[e]very profession has been inspired by the market economy but we are still stuck in some kind of esoteric guild” (Koolhaas in Lee & Baumeister, 2007: 348).

We could summarise the current situation of urban theory and practice with the aforementioned triangle of words. Reflecting on Rosalind Krauss’ essay ‘Sculpture in the expanded Field’ (1979), Angelil and Klingman illustrated this with the following diagram (figure 6).

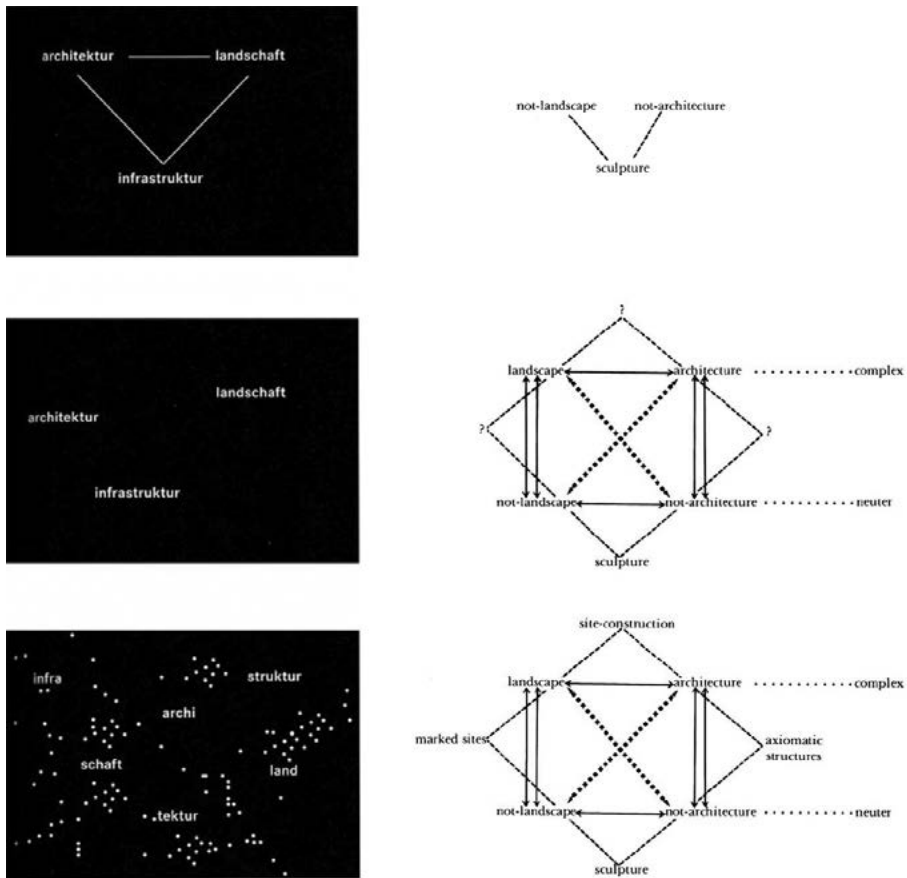


Figure 6 Left: Diagram on the relation of Infrastructure, Architecture and Landscape (Angélil & Klingmann, 1999) Right: Diagram from ‘Sculpture in the Expanded Field’ (Krauss, 1979)

But nothing bright and clear emerges out of that operation: from a clear set of distinct bodies of knowledge we are left to foray into a field of half terms, not excepting the author of this paper.

But can we live like that as designers? Can we just throw out word fragments, like tweets @Archi on the #scape of #land of the #tecture? In practice we see a new disciplinary model. I think rather than completely dissolving disciplinary boundaries, I would like to maintain the disciplinary triangle: infrastructure, landscape and architecture. But after introducing the subject with references like those above, I will use one single case for the rest of this paper.

As a practicing designer and design educator, however doubtful of pre-conceived notions and humble towards the natural environment, I am among those who should answer questions regarding the built environment of our time – be it that of urbanity or that of shrinking regions – with a creation. When I encounter a theory I often ask myself: “*can I make a drawing of it?*” If I find that I cannot, I find little value in the idea as an architect. One thing I have realised in my first years of practice (starting in 1997) is that what we propose as designers, rarely, if ever, gets any better in realisation than the actual drawings we made. Now, in order to draw clearly we must think clearly. How can we tackle such vast fields, these quickly developing forces that shape the contemporary living environment?

I rediscovered an earlier project of OMA with the influence (and collaboration) of landscape architect Yves Brunier when it was recently exhibited in Frankfurt (Elser, 2012): a masterplan for Melun Senart (1987). This project is represented by an astonishingly beautiful architectural model, depicting not the space to be built, which was designed seemingly randomly, an architecture left to uncontrollable forces of markets and the interpretation of builders, but designing the void that should not be built. The architects of OMA write:

“The built is now fundamentally suspect. The unbuilt is green, ecological, popular. If the built – le plein – is now out of control – subject to permanent political, financial turmoil – the same is not yet true of the unbuilt; nothingness may be the last subject of plausible certainties. [...] At a moment when the complexity of each three-dimensional undertaking is infernal, the preservation of the void is comparatively easy. In a deliberate surrender – tactical manoeuvre to reverse a defensive position – our project proposes to extend this political shift to the domain of urbanism: to take urbanism’s position of weakness as its premise.” (OMA, 1987)

The project is creating the voids, and therefore preserving the real quality of the new city: its landscape.

3. MEGASTRUCTURE, MEGAFORM, MEGASCAPE

One reaction to the loss of control of space in architecture and urbanism is the strategy of increasing scale. The term ‘megastructure’ arose in the 1960s. Fumihiko Maki (1964) explains the concept of megastructure as a principal of form, later differentiated from megaform large buildings within the urban tissue by Kenneth Frampton (1999).

“The megastructure is a large frame in which all the functions of a city or part of a city are housed. It has been made possible by present-day technology. In a sense, it is a human-made feature of the landscape. It is like the great hill on which Italian towns were built. Inherent in the megastructure concept, along with a certain static nature, is the suggestion that many and diverse functions may be beneficially concentrated in one place. A large frame implies some utility in combination and concentration of functions.” (Maki, 1964)

Kenzo Tange’s 1960 proposal for Tokyo’s extension into Tokyo Bay as later used as an illustration by Maki to the concepts of that time (figure 7).



Figure 7 Extension of Tokio Bay by Kenzo Tange

The megastructure was taken to almost surrealistic extremes by Superstudio’s ‘Continuous Monument’ (1969): by extending a single piece of architecture over the entire world, it was established to assert cosmic order on earth (figure 8). It’s extremely abstract architecture is enjoyable largely because it is only just readable, and is only represented in contrast to natural landscapes or older city structures.

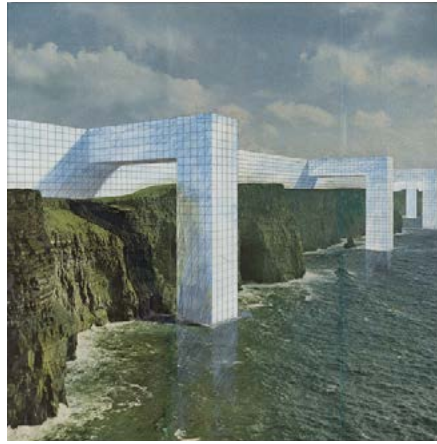


Figure 8 Continuous Monument Superstudio
(courtesy The Museum of Modern Art, New York 2009)

As multipurpose buildings, megastructures typically do not differentiate between building typologies. It is not uncommon in the history of architecture that large buildings change their use. For example, the Roman Market and Legal Court Basilica have become the prototype for the Christian Church, still carrying its original name in Romanic languages. However, the design of such border-crossing structures is truly, enduringly modern. Over time architecture became, among other things, a science of building types: multipurpose structures would not be considered architecture. Like Joseph Paxton's Crystal Palace (1851), which revolutionised industrial building production with pre-fabrication and standard elements. According to Kenneth Frampton (1980: 30) this was not a question of culture but one of engineering.

Of course, in reality designers are not only passively promoting typologies, but actively creating them. Since the end of the twentieth century, architecture, landscape architecture and urbanism have been shaking up the disciplinary framework from within each of their realms – after all, they had only recently been so differentiated. Again, Gilbert Laing Meason coined the term 'landscape architecture' in 1828, first being used as a professional title by Frederick Law Olmsted in 1863. Academic programs in urban design only began to appear after the Second World War (Harvard celebrated the 50th anniversary of their program in 2010). Between landscape and urbanism the term 'Landscape Urbanism' was established at the end of the twentieth century, and 'landscape infrastructure' came along at the beginning of the twenty-first century in the context of theoretical debate, since facilitating the naming of many educational or practicing design studios. In architecture 'bigness', yet another term propagated by Koolhaas (1995), ideologically fer-

tilised disciplinary grounds for the design of megastructures, megaforms or even megascapes.

The on-going negotiation between disciplines is probably a sign of quality. Each discipline is expanding methodological differences beyond the need for classification. If each specific design method is based on experiences of a specific discipline, that transgression beyond the discipline could be the stage of flow and the blurring of disciplinary boundaries could lead to genuine innovation. The flowing between disciplines is legitimate. I believe designs that result from an integration of the disciplines enhance each of them.

Pessimistic critics of culture warn us that craftsmanship falls apart, leaving our disciplines utterly powerless in navigating the forces of modern times. I would like to introduce one work of architecture that, in my opinion, successfully crossed these three disciplinary borders in a single stunning act of design integration.

4. FLOWSCAPES AT YOKOHAMA FERRY TERMINAL

Is the dissolution of disciplinary borders really a sign of the crisis of planning strategies? I do not think so. In the introduction paper we explained the roots of this concept as the marriage of two landscape architectural traditions represented in 'flow' and 'scapes'. We can see the introduction of 'flowscapes' as a way to operate within the contemporary, post-urbanist milieu.

The Yokohama project has been cited by many relevant experts as an example of a new trans-disciplinary practice. It has been cited in overviews of architecture as an expansion into the domain of landscape as Megaform (Frampton, 1999), Groundscape (Ruby, 2002), Groundwork (Balmori & Sanders, 2011), Landform Building (Allen & McQuade, 2011). In *Landscape of Contemporary Infrastructure* (Shannon & Smets, 2010) it is rightfully qualified to be 'infrastructure as public space'. All three disciplines seem to converge on this single building. But how has this been done?

Osanbashi was the result of an international competition that targeted a very ambitious architectural intervention. Yokohama, at the southern end of Tokyo Bay, prides itself on being the most important harbour city of Japan and hosting a terminal of national importance for the largest cruise ships. For the FIFA 2002 World football championship Yokohama was to build Japan's largest stadium, to be the venue for the final.

Alongside other city development initiatives the City of Yokohama launched the Ferry Terminal competition for cruise ships. Compared to other Japanese cities that historically reflect the culturally closed society of the archipelago state, as a port city Yokohama was more heavily influenced by Chinese and European culture and architecture. It became a relatively open city

long before modernism. The 1970s economic boom in Japan, and ship trade and transportation was certainly an important factor in this development.

The competition was announced in 1994, and finalised in 1995. Six hundred and sixty teams participated, roughly half of them from overseas. In the same span of time Rem Koolhaas was finishing his influential 1995 publication *S,M,L,XL*, which I have already quoted several times as providing examples of a kind of disciplinary confusion. In many ways the Yokohama Ferry Terminal looked like the answer to questions then being posed about the possibilities of form-finding within the architectural debate of its time. It seemed to hit a disciplinary nerve, and from the start the project grabbed the attention of architects, in both academia and in the profession.

From among the many architects who entered the competition, including both established architects as well as the young and ambitious, two complete unknowns Farshid Moussavi and Alejandro Zaera-Polo (2002) emerged as first in the selection procedure. In collaboration with structural engineer Cecil Balmond of Arup, they proposed a very innovative structure; while in terms of practical experience in construction, they were still relatively inexperienced. At the time they were teaching at the Architectural Association, and they said, “*this is a project we never planned to win.*” (Salazar et al., 2002: 9) Rather it was designed to “*explore some possibilities that we had become interested in*” through three projects for publication in the *AA Files*, the magazine of the London Architectural School (which became the cover of *AA Files* 29, 1994) (figure 9).

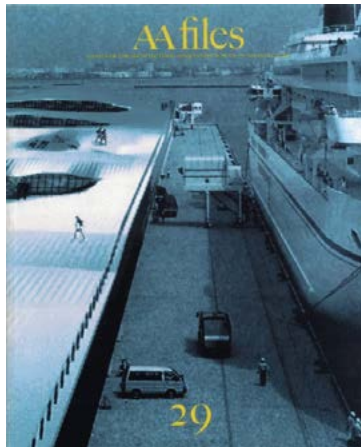


Figure 9 Yokohama Ferry Terminal, FOA 1993-2001,
on the Cover of *AA Files* nr. 29

In his appraisal juror Rem Koolhaas describes the winning design, stating: “it is unique (there has never been a pier like it), and it is architecturally an experiment: an investigation in a new, more fluent way of organising flows – no longer everything ‘put in its place’ but a freer language that can make the familiar exciting again.” (City of Yokohama, 1995: 9)

Both young architects had actually worked at Rem Koolhaas’ firm OMA in the early 1990s. At that time other members of OMA developed the Yokohama Masterplan and Jussieu Libraries (1992), and both evidently left certain traces (see Ruby, 2002). During the time of the Yokohama competition, AA published the Jussieu Libraries of OMA 1992–1993 (figure 10).



Figure 10 Two Libraries of Jussieu, OMA 1992-1993, on the Cover of *AA Files* nr. 26

It was the cover page of the same magazine that Moussavi and Zaera-Polo were developing their design for, and was a project of one of the assigned jurors. In the same period former OMA colleagues of Moussavi Zaera-Polo, Winy Maas and Jacob van Rijs of MVRDV, started their design of Villa VPRO (1993–1997), which in many ways applied the concept of OMA’s Jussieu Library into another type of building. They would later postulate, “*The Building is the Landscape*” (MVRDV, 1999). Likely these connections are more illustrative of the context than somehow indicating a continuation. Even so, the Yokohama project must be seen as quite an exceptional case of successfully negotiating, through collaborative means, between disciplinary boundaries.

As an architect myself, I had followed the project ever since it first appeared in publications. It was then an interesting experiment, and many colleagues were curious whether and how it was actually going to be built. I still

remember my own surprise when I saw the completed building published (Salazar et al., 2002) – after having somewhat lost track of it while busy with my own early built projects. I first visited the building in 2010 on a conference visit to Japan as a field trip in my PhD Research on ‘Architecture with Landscape Methods’ at Delft University of Technology. Even knowing the building rather well, from the aforementioned publications since the competition’s inception, in reality it has still many surprising aspects. Firstly, one’s approach to it – from extremely busy Tokyo through dense Yokohama – provides for a sudden relief and surprising calm. While at the entry traffic lanes, taxi and bus stops dominate, soon after curb side begins a large and extremely calm world. The sea view and gently undulating surfaces create a very special atmosphere. One senses that the giant pier is totally encompassed by the sea, although the harbour situation at Yokohama is quite industrial when compared to a beach at the open sea. In this regard it is very much comparable to a English landscape garden, where movements and routings and views are guided through, and framed by, the manipulation of a designer in order to connect a space to the wider landscape of the fields – or, in this case, of the sea. Even for someone who studied this building the spatial appearance is surprising, even stunning, in reality.

The most surprising thing though is the usage of the building. In general it is quite unexpected to see joggers, people with baby strollers and couples taking wedding pictures in a building – here it is commonplace. Also common are bridal couples posing for their wedding albums. People oftentimes sit on towels or cushions, just as they would for a picnic in a garden or park. A friend of mine observed how people strategically reserve a little space for their families to see the fireworks by spreading blankets on the wooden deck. Many visitors alongside appear just to enjoy the building for leisure time, talking to friends, outdoor exercise and merely walking. It is obvious to the visitor that this infrastructural building is also used as a kind of a park or public open space. Its indoor and outdoor spaces are inviting for walking and experiencing as a landscape – this curious convergence of uses does clearly not match the above separation of disciplines.

The intended infrastructural use – the docking of ships, ostensibly the main purpose of the building – is actually not requiring much more than a continuous connection on one level, on two sides, to the entry deck of the ships. The buildings’ main passenger flow is from street level to boat level, fixed in the competition brief at a height of 5.2 metres above the pier. This function requires large capacities for thousands of passengers boarding or clearing large ships at peak times. The traffic zones, designed to host large numbers of visitors, often remain unused. These halls, then, sometimes remain empty, but are often also being used for strolling and connecting: a conventional, if rather informal, leisure activity for a pier.

The Yokohama Ferry terminal design proposed a series of three continuous undulating planes, intersecting with each other on many levels with a total of eleven ramps. All of the passenger connections form one continuous flow through the building – or rather the projected flow chart diagram of the building generated its continuous form (figure 11).

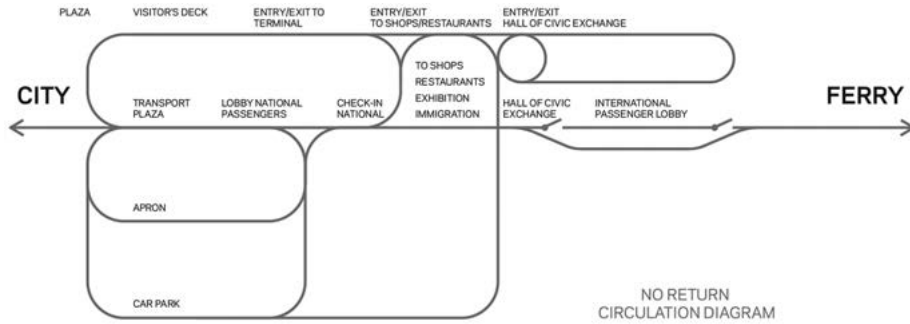


Figure 11 Circulation Yokohama Ferry Terminal (courtesy Foreign Office Architects)

This flow was designed with a flowchart: a diagram of the circulation pattern was drawn up to understand the flows of passengers across the building. In the original competition drawings this flow chart is broken down into a set of views, as a nonlinear, manifold storyboard, identifying a series of viewpoints in between the undulating planes in addition to framed views of sky and water. This method of using flows for creating a scenic route is practiced in landscape architecture as a ‘sequencing of composed views’ (Nijhuis, 2011). Having more in common with Frank Lloyd Wright’s notions of plasticity and spatial continuity (perhaps best realised in his Guggenheim Museum of 1938–59), in architectural terms this organisation of the space in section and plan goes far beyond other modern spatial concepts – such as Le Corbusier’s Plan Libre, or Adolf Loos’ Raumplan (Risselada, 1988) – and to this day Osanbashi still remains a rare example of this high level of spatial, structural and formal integration.

Hokusai’s famous woodblock print of a giant tsunami wave inspired the designer’s formal approach to the problem, connecting the typology with a strong image. The building also uses the form of folding waves for the structural design. The main planes integrate the bearing system: there is no other structure of columns and walls to do the usual shifting and distributing of horizontal to vertical load bearing elements that architects call tectonics. It has also been described in architectural terms as an ‘a-tectonic’ building, although plate tectonics (the geological movement that besides erosion and

sedimentation shapes landscapes) could very well describe the analogy to the form-finding of this project. The theoretical discussion of architecture was then much revolving around continuous space, folding, etc. Such terms were vividly discussed by prominent architects such as Peter Eisenman in *Folding in Time* (1992) or Gregg Lynn's formative AD issue *Folding in Architecture* (1993) that both refer to 'The Fold' again – like Angélie's (among many other's) quotes from *Le Pli* by French philosopher Gilles Deleuze (English translation: *The Fold*, 1993).

The civil engineering side of the project is also mirrored in a novel structural 'folding' approach. The folded planes and main structure of the two large girders are structurally seen as steel tube bridges (figures 12, 13 & 14).

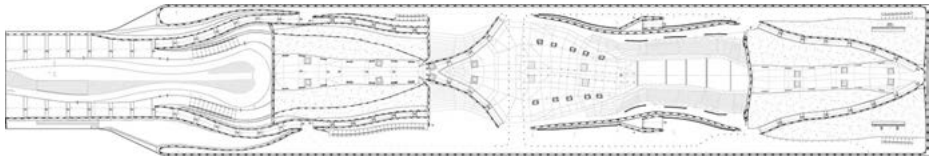


Figure 12 Roof Plan Yokohama Ferry Terminal (courtesy Foreign Office Architects)

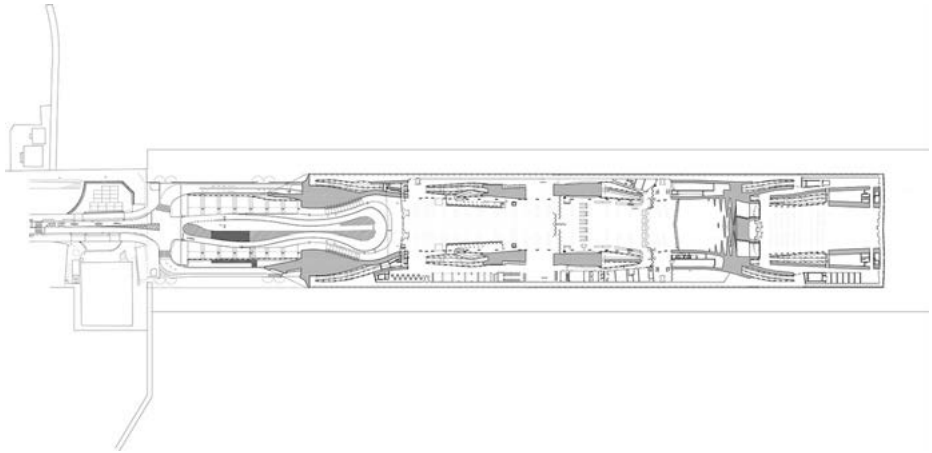


Figure 13 Floor Plan Yokohama Ferry Terminal (courtesy Foreign Office Architects)



Figure 14 Section Yokohama Ferry Terminal (courtesy Foreign Office Architects)



Figure 15 Yokohama Ferry Terminal (photograph by Daniel Jauslin)

In the first competition design the analogy with waving was translated into a bearing system of steel plates inspired by corrugated cardboard, the most common and cheapest packing material. Later in the design development that system was replaced by a steel truss system that consisted of spatial trusses as a primary structure, introducing the folding analogy into the secondary structure or actual form of the beams – providing more visual impact, while at the same time apparently dissolving the structure into space. In both structural approaches the tertiary longitudinal beams are four giant girders, comparable to trapezoid sections of steel or concrete bridges, though vastly more complex in geometry. Both structural approaches follow the same goal: the structure uses no columns, forming large continuous spaces that open onto the harbour city panorama and to the sea itself on three sides. This gives the impression of a passageway, the far-flung feeling one can experience on a ship deck – at a scale comparable to that of the longest ships of the world.

The application of a new form of structural design was solved in numerous interesting ways for this project. Precision and structural optimisation within the main structure could only be achieved by using the high precision structural welding techniques that are used for ship hulls: large pieces of structure were consequently prefabricated on several competing shipyards, and large steel units were shipped by sea to the site in a process very similar to bridge building. Certainly this process, guided by architects, is very remote

from the antique Greek carpentry that inspired the formal system of Western tectonic architecture.

Negotiating the whole range of disciplinary transgressions possible among the three disciplines in one single project, Yokohama is as much infrastructure as it is architecture and landscape. It uses all of the disciplinary frameworks, merging them but not losing ground, creating an anti-object with iconic strength, an experiment with technological vigour. In exceptionally good or intriguing cases of architecture, the formal and theoretical, the constructed and diagrammatic, are not only complementary but inform each other, of which this project is a proof.

The fascinating result of Osanbashi's intended experiment in spatial design methods is that several polar oppositions between disciplines are transgressed and replaced by productive relationships. The complex three dimensional spatial composition manages to multiply its utility and spatial experience in versatile ways: diverse programmatic configurations are based on flows of people, but also on the reuse of spaces conventionally optimised for only a few occasions in a manner that renders them useful for multiple functions in non-peak moments. They become inter-operative.

The spatial effect of this piece of the transportation network goes beyond its mere utility as a terminal; it could be called 'infrastructure as architecture'. Conversely, if we describe works of architecture as objects of design, then the landscaped infrastructure at Yokohama Ferry terminal is a non-object alternative we could call 'architecture as landscape'. Osanbashi provides what is perhaps an unparalleled example of a traffic infrastructure turned into a widely popular public space, enabling experience of the seafront in a dense urban situation: 'infrastructure as landscape'.

Most importantly, all three disciplines are integrated and mutually reinforcing one another, working together in an innovative, unified spatial composition, while facilitating diverse purposes. In short: infrastructure as landscape as architecture.

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WATER INFRASTRUCTURES

The synergy between flood risk protection and spatial quality in coastal cities

ANNE LOES NILLESEN

Abstract

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Coastal regions throughout the world are subject to flood risk challenges. This paper concentrates on the Netherlands; its coastline fulfils an important role in the protection of the Dutch delta. Due to the expected sea level rise, part of the Dutch coastline will have to be reinforced. Along most of the sparsely occupied coastline, the space needed for the reinforcement of the flood risk protection infrastructure can be found easily, either on the seaside or inland. However, some segments of the coastline have been built upon and are difficult to reinforce; buildings have limited the adaptability of the originally flexible coast. One of these locations is Scheveningen, a borough of the city The Hague and a seaside mass-tourism resort operating on a national scale. It is difficult to reinforce the borough's flood risk infrastructure without significant restructuring. In addition to water-safety issues, Scheveningen faces social-economic challenges and needs a qualitative programmatic and spatial impulse. An integrated approach to spatial and flood risk design is essential to come to a qualitatively as well as functionally acceptable solution for multifunctional flood defences. This paper describes and demonstrates the approach and application of an integral 'research by design' study for flood risk management and spatial quality in Scheveningen. It is the result of a collaborative effort between spatial designers and flood risk engineers, who worked together in so-called 'Delta ateliers'. Three different flood risk strategies ('a sandy shore', 'a hard protection body' and 'a perpendicular dam') are used as leading principles for integral designs in which both the spatial assignment as well as the long term flood risk protection assignment are addressed. This results in three different designs that are discussed in relation to their spatial potential and hydraulic efficiency. This applied research by design approach was considered very valuable—even essential—to feed the debate regarding the choice of a flood risk intervention. As a result, this approach will be continued throughout the Dutch National 'Delta Programme' that focusses on long term flood risk protection.

KEYWORDS

flood risk protection; seaside; waterfront; spatial quality; integrated design; Delta Programme; research by design; Dutch delta; Scheveningen

1. INTRODUCTION

Coastal regions throughout the world are subject to flood risks challenges (IPCC, 2007). This paper concentrates on the Netherlands, where the coastline plays an important role in the protection of the Dutch delta. Erosion, climate change and the growing economic value of low-lying parts of the country create significant long-term flood risk challenges. The Delta Programme was established in order to define suitable strategies and interventions to answer these challenges (Delta Programme, 2008). Through several projects the programme is orientated towards specific regions, such as the south-west delta and the Wadden region, and specific topics, such as freshwater supply. One of the regional sub-projects concentrates on the Dutch coast.

In this project, a series of expected short-term (2050) and long-term (2100) weak spots in the Dutch coastal defence system were identified and addressed. The short-term weak spots have been strengthened through regular maintenance of existing flood risk protection infrastructure works. In the long term, regular maintenance will have to be carried out continuously to compensate for erosion. In addition to erosion, rising sea water levels will contribute to the creation of new long-term weak spots as well. In these coastal sites, the flood risk protection infrastructure will have to be reinforced. This infrastructure consists of a combination of natural stretches of sandy dunes or barrier islands and elements such as dikes, barriers and dams (Hidding & Van der Vlist, 2009).

Given the sparse occupation of most of the Dutch coastline, the extra space needed for the reinforcement of the flood risk protection infrastructure can easily be found either at the seaside or inland. However, some settlements are located in close proximity to, or even directly on the coastal defence line. One of these is the former fishing village of Scheveningen that dates from the Middle Ages. Nowadays Scheveningen is a relatively densely populated borough of The Hague and a seaside mass-tourism resort operating on a national scale. For such a location, it is difficult to reinforce the flood risk infrastructure without significant restructuring, which is controversial and costly given the private ownership of most of the properties. In addition to water-safety issues, Scheveningen faces social-economic challenges. The old town centre has degraded and needs qualitative programmatic and spatial improvement (Municipality of The Hague, 2009).

An integrated approach to spatial and flood risk design is essential to come to a qualitatively and functionally acceptable solution for multifunctional flood defences. Such an integrated approach becomes even more relevant if the flood risk protection task coincides with a complex spatial assignment. The latter is the case in Scheveningen. Given the dual requirements of social-economic and flood-risk improvements, an opportunity for synergy arises (Nillesen, 2014).

This paper describes an integrated research by design study that is conducted in order to develop designs for flood risk interventions that are effective from both the perspectives of flood risk management and spatial quality. It is the result of a collaborative effort between spatial designers and flood risk engineers, who worked together in so-called 'Delta ateliers'. In this study, three different types of interventions for Scheveningen were developed and evaluated. The interventions are referred to in this document as 'a sandy shore', 'a hard protection-body' and 'a perpendicular dam'.

The methods paragraph starts with a brief introduction on the concepts of the delta ateliers and research by design approach. Subsequently, the flood risk assignment and spatial assignment for Scheveningen are described, as well as specific choices regarding design goals that serve as starting points for the development of the aforementioned designs. Then the designs for flood risk management and spatial quality themselves are described. The paper concludes with a reflection on the methodology.

2. METHODOLOGY

Atelier sessions and research by design are approaches that are often referred to in contemporary design related studies. The exact meaning of those terms often remains vague or undefined, therefore this paragraph will start with the description on how those approaches are used within this research. The use of the layer model as a conceptual framework to describe and understand the essence behind the flood risk assignment in Scheveningen is then set forth.

2.1 Delta ateliers

Workshops or design ateliers that bring together different stakeholders and multidisciplinary experts are successful work formats to reach an integrated design (Prominski et al., 2012). Atelier work sessions in which stakeholders and designers work together to develop a holistic plan are often referred to as 'charettes' (Girling, Kellett & Johnstone, 2006). However this term is typically used to describe interactive sessions for community participation (Sanof, 2000; Girling, Kellett & Johnstone, 2006), whereas this research focuses on integrated design and participation among professionals. Because of the community participation connotation, the term 'charettes' in this study is deliberately avoided and the design sessions are referred to as 'delta ateliers'.

During this research two types of delta ateliers have been applied: 'interactive stakeholder sessions' and 'expert sessions'. Interactive stakeholder sessions are workshops in which professional stakeholders and experts in-

teract. The goal is to share knowledge, to establish joint fact-finding, to identify relevant topics and assignments, and to create understanding and agreement on different standpoints and visions. An interactive stakeholder session consists of a general presentation to bring participants up to date and the actual interactive workshop, for which the participants are divided in small groups that discuss topics under guidance of a team leader. At the end of the workshop session, there is a feedback round followed by a discussion under the direction of the atelier leader and agreement is reached on standpoints and visions.

Expert sessions focus on collecting, sharing and creating knowledge. During sessions with a core team of multidisciplinary experts (urban designers, landscape architects and civil engineers) insights are created and shared, knowledge gaps are identified and measures and strategies are proposed, integrated or assessed. In instances when a knowledge gap is identified, experts are requested to do additional research. The urban design office *Defacto Urbanism* supported the delta ateliers by preparing the sessions, performing additional in depth analysis and further developing, integrating and visualising the conceptual visions and design proposals as formulated during the ateliers. The outcomes of the delta ateliers and the additional research and design proposals were combined in a research report *De Stad aan Zee* (Atelier Kustkwaliteit, 2011).

During this research three interactive stakeholder sessions were organised. The first session focussed on the problem definition, the sharing of knowledge regarding flood risk protection and spatial tasks and ambitions. Agreement was reached on the long-term goals and the future development scenarios that will be applied.

As a preparation for the second interactive stakeholder session a spatial analysis of the area was performed by the urban design office based on the information shared during the first session. An expert session was conducted in order to formulate and select three flood risk interventions that were effective from a hydraulic point of view. During the second session three effective interventions from a flood risk point of view were confronted with spatial considerations of the area. Opportunities and threats were identified and discussed. The outcomes of the first and second sessions were used as building blocks in the preparation of the third session.

Based on the building blocks as described above, the design office performed a research-by-design exercise in which integrated designs were made that address both flood risk and spatial considerations. The development of the integrated design was done in cooperation with the multidisciplinary expert team that provided detailed information on the flood risk related aspects of the design alternatives. During the third interactive stakeholder session the outcomes of the research-by-design exercise were presented and dis-

cussed among experts and stakeholders.

2.2 Research-by-design

Different definitions of research-by-design exist (Geldof & Janssens, 2013). The research-by-design method used during this research assumes a definition in which a single parameter is systematically varied (the type of flood risk intervention) while fixing other parameters (such as the location, the expected scenarios for climate change and economic development, and the spatial design component). The different flood risk interventions are used as a leading principle for an integrated design in which both the spatial considerations and long-term flood risk protection are addressed. In the Scheveningen case this results in three different designs that are discussed in relation to their spatial potential and hydraulic efficiency. The aim of this research-by-design study is not to develop and select the most favourable alternative, but to feed and support the on-going debate regarding flood risk interventions for Scheveningen by exploring strategic opportunities for flood risk protection.¹

2.3 Layer analyses and complex systems

In this study the 'layer model' is used as a conceptual framework to describe and understand the essence of the flood risk assignment in Scheveningen. The layer model was documented by the Dutch Ministry of Infrastructure and Environment (VROM, 2001) and based on the triple layer model by Ian McHarg (1969). The layer model contains three conceptual layers: The substratum (the natural layer of the subsoil in which changes take place over the course of centuries), the network (the layer of the infrastructural networks, changing over the course of 50-100 years) and the occupation layer (the layer of the human occupation, changing over the course of 25-50 years) (Meyer & Nijhuis, 2013). In the current research context, these layers are interpreted as the three layers of water, flood risk infrastructure and occupation.

3. THE FLOOD RISK PROTECTION TASK

The coastline is part of the Dutch flood risk protection system, protecting low-lying parts of the Netherlands against floods in the event of a storm surge. The Dutch coastline used to be a dynamic landscape that transformed over time due to erosion, sedimentation and varying water levels. However in 1990 the Dutch government decided to define a base coastline (*basiskustlijn*) to prevent further erosion of the coastline. The main goal of this measure was twofold: to protect both the sea defence line and the functions in the coastal zone. The coastline is maintained by Dutch water boards and if the dunes

do not meet the flood risk protection standards anymore or there is a severe deviation from the base coastline, action is taken to reinforce the coastline. When it comes to reinforcing the coastline, different landward and seaward interventions are possible, varying from more natural sandy reinforcements to hard structures such as dams, quays and barriers to hold back the seawater. The Dutch erosion management policy is referred to as ‘dynamic preservation’ (VROM, 1990) and prescribes a sequential preference of measures. Preservation and free transport of sand along the coast is encouraged. If an intervention is necessary, this is done with sandy (or ‘soft’) measures, only using hard measures such as constructions when they are unavoidable (VROM, 2006).



Figure 1 Scheveningen coastal protection zone

Scheveningen is part of the sandy coastal stretch referred to as the ‘Holland coast’ (Mulder, Hommes & Horstman, 2011) which protects the core economic and urban centre of the Netherlands (the Randstad) from flooding. In figure 1 the coastal protection zone of Scheveningen is visualised. The coastal protection zone consists of both the actual flood protection body as well as a reservation zone, anticipating future land or seaward extensions of the flood risk protection body. When the flood risk protection body is a dune (as is the case in Scheveningen) the possibility of that part of the dune collapsing during a storm surge is taken into account. The dune is designed to be wide enough to still function as a flood protection body after a partial collapse. The line that should still be able to shield the water under all circumstances (within the range of the flood risk protection standard) is referred to as the ‘water shielding line’. In Scheveningen, the water shielding line is positioned in the densely built centre. This complicates the enforcement of the sea defence line since the flood risk protection body as well as most of the reservation zone are built on and with that, fixed.

When following the layer model theory the occupation layer is regarded to be the most flexible layer. In this case, the occupation layer has actually become the fixed layer. The dynamics of sedimentation and erosion on a local scale have already caused changes to the base coastline and protection standard over the course of decades. This asks for the involvement of the infrastructural layer. However, the occupation layer on top of the infrastructure layer consists of buildings that do not match the theoretical life span from the layer model of 25–50 years: For example the famous Kurhaus building, a hotel along the beach–promenade that was built in 1887 and many heritage protected houses that date from around the year 1900. Of course such monuments can be regarded exceptions, but even the ‘modern’ privately owned seaside apartments already date from the seventies and are expected to last at least some more decades. In other words, the necessary dynamic of the infrastructural and occupation layer to adapt to natural processes is in practice limited by the built tissue of the occupation layer.

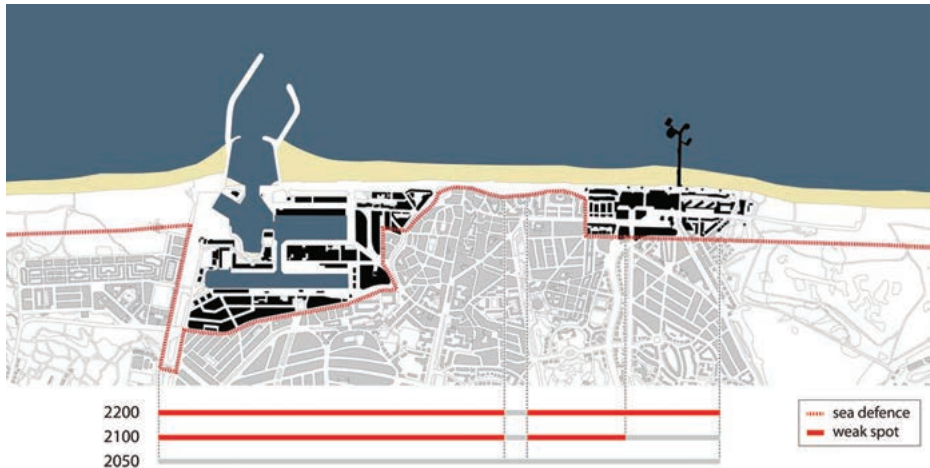


Figure 2 Indication of expected weak spots of the sea defence (in red) over time

When considering the maintenance of the flood risk protection standards on the short term (up until the year 2050) a weak spot was identified in the old village of Scheveningen (figure 2). This weak spot has been already resolved with the realisation of a higher boulevard. With that addition, the coastal protection is extended seaward by the construction of a hard structure. Figure 3 indicates the new extension movement of the water shielding line seaward. This new extension by the Spanish architect de Sola-Morales has been praised for the added spatial value that the enforced boulevards offer Scheveningen.

In the long term (2100) the whole sea defence of Scheveningen including the new extension is expected to need re-enforcement.



Figure 3 The boulevards' extensions shifts the water-shielding line seawards

During the first interactive stakeholder meeting the position was taken that restructuring the complete sea defence line at its current location, or land inward is neither feasible nor desirable. This means that the focus of this research is a seaward extension. During the first expert meeting three main principles for extending the sea defence line were decided upon: a sandy dune extension, a hard protection body and a perpendicular dam. An important starting point was that the dimensions of the proposed flood risk protection bodies should be viable from a flood risk protection point of view until 2200.

4. THE SPATIAL ASSIGNMENT

Two important positions with respect to long term scenarios were taken during the first stakeholder sessions: in the long term the city of The Hague will still grow regarding both economics and population, and the borough Scheveningen will remain an important part of the city of The Hague and should reinforce the identity of The Hague as a city by the sea.

During the first interactive stakeholder session the governmental vision and ambition for Scheveningen were presented. The findings were later supplemented with the outcomes of a spatial analyses performed by the urban design office. The spatial tasks that were identified concerned the identity, accessibility, spatial quality and vitality of Scheveningen.

4.1 Identity

Within Scheveningen three different coexisting identities can be distinguished: that of Scheveningen harbour, Scheveningen village and Scheveningen resort. The harbour in the south of Scheveningen has a rough character and offers potential for redevelopment now that many businesses are relocated. The adjacent part of Scheveningen is the authentic centre of the historic fishermen's village Scheveningen. Here we find small-scale residential buildings. The central axis of the village is directly connected to the seaside. North of the village the futuristic seaside resort can be found, characterised by the faded glory of the boulevard, the Kurhaus hotel and the Pier.

The different seaside towns along the Dutch coast all have their own distinctive characteristic and identity. The wish to contain and strengthen this difference of identities is expressed in a regional vision (Provincie Zuid-Holland, 2009). Scheveningen stands out as the only seaside town with a metropolitan identity. However the city centre of The Hague is not well connected to the borough of Scheveningen. You could say currently Scheveningen is a village by the sea instead of The Hague being a city by the sea. In order to enforce the identity of a city by the sea the ambition is to develop Scheveningen to become a mixed-use urban sub-centre of The Hague (Municipality of The Hague, 2009).

4.2 Connectivity

At both the city scale and the local scale, Scheveningen is poorly connected to the seaside. From the The Hague train station it is a 40-minute tram ride to reach the seaside. During sunny days, regular car traffic is hampered by traffic jams. Both directions of travel bring you to either tram stops or parking garages. At these points, although you are very close to the seaside, the seaside is not experienced. The sections in figure 4 show how the barrier formed by the dune top separates the arrival point and the tissue of Scheveningen from the actual seaside.

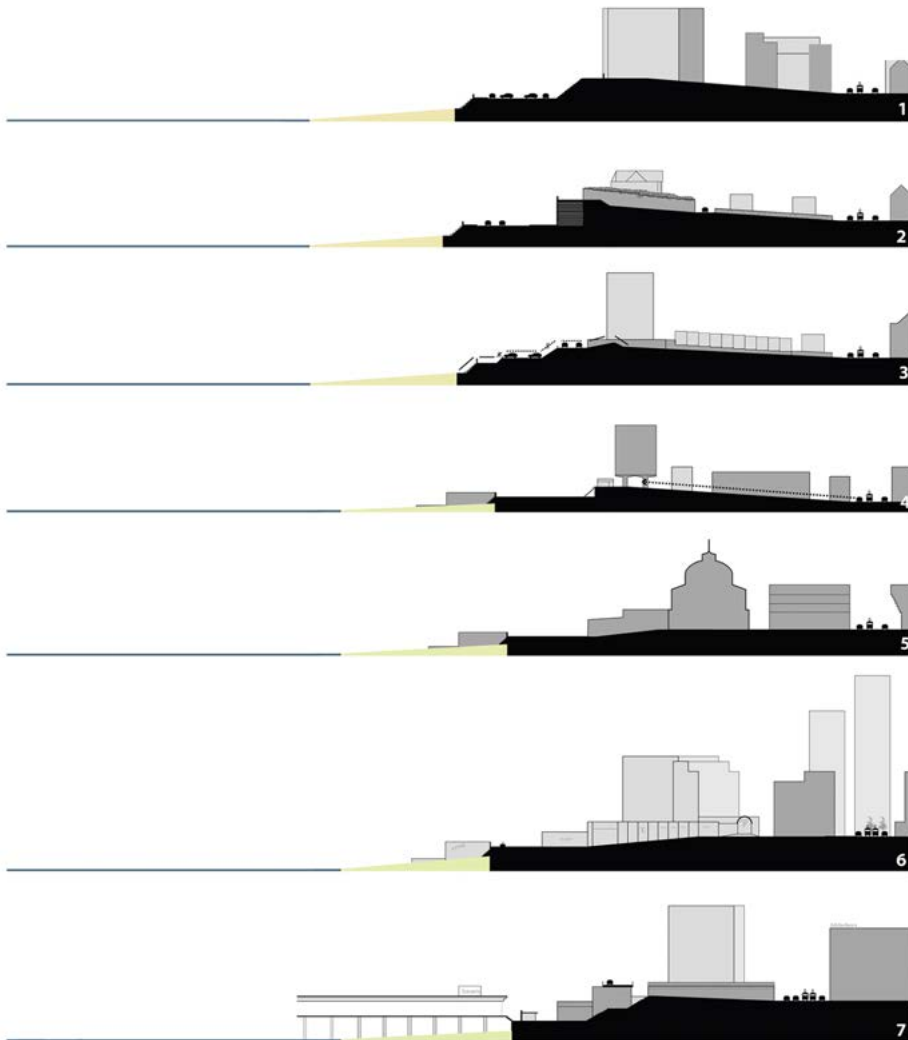


Figure 4 Scheveningen sections; from its entry points to the shoreline

4.3 Spatial quality

During the first interactive design session the experts and stakeholders were asked to name the qualitative aspects of Scheveningen (figure 5). The participants constructed a map, indicating the challenges from a spatial point of view (figure 6). In general the spatial quality in Scheveningen was considered to be poor. Buildings alongside the boulevard are oriented towards the sea only, and many streets have blind facades or parking garages on street level. The streets close to the sea lack any trees or any qualitative public green due to the strong salty wind. Additionally, many buildings are due for renovation and the partly abandoned harbour is fenced off. The proximity of the sea

and some of the majestic buildings along the boulevard offer a great potential, as do the characteristic 1920s and 1930s neighbourhoods. The character offered by the old harbour offers potential as well.

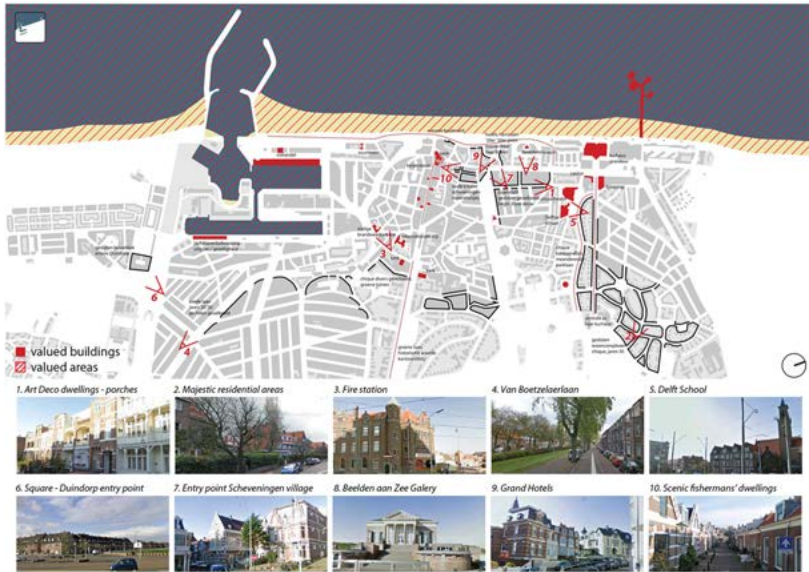


Figure 5 Qualitative elements in Scheveningen



Figure 6 Scheveningen's poor quality areas

4.4 Vitality

Tourism is an important economic contributor for Scheveningen. The seaside now mainly attracts day-trippers that do not spend much on average. Such tourism is seasonal and only pays off for part of the year. The goal for Scheveningen would be to create a mixed programme that is interesting for both tourist and business visitors, and secure a year-round programme to attract more long-stay visitors. The faded glory of the boulevard could be supplemented with a new contemporary identity to attract a wealthier group of tourists.

5. THREE INTEGRATED DESIGNS FOR A SAFE AND VITAL CITY BY THE SEA.

To integrate the three different flood risk protection interventions with the spatial considerations and the ambition of Scheveningen, three design concepts for the long-term have been made. The three research-by-design studies resulted in different designs. The first design concept with a hard flood risk protection body is labelled 'the city at the sea', the second concept, with a sandy flood risk protection body is labelled 'the city behind the dunes'. Finally, the third variation based on the perpendicular dam led to the design for 'the city in the sea'.

Within the three designs we can both find generic interventions applied in all three of the design variations to address part of the spatial issues of Scheveningen, as well as specific spatial interventions that are unique for one design variation and relate directly to the choice for a certain type of flood risk intervention. First the generic spatial interventions will be described. Subsequently, the unique qualities of the three design variations in relation to the applied flood risk intervention are described.

In all of the designs a new seaward city extension is used to connect the three parts of Scheveningen: Scheveningen harbour, Scheveningen village and Scheveningen resort. The different identities and characteristics of the three town parts are reflected in the new design of the boulevard. The extension offers space for new economic functions and allows for a new identity of the Scheveningen seaside. There are two essential historical points connecting the existing tissue and the sea: the endpoint of the central street of Scheveningen village and the Kurhaus. At both locations the direct visual and functional relationship between the existing tissue and the sea is retained and enforced. The monumental square in front of the Kurhaus is restored allowing the Kurhaus to become a landmark that marks the transition of one of the main entrance roads to the sea. The tramline is diverted seaward and a direct view of the sea is established at all stops.

5.1 Hard seaward extension: City at the sea

The hard seaward extension brings the boulevard and the water shielding line seaward (figure 7). This gives space for an additional permanent programme resulting in a metropolitan city by the sea. A reference project for this identity is the new business and living district of Hafencity in Hamburg, Germany.



Figure 7 City at the sea design plan

The height of the water shielding part of the boulevard must be +14 meters NAP in 2200 (Arcadis & Alkyon, 2005). The current boulevard is +6.7 meters NAP. This new height of the boulevard can lead to an undesirable detachment between the boulevard and the sea. Therefore maintaining a strong relationship between the new boulevard and the sea was an important design theme. The choice was made to create a stepped boulevard with three different flood risk protection levels. Moving from the water shielding line towards the sea, an unembanked area at the height of +7 meters can be found, which will flood in extreme weather conditions during the winter months. In this unembanked area additional flood risk protection is achieved by flood proofing the ground floors of individual buildings and applying functional uses less vulnerable to flooding such as car parking. The third element is a timber boulevard in close proximity to the sea. This part of the boulevard brings visitors close to the sea (as does the beach area currently) and will flood regularly during the winter season. The functions positioned along this low-lying boulevard are seasonal functions such as surf rental shops and beach bars that are disassembled in winter.

The flood risk protection body is designed in a way that it can be hinged on a complete floor level, which makes it robust. However, working with a hard construction in the natural surroundings of the dunes creates lots of erosion; sand will have to be supplemented repeatedly under the water level.

5.2 City behind the dunes

To extend the dunes seaward, sand is supplemented in front of the current boulevard (figure 9). Depending on the desired proportions of the dune this extends the current beach with tens of meters and heightens it to approximately 12 meters above NAP (Arcadis & Alkyon, 2005). The water shielding zone covers the part of the dune that could collapse in case of a storm. This section should be extended in case of sea level rise or erosion. Therefore it is essential that this zone of the flood risk protection body remains flexible and will not be fixed by the infrastructural layer.



Figure 9 City behind the dunes design plan

The necessary flexibility of the dune is the main design theme of the city behind the dunes. In the water shielding zone, only flexible or seasonal buildings can be positioned. In this zone flexible artist residences and tourist apartments could be located. On the beach itself, which is subject to seasonal tides, seasonal pavilions can be realised. There is potential for pavilions and pools to be also located in the sea. When the dune is extended far enough landward of the water shielding zone the opportunity arises to build permanent buildings. Permanent apartment blocks are proposed within the dune near Scheveningen harbour. Along the current boulevard a new neighbourhood is designed, referring to the majestic living neighbourhoods of the

thirties (figure 10). The character of Scheveningen will be that of a city with grandeur positioned on the beach.



Figure 10 Dwellings amongst the sand dunes

Lots of sand will have to be supplemented to create these new dunes and since the dune is positioned seaward it will erode. The erosion does not have to be problematic; the sand gets transported along the coast and Scheveningen will function as a sand engine, supplementing Holland's northern beaches (this principle is currently tested near Hook of Holland), but on-going maintenance will be necessary.

5.3 City in the sea

The third design variation is the city in the sea. Here a perpendicular dam extends Scheveningen into the sea and protects the coast from eroding (figure 11). If a perpendicular dam is applied, additional erosion and sedimentation will affect the beaches nearby. The rule of the thumb given by the participating engineers is that along a stretch of beach of approximately 1.5 times the length of the dam, sedimentation will take place. Beyond that part of the beach, extra strong erosion will occur.



Figure 11 City in the sea design plan

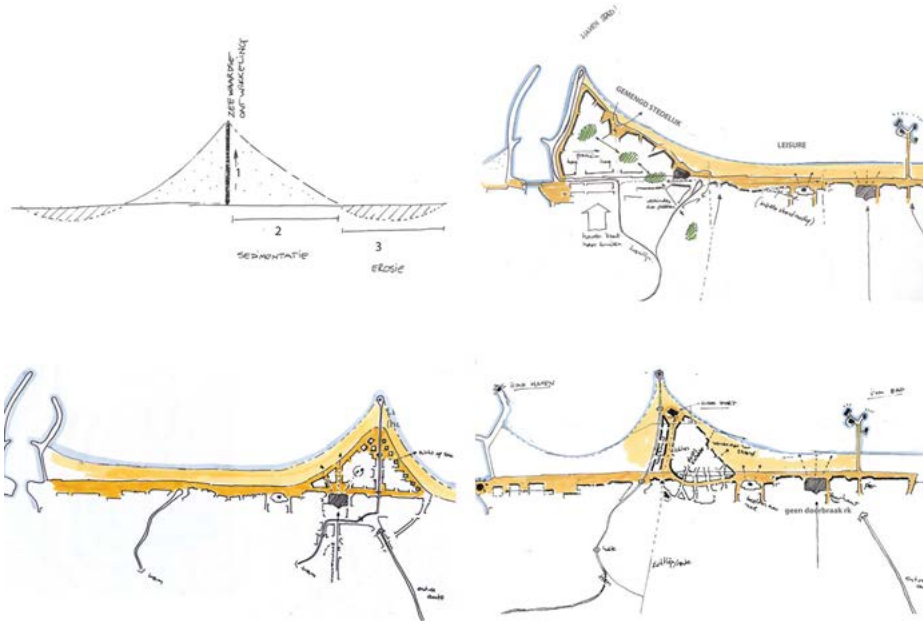


Figure 12 Dam placement evaluations

The main design theme of this design variation was finding the optimal positioning of the dam. An optimal placement would be beneficiary to both the flood risk assignment as the spatial quality assignment. The design has been formulated by testing multiple locations for the dam and then evaluating these locations (figure 12). Finally the dam was positioned in between Scheveningen village and Scheveningen beach. The dam divides the current seaside in two parts: on the south the calmer beach for the local inhabitants and on the north the touristic resort. The tramway can be extended to the end of the dam and bring tourists close to the beach. The type of beach town emerging on the elevated dam with a gradual slope can be best compared with Mediterranean seaside towns.

After placing the dam, the natural sedimentation will already take care of some of the needed supplementation. However, a big supplementation is necessary to extend the beach to its maximal volume. The dam protects the sand from eroding so less maintenance will be necessary compared to the other design variations.

6. CONCLUSIONS

This paper described the outcome of an integrated research-by-design study that was conducted in order to develop designs for flood risk interventions that are effective from both the perspectives of flood risk management and spatial quality. Using different optional flood risk interventions as design themes, three different designs were created that demonstrate different options for The Hague as a city at the sea. Although similar spatial interventions and concepts were used to address the spatial considerations as prescribed (the improvement of the accessibility, vitality, spatial quality and identity of Scheveningen), the three designs show completely different types of beach resorts with different identities. This relates to the choice of different flood risk interventions. The various flood risk interventions lead to different main design themes and, as a result, a different design focus for each of the three design variations. Additionally, the physical requirements and characteristics of the flood risk interventions (for instance the difference between a hard quay or sandy dune) directly relate to specific conditions and thus different possibilities for, and atmospheres of, seaward development. Using this approach the spatial characteristics and consequences directly related to different choices regarding flood risk interventions could be explored. This was considered very valuable – even essential – to feed the debate regarding the choice of a flood risk intervention. As a result, this approach will be continued throughout the Delta programme.

This design study qualifies as research-by-design, as the influence of varying a single parameter in the flood risk intervention on the design outcome is transparent, understandable and replicable. The design variations could be assessed from a flood risk perspective in relation to the robustness and necessary maintenance of the design solution. However, there are no objective assessment criteria available to evaluate the different alternatives from a spatial quality perspective; the different designs were mainly judged based on personal preference. In that sense, the sub-study preformed to identify the profitable location for the perpendicular dam both from a flood risk as well as a spatial perspective. This could be considered a more pure form of research-by-design since the different options are assessed both from a functional perspective and a spatial perspective, resulting in the preference for an alternative. This sub-study also fits the definition of De Jong and Van der Voordt (2005) for research-by-design as not only systematically testing different options but also testing them on different locations.

The use of the layer model as a conceptual framework was very useful. It helped to clarify that in the case of Scheveningen, the occupation layer, which is usually considered the most flexible layer, is in fact a fixed layer. This is essential in order to understand the problems related to the current flood risk assignment. The relationship between the layer model and the current flood risk assignment in the Netherlands is subject to a continued research effort.

ENDNOTES

- 1 see <http://www.deltacommissaris.nl/onderwerpen/delta-atelier/>

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Design challenges of multifunctional flood defences

A comparative approach to assess spatial and structural integration

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Abstract

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Due to the changing climate and increasing urbanisation delta cities are faced with an increasing flood risk. In The Netherlands many of the flood defence infrastructures, such as dikes and flood walls, need to be adapted or improved in the near future, to comply to current or improved safety standards. These improvements directly affect landscape and urban development. In its 2008 report, the 2nd Delta Committee presented the idea of multifunctional flood defences, which are flood defence structures that deliberately provide opportunities for other functions. Since then, spatial designers and hydraulic engineers together delivered a wide palette of designs and concepts, resulting in a rather fluid and indefinable concept of multifunctional flood defences. This paper presents a method to describe the level of multifunctionality, based on two existing spatial and structural assessment methods from the fields of civil engineering and urban planning. The combined method distinguishes four ascending levels of integration, ranging from spatial optimisation to structural and functional integration. The combined classification method is tested on a selection of cases of multifunctional flood defences in the Netherlands. Based on this test, it is concluded that the classification method is a useful and generic method to describe the level of multifunctionality. Some of the selected examples look very innovative and multifunctional at first glance, while the level of spatial and structural integration is limited. Other examples might not be very spectacular from a spatial designers point of view, but show that true functional integration of flood protection with multiple other functions is already feasible, depending on the local context. The method helps to bridge the gap between the practices of civil engineering and urban and landscape design. Also, it makes clear that flood risk management is part of an overall process of integrated area development, anticipating on what could be described as a multifunctional flood defence zone.

KEYWORDS

multifunctional flood defence; multifunctional dike; integrated flood defence; integral flood design; interdisciplinary design; delta management; design; flood defence design; dike design; delta dike; climate dike; super levee; flood defence zone

1. INTRODUCTION

The densely populated Dutch delta is vulnerable to both coastal and fluvial floods. A large network of flood defence structures like dykes, dunes, dams and locks protect the major cities of Amsterdam and Rotterdam and the low-lying polders of the Randstad. These structures are gradually incorporated into the urban fabric as a result of rapid post-war urbanisation and – more recently – the transformation of former port areas outside the levee protected areas. Here future flood risk management conflicts with the spatial interests and ambitions of local stakeholders. In areas where dykes and the urbanised landscape have almost merged, traditional dyke reinforcement results in an undesirable claim on space, high expenses and an extended planning and realisation process (Van Veelen et al., 2010). In large urbanised deltas outside the Netherlands, whether it be highly developed urban areas such as the New York–New Jersey Estuary, or developing metropolitan regions such as Jakarta and Ho Chi Minh City, the integration of flood risk management with urban developments also presents a challenge. The question is how to improve flood defence structures, while avoiding enormous social costs and uncompromised spatial solutions.

Both in the Netherlands and other urbanised delta regions, concepts of integrating flood risk management structures with other functions are currently being developed and tested. The Dutch Second Delta Committee embraced the concept of ‘multifunctional flood defences’ (2nd Delta Committee, 2008) as an overarching concept describing structures that are designed to integrate flood protection with functions like infrastructure, housing, recreation and ecological spaces. New ideas from research and practice such as the ‘unbreakable’ dyke, delta dyke, and climate dyke were developed. Although integrated flood defences have already been planned and realised in many different places throughout the Netherlands such as Katwijk, Scheveningen, Rotterdam, Dordrecht, Tiel and Vlissingen, an assessment method that integrates both the design approaches of civil engineering and spatial planning is still missing.

In this chapter, a comparative assessment method and classification is introduced that aims to assess both the spatial and structural composition of multifunctional flood defences. This method is based on an integration of the design methods of urban planning and hydraulic engineering, to provide a way of design as an “*important and essential approach to intentional change*” (Nelson & Stolterman, 2012) that could help both urban planners and hydraulic engineers to develop a mutual language. It should also enable the link between the strategic level of landscape and flood risk planning with a concrete feasible level of structural design. The proposed method could thus form a useful tool to support both horizontal cooperation on operational level of design and improve communications between the strategic and tactical level of

decision-makers and designers. In this way, this approach contributes to a design culture, as proposed by Nelson & Stolterman (2012), where *“it is important for leaders to recognise that their challenge is that of a designer.”*

To get a grip on the structural design of multifunctional flood defences, the following section first briefly describes the evolution of flood risk strategies and flood defence design in the Netherlands. Following on from this, the composition of traditional flood defences and some new concepts are explained. Then, the assessment method of the structural and spatial integration is introduced, based on an overview of design perspectives. This method is applied to several cases: the Dakpark and Hilledijk in Rotterdam and the Noordendijk in Dordrecht. The chapter ends with conclusions and recommendations for the spatial and structural design of multifunctional flood defences. Although the cases studied in this chapter represent typical Dutch flood risk management structures, the assessment method is generic and can be applied in other delta regions where similar integration challenges play a role.

2. TOWARDS NEW FLOOD RISK STRATEGIES AND CONCEPTS

2.1 An introduction to the flood management system of the Netherlands

Dutch flood risk management has evolved over time and in recent years has been ever more influenced by societal developments (Heems & Kothuis, 2012). There are several recent changes to the current Dutch flood risk management system that have a substantial impact on the design and layout of flood defences. To understand the impact of these changes it is necessary to introduce some key elements of the Dutch flood risk management system and local design methods.

The Dutch flood protection system is based on closed networks of primary flood defences: so called ‘dyke rings’ that protect both urban and more rural areas along the North Sea coast and the main rivers. The traditional design of flood defences was based simply on experience and local conditions. After the catastrophic 1953 flood this deterministic approach was replaced by a flood protection philosophy based upon a cost-benefit optimum analysis wherein the cost of increasing protection is balanced against the reduction in flood risk. Because of the availability of statistical data of water levels and the development of an advanced analysis method, the flood risk could be related to the exceedance frequency of a critical water level. Flood defences had to be designed in such a way that this critical water level could be resisted. This method is known as the ‘semi-probabilistic design method’ because the strength of flood defences was still considered as a fixed value (TAW, 1998). This new approach resulted in flood protection standards that differ per dyke

ring, depending on the economic value of the hinterland it protects and character of the local hydraulic conditions.

2.2 Towards a risk-based approach

In spatial planning, however, flood risk soon proved not to be a determining factor. Low-lying polders were urbanised, resulting in a gradual increase of the consequence of a flood. The Environmental Assessment Agency noted already in 2004 that human lives and economic values are less protected than originally intended when the current safety system was introduced in 1960 (Ten Brinke & Bannink, 2004). To address this imbalance between safety standards and growing consequences, these safety standards are currently under discussion. A tightening up of the flood protection standards, however, implies a drastic improvement of flood defences in the urban or rural environment.

In parallel, the design method of flood defences is changing. A full ‘probabilistic design method’, where the strength of flood defences is considered as a distribution instead of a fixed value, is a more accurate method than a semi-probabilistic method. Recently, numerical methods have been developed to carry out this way of design. In addition to the traditional design criteria based on overtopping and overflow of the structure, also failure mechanisms based on the stability of the structure (for example piping and sliding) are included in the risk calculation.

2.3 New flood defence concepts

The advancement in risk analysis together with societal developments has led to a new direction in a multi-layer flood risk approach where risks are not only reduced by preventing measures (layer 1), but also by adapting spatial planning and urban design (layer 2) and by introducing disaster management (layer 3) (Ministry of I & M, 2009). Although the cost-effectiveness of investments in reducing risk strongly varies per layer and depends on local conditions and the specific nature and probability of a flood (Kolen et al., 2011), this new approach offers possibilities for the integration of flood risk management and spatial planning.

A change to a risk-based approach has consequences for the design and layout of flood defences. The Dutch research institute Deltares studied the relative effectiveness of creating ‘unbreachable’ dykes to reduce the mortality rate for each dyke ring area (De Bruijn & Klijn, 2011). These unbreachable structures can be defined as flood defences that remain stable even when the Normative Water Level is exceeded, reducing the probability of an uncontrolled flood by 10 or even 100 times. This concept of unbreachable flood defence structures forms the basis for different multifunctional concepts that are known under a wide range of names, such as the delta dyke, super dyke,

broad dyke, robust dyke and climate dyke (figure 1). The premise is that the concept of unbreachable and multifunctional dykes is more cost-effective than conventional dykes because of real-estate development opportunities and benefits of optimal land use. Although some case study research (De Moel, 2010, Veelen et al., 2010) supports this claim, the cost effectiveness of unbreachable and multifunctional flood defences has not yet been researched in depth.

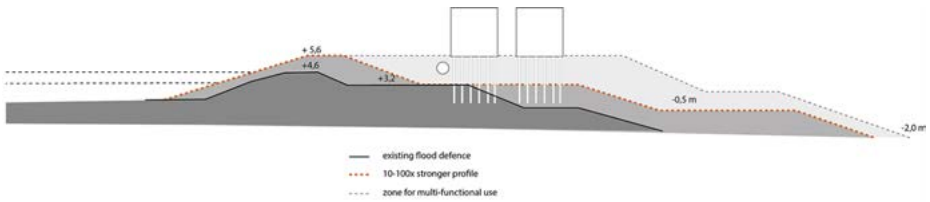


Figure 1 Cross-section of a multifunctional 10 x stronger dyke: in dark grey profile of a mono-functional river dyke, in light-grey a 10 x stronger dyke and zone for multi-functional use (adapted from: Tromp et al., 2012)

3. SPATIAL AND STRUCTURAL INTEGRATION

In this section a method is proposed to assess the structural and spatial integration of multifunctional flood defences, based upon combining a classification of the structural elements composing a flood defence, with a classification of dimensions in multiple spatial use.

3.1 Structural elements

To evaluate the degree of spatial and structural integration of flood defences, it is necessary to understand the geometry and composition of a traditional dyke. The composing elements can be derived from the main characteristic of flood defences: water-retaining elements, elements that provide structural stability and strength, and elements that have a positive (or negative) influence on hydraulic conditions.

Drawing on the research of Huis in't Veld et al. (1986) and Venmans (1992), the main elements of a flood defence can be grouped according to their structural role:

- *Water retaining elements* provide protection against floods through their height and water resistance (impermeability).
- *Supporting elements* support the water retaining elements by providing additional strength or stability. This element type includes erosion protective elements and transitional structures.
- *Objects* do not have a flood protection function but are part of the flood de-

fence and have influence on the strength and stability of the structure as a whole.

- *Structural elements that change the hydraulic boundary conditions.*
- *The subsoil, which should finally resist all forces acting on the flood defence.*

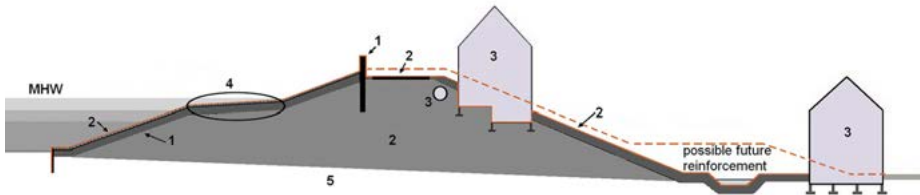


Figure 2 Cross-section of a lake dyke with indication of the structural element types

These element types are illustrated in figure 2, which could represent a sea dyke, but the basic components can be recognised in other types of flood defence structures. Generally, water-retaining elements (type 1) consist of a clay layer or a wall (sheet piles or a gravity structure for example). Supporting elements (type 2) are the core of a dyke and the anchors of a retaining wall, but also the revetment that protects the inner slope of a dyke against erosion due to overtopping waves. Objects (type 3) consist of houses, roads, parking garages, etc. Often such an object is not currently part of a flood defence, but will become part of it when the flood defence is widened. An example of a structural element that changes the hydraulic boundary conditions (type 4) is an outer berm, which dampens the waves and thus reduces the wave overtopping volume. Also, foreland and vegetation can act as elements that influence the boundary conditions. Finally, all forces acting on the flood defence and the forces exerted by the flood defence itself (mostly its own weight) have to be resisted by the subsoil (type 5). For hydraulic structures it is typical that a major horizontal load (from the adjoining water) is transferred to the subsoil.

By classifying these element types, the degree of integration of objects with the basic elements of a flood defence structure can be determined.

3.2 Spatial dimensions of multifunctionality

In the context of urban planning, multiple land-use refers to situations where the existing space is more intensively used (Hooimeijer et al., 2001). This can be achieved by the morphological integration of functions (the stacking of multiple functions in one building or construction), by mixed space use (multiple functions in a certain defined area) and by temporal shared-use of

the same space. The degree of spatial integration used in this chapter is based upon a classification by Ellen (2011) and adapted by Van Veelen (2013), who distinguishes four spatial dimensions of multifunctionality. These dimensions are used for evaluating the degree of spatial and functional integration, with slightly adapted terminology (see also figure 3):

- *Shared use.* A flood defence structure is (temporarily) used by another function, without any adjustments to its basic structure. It is generally possible to use the flood defence for infrastructure, recreation and agricultural uses, as long as the functioning of the flood defence is not impeded.
- *Spatial optimisation.* The basic shape of the flood defence is adapted to create space for other structures. These structures are technically not part of the flood defence structure. Spatial optimisation is found in many places in the highly urbanised areas of the Dutch delta. The most compact and spatially optimal shape is obtained if a vertical retaining wall is applied which replaces a dyke slope or berm, leaving space for housing or other functions.
- *Structural integration.* An object is built on, in or under the flood defence structure, but does not directly retain water. The concept of structural integration is used in situations where the current dyke is over dimensioned (super dyke) or many times stronger than necessary (unbreachable dyke).
- *Functional integration.* The water-retaining element of the flood defence also functions as a part of the structure with another function (the 'object'). Although this concept is technically feasible, it is hard to find realised examples of full integration. There are some historically evolved situations in which the dyke is part of a medieval city wall (as seen in Kampen) or a row of old buildings (as seen in Dordrecht).

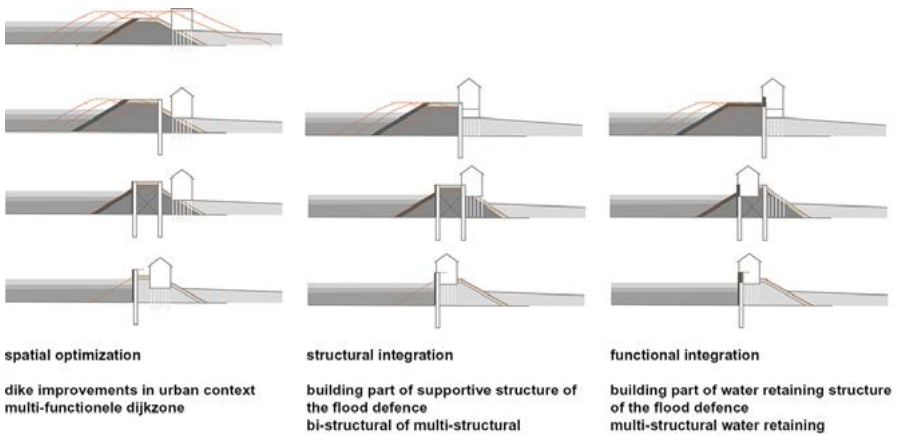


Figure 3 Various examples with different degrees of spatial integration

3.3 The combined approach

The determination of the degree of integration starts with identifying the compositional elements of a flood defence structure. As a first step it should be determined whether an element has a water-retaining function or influences the strength and stability of the flood defence structure as a whole. If this is not the case, the integration is categorised as ‘shared use’, as long as the basic shape of the flood defence is not altered. If the flood defence shape is adapted to allow more spatial compactness, the situation is categorised as ‘spatial optimisation’. If the object, or part of it, fulfils a structural role in the flood defence structure, it is evaluated as ‘structural integration’. If this structural role is retaining water, the category is called ‘functional integration’.

This method will be used in the following sections where three multifunctional flood defence structures are evaluated.

4. ANALYSIS OF EXISTING MULTIFUNCTIONAL FLOOD DEFENCES

The described analytical method to determine the degree of spatial and structural integration is tested with help of real cases. These cases are selected based on an overview of existing studies and reports on multi-functional or innovative flood defences. The majority of these cases are briefly analysed in terms of spatial and structural integration based on the available literature. Three cases of multifunctional flood defences are analysed in more detail, using urban master plans, original building permits, archival research and interviews with key players during the design process. These cases are selected because they are clear examples of three different dimensions of multi-functionality and because these examples are well documented. The cases are assessed on (1) design criteria (2) spatial integration (3) structural integration and (4) flood defence concept.

4.1 Dakpark Rotterdam: Shared use

The ‘Dakpark’ is an elevated park on a former railway yard in the Delfshaven quarter in Rotterdam. The park is located on the roof of a new shopping centre, which includes a parking garage (hence its name: ‘dak’ in Dutch means ‘roof’). The park is the largest green roof in Rotterdam and one of the largest in the Netherlands. The park offers a playground, communal garden and a Mediterranean garden with an orangery. The Dakpark is 1000 m long and 80 m wide. The park is situated 9 m above street level. The car park has space for approximately 750 cars. The Dakpark is combined with a dyke, the ‘Delflandse Dijk’, that is part of dyke ring 14, which protects the urban area of the Randstad.

The idea for a large city park is part of a longstanding agreement with residents to add more green space, stemming from the urban renewal process of the surrounding ‘Bospolder-Tussendijken’ district. The district authority finally decided to designate 80% of the space that became available for ‘green’ purposes. The project developer and owner of the area, the Rotterdam Port Authority, intended to develop a commercial and industrial zone, which was conflicting with the residents’ ideas. Ultimately a multifunctional structure has been designed that accommodates shops, offices, and a parking garage on the ground floor and first floor and a park with leisure functions on the rooftop (Kennisbank Platform31, 2013). Important issues that had to be solved were the division of the costs, the presence of objects like stair-cases in the flood defence, and the by-law of the Water Board which contains regulations regarding building in the vicinity of the flood defence (Van der Leeuwen, 2008).

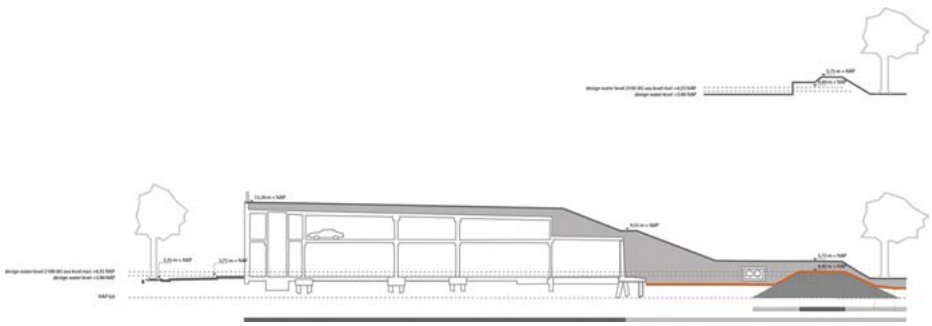


Figure 4 Cross-section of the 'Roof Park' Rotterdam

The original dyke is not integrated into the new structure of the Dakpark building itself (figure 4). Instead the shopping, office and parking complex is situated next to the old dyke and the space in between the complex and the dyke has been filled out by soil. Meanwhile, the crest height of the dyke was raised to make it ‘climate-proof’, which means that a worst-case scenario in terms of sea level rise has been taken into account for the design lifetime of the flood defence. The complex is situated in the outer zone, the ‘influence zone’ of the flood defence according to the definition by the Water Board. Building in this zone is only allowed under exceptional circumstances, but in this case it is compensated by the reinforcement of the park strip. Several agreements including those regarding the foundations of the core zone,

and ease of inspection, ensure that Dakpark will maintain its flood protection function in the future (City of Rotterdam, 2008).

The Dakpark complex itself does not contain structural elements that are part of the flood defence. The additional soil layer on top of the dyke is not considered to contribute to the retaining height because the Water Board regards the existing profile as the flood defence. This dyke profile has not been adapted to make space for other functions. The Dakpark therefore is classified as 'shared use'.

4.2 Hilledijk Rotterdam: Spatial optimisation

The Hilledijk in Rotterdam is one of the last remnants of the old river dyke that protected the land from flooding from the river Maas. The dyke together with an old railway yard currently function as a spatial barrier between the Afrikaanderwijk and the new developments of Kop van Zuid. One of the key principles of the 2004 Parkstad masterplan is to dissolve this barrier by redeveloping the railway yard and transforming the dyke into a gradually ascending landscape, visually softening the height difference between the elevated area and the low-lying Afrikaanderwijk. This new 'dyke landscape' will be used as a base for the development of different building blocks accessed through a new road on the top of the existing flood defence. The area between the buildings will remain accessible for inspection and maintenance (Palm-bout Urban Landscapes, 2009).

During the process of drafting the Parkstad masterplan the Hollandse Delta Water Board had scheduled a dyke reinforcement for a section of the Hilledijk, to be finished in 2014 as part of the *Flood Protection Programme (Hoogwaterbeschermingsprogramma)* 2. The spatial and temporal coincidence of both developments contributed to public support for a multi-functional solution, where both parties benefit.

An important design principle is that the new flood defence is spatially and functionally separated from the new buildings lined up on both sides of the crest. The new buildings are not integrated in the actual water defence, but will be constructed just outside a theoretical profile of the new flood defence. This means that when the buildings will be removed, the flood defence structure remains intact. The flood defence itself will be designed to a design water level corresponding with a 100-year moderate sea level scenario. One of the additional design criteria is that the water defence should resist a flood level corresponding with an average frequency of 1/10.000 per year, although the dyke ring 17 has been standardised to a 1/4000 per year exceedance frequency. Although the new buildings are legally not part of the flood defence they will contribute to the strength of the embankment, creating a virtually unbreachable dyke that is many times stronger than actually necessary. The Hilledijk can thus be considered as practically unbreachable (figure 5).

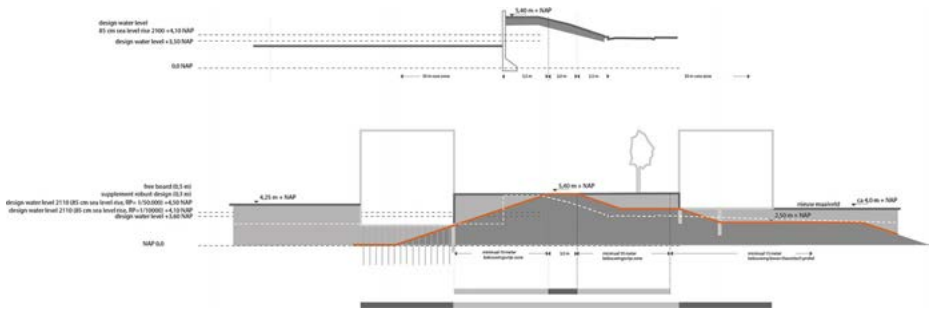


Figure 5 Cross-section of the 'Hilledijk' in Rotterdam

Because the floor levels of the existing houses along the Hilledijk are much lower than the desired level of the proposed street, demolition of these building blocks is inevitable (Palmbout Urban Landscapes, 2009). Due to the current financial crisis the development of the Parkstad Masterplan has slowed down and the demolition of buildings blocks has been postponed. The question has arisen whether the interdependence in the design of the flood defence and urban development is a restriction to adapting to changing circumstances.

The Hilledijk can be classified as a situation of spatial optimisation by using overlay of urban functions, without structural or functional integration.

4.3 Noordendijk Dordrecht: Functional integration

After the disastrous flood of 1953 the urbanized part of the Noordendijk (North Dyke) in Dordrecht was reinforced with a cofferdam, to avoid demolition of the historical buildings lined up on both sides of the dyke. In the late seventies this dyke, although sufficiently strong, did not comply with the more stringent height requirements posed by the first Delta Committee. Creating a higher dyke proved to be difficult. The initial plan of the water board consisted of a traditional dyke reinforcement by strengthening the outer-slope of the dyke towards the river slack tide. This required demolition of a row of historical buildings and relocation of a power plant and the last windmill of Dordrecht. When in September 1987 all reinforcement projects were provisionally suspended by new plans for a storm surge barrier in the Nieuwe Maas, the planning process came to a halt (Erfgoedcentrum DiEP).

After the realisation of the Maeslant barrier in the early nineties the possibility appeared to integrate the reinforcement of the flood defence with an urban renewal project on the south slope of the dyke. A floodwall was realised in sections with insufficient space for a slope. This 500 meter long L-shaped concrete floodwall with a seepage screen (of steel sheet piling) is at some

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Evaluation of the method

The aim of the proposed assessment method is to find a way to describe the degree of structural and spatial integration of the flood defence function with other functions. This section discusses the findings coming from the application of the proposed method.

The proposed assessment method is tested on a set of cases, of which three are presented in this chapter. In all cases it proved to be possible to distinguish the composing structural parts and to determine the integration category. It also appeared that the method is systematic and transparent and can be generally applied to a wide range of multifunctional flood defences.

During testing it turned out that application of the method contributes to a better understanding of the structural composition of the sometimes inconsequently used spatial concepts like 'super dykes' and 'broad dykes'. It also increases insight into the efficiency of the combination of functions: some of the selected examples look very innovative and multifunctional at first glance, while the level of spatial and structural integration is limited. Many examples are spatially optimised, but not structurally or functionally integrated. Other examples may not be very spectacular from a spatial designers point of view, but show that true structural integration of flood protection with multiple other functions is already feasible, depending on the local context.

A better understanding of the integration of functions or structures could also contribute to a better allocation of responsibilities for inspection, maintenance and future investments. After all, a clear understanding of what structural element serves what purpose provides a common starting point for discussions.

The main generic conclusion is that the method will help both urban planners and hydraulic engineers to develop a mutual understanding of the various interests from a flood management and spatial development perspective. Because of the design-based classification, the method can be applied to discuss spatial integration of multifunctional flood defence structures in different governance contexts.

5.2 Design challenges of multifunctional flood defences

The cases show that all categories of integration are technically feasible and in compliance with the current safety standards. This does not imply however that the authorities responsible for flood protection have no reservations when it comes to issues of inspection, maintenance and sustainability of multifunctional flood defences.

The case Hilledijk shows that the strategy of oversizing the flood defence is a promising strategy to increase space for intensive urban use and at the same time to redesign the flood defence into a virtually unbreachable struc-

ture. Especially in highly urbanised areas all over the world where traditional dyke reinforcement would have negative spatial impacts and be an extended and costly process, this concept is a promising strategy to align spatial development with flood risk management structures. Although wide and multifunctional used flood defences already can be found at several places (for example Maasboulevard and Hilledijk in Rotterdam, the Super Levee in Tokyo and the boulevard in Wuhan, China), the realisation of this approach on a larger scale would imply a complete redevelopment and redesign of the urban waterfront zone, which is not always feasible and applicable.

The case Noordendijk shows that it is necessary to develop design strategies that are able to deal with dissimilar life cycles of urban and flood risk management structures. In general, flood protective infrastructures have a designed life cycle of at least 50 to 100 years, while urban functions are designed for a life cycle between 20 to 50 years (TAW, 2003, NEN-EN 1990). Also uncertainties, caused by demographic changes and climate change, require flexible design concepts. It is necessary to develop construction methods and design that enable easy replacement or adjustment if necessary, with minimal destruction or demolition.

5.3 Multifunctional flood defence zones

To fully exploit the spatial and functional benefits of multifunctional flood defences, modifications to the regulatory framework are necessary. While considering the degree of integration, for example, it becomes clear that the Dutch ledger zones (legal zones that restrict building activities in a certain area) are often not tailor-made for multifunctional flood defences. A striking example of this situation is the Noordendijk in Dordrecht, where the integrated floodwall has not resulted in a protection zone that matches the actual failure mechanisms of a floodwall. This mismatch between legal protection and structural and spatial state of a flood defence is particularly relevant for oversized multifunctional dyke concepts, where the water boards still lack the legal instruments to appoint the oversized multifunctional zone as a crucial part of the structure.

This is also the case for the legal protection of structural elements that influence the hydraulic boundary conditions. Forelands, for example, often play a role in wave reduction, but are not included in the dyke height estimation because they are out of the regulatory framework of water boards (i.e. beyond the widest ledger zone). By not considering flood defences as line infrastructures, but more as multifunctional flood defence zones, forelands could become legal elements of flood defences, resulting in more cost-effective designs.

The challenge is to deal with these issues and to take them into account during the planning and design phase. The method described in this chapter

helps making ideas more specific and easier to discuss. It is therefore recommended to use this method in both national and international contexts.

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A critical approach to some new ideas about the Dutch flood risk system

TIES RIJCKEN

Abstract

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Decisions on measures to improve a flood risk system are in part supported by general ideas about how the system works and should work. After the completion of the Dutch Delta Works around 1990, such new ideas regarding flood risk emerged. Some of these may be appealing at first, but appear debatable after a closer look. In this paper, fourteen such debatable ideas, familiar to most Dutch water professionals, are formulated and criticised, in order to find out what can be learned from them. The most important Dutch national flood risk policy documents since 1990 are reviewed for quotes that illustrate these ideas, complemented by scientific papers and other documents. These quotes present different expressions of these ideas, and their number can suggest whether they are broadly shared or marginal. In twelve of the twenty most important government documents, 47 quotes were found; in 26 documents of other types, another 39. Eleven quotes describe the idea that 'water should not be our enemy, but our friend'. Fifteen quotes were based on the idea that flood protection entraps us in a dangerous 'spiral of risk', which can be stopped, 44 quotes are related to the idea that flood risk reducing measures should be 'natural' or 'move with nature'. The remaining quotes illustrate other debatable ideas, such as 'water should lead spatial planning' and 'rivers should not be squeezed into a corset'. The frequency of such quotes suggests that ideas about 'water as a friend', the 'spiral of risk' and 'moving with nature' have not been marginal. It is however difficult to determine how influential they have been in decision-making, since general ideas are not the only factors leading to decisions. The general critique to the three ideas is that they present preferred measures as generally logical conclusions without a systematic comparison of alternatives for particular situations. Behind the new ideas lies increasing societal interest for objectives like an attractive water landscape (water as a friend), reducing our dependence on technology (spiral of risk) and nature conservation and development (moving with nature). This analysis further suggests a couple of final remarks, which are hard to prove and are open for discussion.

KEYWORDS

flood risk; water infrastructure; systems analysis; policy analysis; soft objectives; quality; aesthetics; meaning; storytelling

1. STUDYING DEBATABLE IDEAS ABOUT FLOOD RISK

The Dutch landscape may for a large part be seen as a gigantic highly man made water processing machine. A primary objective for this machine is to limit the probability that the seas and main rivers break through its elevations, the dykes, which protect 65 per cent of the country from flooding. Throughout the centuries, the Dutch water machine has continuously been improved and upgraded: the cross-section of a medieval sea dyke was at most 50 metres squared, reaching two or three meters above mean sea level, nowadays a dyke at the same location is easily four times as high and ten times as voluminous.

The water machine is never finished. Under the *Delta Plan* (1953–1997), over a thousand kilometres of dams and dykes along the coast and estuaries were newly built or upgraded. Between 1995 and 2015, about 500 kilometres of rivers were tackled in the projects *Delta Plan Large Rivers* and *Room for the River*. Currently, upgrades are being conducted under the *High Water Protection Program* prepared by the *Delta Program*. Since 1960, average yearly costs of flood risk system upgrades are estimated 400 million euro (in 2014); maintenance and operations cost about the same.

How are decisions for upgrades made, and which choices do decision-makers have? According to TAW (1998), Vrijling, Van Hengel and Houben (1998), Eijgenraam (2007), Kind (2013) and others, upgrades are viable when the benefits of an investment (primarily risk reduction) outweigh the costs (primarily building costs). The flood protection standards in the Dutch *Water Act* are derived from such a cost-benefit analysis. The system has to match up to the standards, but in practice, decisions for upgrades are often postponed and finally happen only after a flood or near-flood, or when times are right for other reasons.

When flood risk reduction is wanted somewhere, in a flood risk system that includes dykes, there are five types of measures available: (1) improved disaster management such as evacuation plans, (2) local measures behind the dyke, such as flood proof buildings and risk zoning, (3) dyke upgrades, (4) load reduction by river widening and deepening (spatial measures), (5) load reduction by control objects redirecting flows on a higher scale level for instance a storm surge barrier (Klijn et al., 2012). Figure 1 shows examples of types 2, 3 and 4. Each of these measures can impede or support a wide range of accompanying objectives related to shipping, freshwater supply, transportation infrastructure, ecosystems, and so on.



Figure 1 Three ways to reduce flood risk, next to disaster management and measures to redirect flows on a higher scale level (like a storm surge barrier or a spillway near a river bifurcation)

Decisions regarding which measure to take are made in an elusive process, one where ideas, beliefs and preferences among a large group of people converge (Rijcken et al., 2012). There are many theories about political decision-making, like the systems approach, revolving around system models, versus the network approach, revolving around actors and processes. Decisions may be rational or emotional, be comprised far-reaching blueprints or adaptive incremental steps or be pragmatic or appeal to a grand vision. In whichever way they are made, general *ideas* about how the flood risk system works and should work, play a major role. Someone may be in favour of a storm surge barrier because of the outcome of a *specific* cost-benefit analysis, but also because he or she believes in the *general* idea that a river mouth near a major port ought to be protected by a moveable barrier, regardless of the specific analysis.

In scientific discourse, most time is spent on elaborating good ideas and some time on dismantling bad ideas. Critical publications about flood risk ideas are usually personal opinionated essays (Boorsma, 2007; Rijcken, 2008; Vrijling, 2008; De Wit, Jongejan & Van der Most, 2010 and Jonkman, 2013), or comments on specific publications or policy proposals (Rijcken, 2007; Jongejan et al., 2008 and 2012 and Waterforum, 2013).

This paper is more extensive and makes an inventory of the major Dutch policy documents, looking for multiple ideas which can, carefully, be called *debatable*. Related quotes are collected, classified, dated and tallied in order to be able to make a conclusion whether an idea is marginal or more broadly shared. Three debatable ideas are scrutinised in terms of the reasoning used and the potential harm. The final general discussion considers what these debatable ideas have in common and suggests what can be learned about related preferences and perceptions in society.

The literature review begins around 1990, the final years of the Delta Works. In 1986, the famous Eastern Scheldt barrier was completed and a year

later parliament voted to build the Maeslant barrier. These feats of engineering marked the end of a technocratic mind-set, according to many (Van Rooy & Sterrenberg, 2000; DG Water, 2006; Meyer, 2012; Correljé & Broekhans, 2014), which the debatable ideas in this paper appear, at least in part, to rebel against.

Method

The research starts with a list of debatable ideas, collected in the years leading to this article. A *debatable idea* is an idea open to discussion because it seems to contain inconsistencies, logical formal flaws or otherwise present conclusions which do not logically follow from the premises. ‘Climate change forces us to improve our evacuation plans’, is debatable because improved evacuation plans are not the only possible response to climate change. ‘We prefer evacuation plans over other risk-reducing measures’, is a preference, not directly formally debatable.

A debatable idea is revealed in *illustrative quotes*. These quotes can similarly be debatable on formal grounds, or otherwise illustrate the debatable idea. ‘The main part of our organisation believes that climate change forces us to improve our evacuation plans’ is not formally debatable, but reveals the presence of the debatable idea.

A debatable idea is *not marginal* when related illustrative quotes are found in more than 10% of the twenty most important national policy reports, and furthermore in multiple scientific publications and other professional documents.

Of the list of debatable ideas, the three most prevailing and most controversial ones are elaborated. For each, the most illustrative quotes are selected and the idea is explained in pictures and drawings. Each idea is then explained and criticised both in terms of its reasoning and the potential harm. It is then made clear which types of risk reducing measures are supported by the idea. These are put together to support the final remarks in the general discussion.

"Until now, space in the Netherlands has primarily been facilitating human activities. Natural forces were tamed. Rivers were embanked, estuaries dammed and inland seas turned into polders. **Human functions lead in spatial planning.** Awareness increases that this approach knows not only advantages, but also yields more and more costs and is finite. The tamed natural forces will, sooner or later, be stronger than man. This can be avoided by no longer working against nature, but with nature, and adjust land use to the possibilities of the water: **water is leading.**"

Derde kustnota (V&W 2000)

"(...) a policy [is needed], where **water is less seen as an enemy that should be fought, but as an ally** with nature, agriculture and urbanisation."

Rapport Commissie WB21 (2000)

"Historically we have restrained the water with pumps and levees, but that strategy is changing radically. According to the latest insights we should, in doses, let the water in, rather than **entrench ourselves behind ever higher walls.**"

magazine article (Metz 2012)

"Over the last centuries, a lot of space has been taken away from the river. As a result, **rivers have been sandwiched between dikes** which have, during the recent decades, become ever higher."

PKB Ruimte voor de Rivier (V&W 2006)

"Large investments (...) ask for more protection and therefore more enforcements of flood defenses. **This makes us go around in a vicious circle.**"

Vierde nota waterhuishouding (V&W 1998)

"The shift boils down to the Netherlands having to adapt to the water. We have to give space to the water, in stead of take it away (...) Space not in height or depth by deepening channels, but in width. This costs space, but in return we get safety. (...) Only by giving space we can really get our house in order, because if we do not do that, the water will take the space, sooner or later, by force."

Anders omgaan met water (DG Water 2000)

"Traditionally, flood management practices in Europe have focused on predominantly hazard control, or i.e. flood protection measures such as dykes or drainage systems to reduce the probability of flooding. However, in the past two decades **major flood disasters have created the need to shift** from flood protection to a more integrated approach in which flood risk is actively managed to also reduce flood impacts."

scientific publication (van Herk 2014)

"(...) do we choose to **connect to natural processes, or will, on the contrary, the oppression of natural processes be our starting point?**"

policy vision report (Projectteam NW4 1995)

Figure 2 Examples of illustrative quotes. The ones related to *water is our friend* in blue, the *spiral of risk* in orange, *moving with nature* in green, other ones in grey. The captions give the document titles (for the major national policy documents) or the type of document (for other types of documents); between brackets () the reference

2. THREE DEBATABLE IDEAS

We conducted a survey, searching for quotes that illustrate the following fourteen ideas, each well known to most Dutch water professionals.

- Water is our friend, not our enemy.
- A focus on preventing flooding catches us in a spiral of risk, which should and can be reversed.
- We have to move along with nature and strive for natural solutions.
- Because of climate change, we have to innovate.
- Innovative solutions are better than traditional solutions.
- Spatial solutions are better than technical solutions.
- Precipitation should first be retained, then stored, and then discharged.
- Water should take the lead in spatial planning.
- Water problems should not be passed on to adjacent water systems.
- Rivers should not be sandwiched, laced up, or squeezed into a corset.
- We can't go on raising the dykes forever.
- Flood risk reducing measures are part of a safety chain with links that should all be strong.
- In a risk system, every layer of risk reduction has to be addressed with measures.
- Residual risks have to be addressed with measures.

To illustrate these ideas, the twenty major policy documents since 1989 are read or scanned (Ctrl-F in PDF files) for the words *leading*, *diverge*, *store*, *lace up*, *corset*, *forever*, *chain*, *vicious*, *residual risk*, *spiral*, *friend*, *enemy*, *moving along*, and *natural* (in Dutch). Figure 2 shows examples of illustrative quotes found in the survey.

Of these fourteen debatable ideas, numbers 4 to 14 are not further elaborated; ideas 4, 5, 6 and 7 favour particular measures in such an obviously general way that they are hardly controversial. Ideas 8, 9 and 10 are well-known, but few written quotes with logical flaws were found. A critique of 8 would be that when land use and water management are intertwined, it is not clear which of the two leads, and why this matters; regarding 9 it would be that water management is essentially about passing problems on towards the best locations to solve them; to 10 that rivers are not human bodies which can be squeezed in a corset, but volumes discharging precipitation, defined by a surrounding geometry of mostly sand and clay. Ideas 11, 12, 13 and 14 overlap with number 2. Ideas 1, 2, and 3 seem to be the most prominent and controversial. Figure 3 lists the document types scanned. Figure 4 shows when the debatable ideas were found. Quotes illustrating a struggle with the concept of nature are the most abundant.

	Documents	Quotes			
		Friend	Spiral	Nature	Other
Major national policy documents	15	2	4	25	8
State commission reports	5	2		3	3
Scientific publications	8	1	4	3	4
Other documents	18	6	7	13	1

Figure 3 The twenty most important national policy documents on the Dutch flood risk system were read and scanned for quotes like the ones in figure 2

	Documents	Quotes			
		Friend	Spiral	Nature	Other
1990 – 1994	5	1	2	2	
1995 – 1999	4		2	5	1
2000 – 2004	6	3	4	7	6
1005 – 2009	16	5	4	13	3
1010 – 2014	15	2	3	17	6

Figure 4 Most quotes were found in the 2000s and few before 1995

1 – *Water is our friend, not our enemy*

In his foreword to the final report of the (State) Committee Water Management 21st century, the chairman writes: *“there is no doubt that in the Netherlands, the sink of Europe, a different approach is needed. Too much we still deal with [only] technical management, while time is pressing for a different water policy [...], where water is less seen as an enemy who should be fought, but as an ally with nature, agriculture and urbanisation.”* (Commissie WB21 2000)

In 2006, the ministry wrote: *“[t]here is a growing awareness that living with water contains risks, but also offers opportunities, such as quality of life, economic profit, and roots for national identity”* (DG Water, 2006). This notion was a central theme in the 45 million euro knowledge program Living with Water, whose chairman wrote:

“Living close to the river doesn’t only entail flood risks but is also deeply connected to quality of life. [...] this idea is put to work in the design of river management that includes the local problematic aspects of making room for the river but also provides new opportunities for economic and social development. This expresses and supports the paradigm shift from ‘fighting the floods’ to ‘living with water’.” (Swanenvleugel, 2007)

World Wildlife Fund put it like this: “[w]e don’t stand a chance fighting the far reaching consequences of climate change, when we keep seeing the sea and the whimsical tides as the prime threat against which we have to arm ourselves” (Braakhekke et al., 2008). Figure 6 is taken from a Living with Water document.

The quotes were often practiced in a context of certain popular or preferred measures – see figure 7 for an indication.

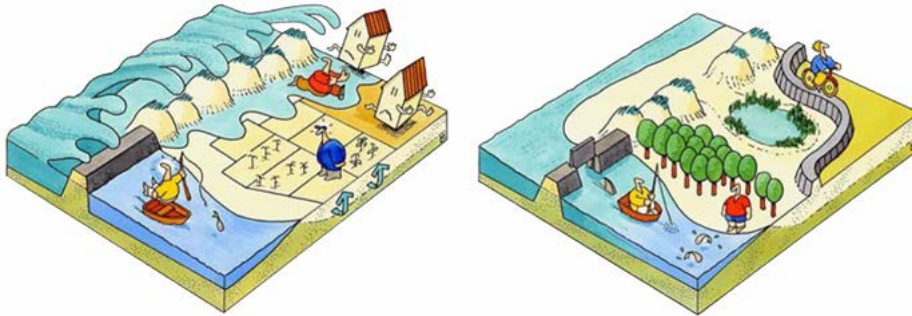


Figure 6 ‘From averting the water [...] to accommodating’ (Programmaorganisatie Leven met Water, 2006)

Types of measures

Disaster management

Water is our Friend, not our Enemy

not mentioned

In the context of the quotes, disaster management measures were not mentioned.

Local measures and risk zoning

some measures
favoured

Floating housing and water storage treat water as a friend.

Upgrading dikes

generally
disfavoured

Dikes consider water as an enemy. Dike heightening is worse than dike strengthening.

River widening and deepening

generally
favoured

River measures which reduce water levels treat water as a friend.

Redirecting flows on a higher scale level

some measures
favoured

Large engineering objects are hostile, but moveable barriers are favoured over dams.

Figure 7 A brief indication of the types of measures favoured and disfavoured in the context of the quotes illustrating the idea that *water is our friend, not our enemy*

"The battle has calmed down. Concerning levee enforcements the crisis in the culture-nature relationship will be heated just once again. Will we literally add another layer or is it time to take a different path? This much is sure: the ruler has won a great victory over the water. It is now time to **care about the exhausted waterwolf and try to become friends with him.**"

essay (Kockelkoren 1994)



"People choose for attractive and healthy water around them for living, recreation and to enjoy. Direct involvement however, only occurs until they are threatened or experience nuisance and damage. Then the government is called upon, because they expect the government to take care of their safety and protects them from nuisance and damage. **Water as an ally again loses to water as a friend.**"

Rapport Commissie WB21 (2000)

"In living with water, we see better guarantees for the generations to come, than solely technically restraining water."

"Slowly, more water appears in neighbourhoods, filled canals are reopened and more and more wet nature appears within our urban structure: water breaks through the hardness of concrete, stone and stress. In this state of mind, **water is not considered an enemy or prey, but rather a partner.** The properties of the water itself and the way it is experienced, should be starting points."

Anders omgaan met water (DG Water 2000)

"This long cherished self image of bold conquerors on a swampy subsoil needs a thorough revision for multiple reasons. **We don't stand a chance fighting the far reaching consequences of climate change, when we keep seeing the sea and the whimsical tides as the prime threat against which we have to arm ourselves.** (...) In the 20th century we learned important and expensive lessons about the limits to the ongoing canalisation of rivers, the neglect of the natural dynamics of flood plains; the challenge now is to rebuild our trust in the natural resilience of our own estuary. (...) **We have to work with water, play with it,** rebound with nature and dare to again profit from natural dynamics."

NGO report foreword (Braakhekke et al. 2008)

“Living close to the river doesn’t only entail flood risks but deeply connects to quality of life. In Freude am Fluss this idea is put to work in the design of river management that includes the local problematic aspects of room for the river but also provide new opportunities for economic and social development. This expresses and supports the **paradigm shift from ‘fighting the floods’ to ‘living with water.’**”

foreword to a research report (Swanenvleugel 2007)

“Building dykes ever taller is not the answer to increasing flood risks. The European project ‘Freude am Fluss’ proposes a new approach to flood risk management along embanked rivers: **‘live with water rather than fight it’** and ‘more room for the river’. This new way of thinking includes two main pathways which interact with each other: The first is technical innovation to adapt housing, land use and activities on the floodplain. In other words: land use has to become flood tolerant. [...] the second pathway focusses on developing a process of joint planning [...] Applying this new concept will fundamentally change the way we manage our river basins.”

documentary introduction (Freude am Fluss 2006)

“There is a growing awareness that living with **water contains risks, but also offers opportunities** (quality of life, economic profit, roots for national identity), which, however, can not be cashed, kept or used, without a struggle.”

Waterkoers 2 (DG Water 2006)



presentation (Adriaanse 2009)

“For a long time policy has been pledging to accommodate water by ‘space for the river’ and ‘space for water’, mostly combined with nature development. [This] policy aims at giving water the place in spatial development issues it deserves, and not always considers it an appendix. **Do not only reduce the probability of flooding, also create, here and there, some space for water.**”

scientific publication (van der Most et al. 2010)

Figure 5 Quotes illustrating the idea Water is our Friend, not our Enemy

The statement that water should not be our enemy but our friend makes a pledge for an attractive landscape and other ‘soft’ values on which the flood risk system can have an impact. Yet, the idea opposes two approaches that have always existed, and will always exist, side by side. Under the old paradigm perhaps, the aesthetic and emotional values of water were not acknowledged by policymakers (but they certainly were by others). Still, water has always had functions through which it is logical to consider water as an ally, like shipping, drinking water and agriculture. Under the new paradigm there will still be storms and heavy rainfall, at rare times, when the water surely feels like an enemy to all.

Furthermore, it is not clear exactly why this polarisation is made. It would be a clear standpoint to want to allocate a smaller part of the water management budget to fighting floods and more to increasing quality of life, or to obtain additional budgets to finance particular water-as-a-friend objectives, separate or integrated with flood risk. Instead of taking a clear defensible position like this, it is often claimed that when we treat water as a friend, its hostility will be reduced – a confusing idea that can never be true in general.

How could this idea be damaging? When it is unclear how enemy and friend-oriented objectives and budgets are connected, it matters which parts of the budget is directed to which issues, making it harder to make and explain decisions. The prerequisite that projects have to address water as an enemy and as a friend simultaneously, excludes packages of measures that meet both objectives separately against lower costs than their integrated alternatives (figure 8). In 2005 the Netherlands Bureau for Economic Policy Analysis (CPB), presented an alternative to the concept of ‘making room for the river’, with flood risk reduction projects and nature-oriented projects partly separated, generating lower total costs but with more total natural value (Ebrecht et al., 2005). The recommendation was discarded, possibly influenced by the idea that ‘water as a friend’ should not be treated separate from ‘water as an enemy’.

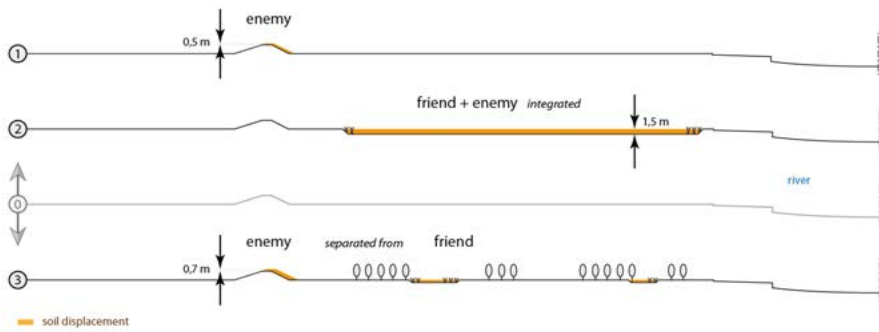


Figure 8 The idea that water should become our friend to reduce its hostility, favours certain measures without carefully considering the pros and cons of alternatives. In this figure, the three redesigns of the river profile give the same increase in discharge capacity. Option 1 treats water as an enemy. Option 2 is a typical *room for the river* floodplain excavation: water as a friend. Dyke heightening is avoided, but to achieve the same increase in discharge capacity as option 1, more than ten times as much soil than with option 1 has to be displaced. The resulting nature is high-maintenance; vegetation has to be cut frequently to keep roughness low. Option 3 treats water as friend and enemy separately. Vegetation can grow freely in the flood plains (water as a friend) because the increase in roughness is compensated by the dyke (water as an enemy). This option, if mentioned at all, has no support in the Netherlands

2 – The spiral of risk

In the cabinet’s decision on the fourth water plan, the ministry of public works and water management wrote:

“In the Netherlands we have been building levees and quays for many centuries. The higher and stronger these become, the larger the sense of safety. This makes the embanked land attractive for developers and investors. Large investments in their turn ask for more protection and therefore more enforcement of flood defences. This makes us go around in a vicious circle. [...] Extreme circumstances like storms at sea and high river discharges ask for extra space, space with which the spiral of land subsidence and raising dykes, of encroaching development and the call for flood protection, can be broken.” (V&W, 1998)

Two years later, a heavyweight report by multiple governments from the lower rivers region stated: *“upgrading levees alone is eventually a dead-end road, and will lead to increasing risks for consequential damages of possible floodings”* (de Jong et al., 2000). A scientific publication mentions that in the Netherlands *“the height of the dams will have to be increased for centuries to come [...] the chance of flooding is reduced, but the potential damage after a storm flood is enlarged: seawalls and dykes provide a false sense of safety against flooding.”* (Smits et al., 2006) Figure 10 was published in a national policy vision document. See figure 11 for an indication of popular or preferred measures found in the context of the quotes.

"Ongoing embankments and sedimentation of the floodplains forced the high river discharge in an **ever tighter corset**. In stead of dealing with the deeper underlying cause, solutions were sought in clearing natural obstacles in and along the river. Also the levee enforcements, which started around 1820 and are still going on, fits in an agrarian spirit of age, whereby of course also the increased economic importance of the embanked area plays a part. Looking back at 150 years of levee enforcements, we can not withdraw the impression that this is, in part, a **vicious circle, which can not be broken as long as intensive agriculture dominates the floodplains.**"

NGO report (Helmer et al. 1992)

"The historical traditions of large embankments and similar infrastructure are still being replicated (...). **This reliance and belief in large technological solutions is known as 'technological entrapment'**, and whilst new embankments may be appropriate in certain circumstances, a reliance on these and other 'big' solutions exclusively risks a loss of flexibility, adaptability and ultimately sustainability in flood-risk management."

scientific publication (Zevenbergen et al. 2010)

"Risk was defined as the product of the probability of being flooded and the scale of the consequences. In the Netherlands, it was argued, the reduction of this probability had allowed an ongoing expansion of the economic value and of land use behind the dikes, thus enhancing the vulnerability of the country, in case of another exceptional flood. Ultimately, the risk had not been reduced as much as was widely believed. Thus, the government was confronted with the paradox that **the smaller the probability of flooding, the higher the vulnerability.**"

scientific publication (Correljé & Broekhans 2014)

"The question is what counts: the safety behind the dike, or the safety of the dike itself. (...) The discussion we have had lately, is about the transition to a **new approach, to the safety behind the dike, the real safety for the people behind the levees.**"

parliamentary discussion (van Veldhoven & Sneep 2012)

"Our forefathers would **not for a moment have thought of building in the lowest parts of our country**, but our contemporary planners see no problems at all."

popular-scientific book (van Duijn 2007)

"(...) the height of the dams will have to be increased for centuries to come, because the land behind the levees cannot grow in elevation anymore with the rising of the sea. Maintenance of the civil-engineering structures, and mitigating their unpredictable impacts on ecosystems, involve very high recurrent costs. **The chance of flooding is reduced, but the potential damage after a storm flood is enlarged: seawalls and dykes provide a false sense of safety against flooding.**"

scientific publication (Smits et al. 2006)

"From a socio-economic point of view, the impression of safety bestowed by the dykes, invites people to invest money behind them. Towns and villages prosper and tend to grow. Although the frequency of a potential disaster has diminished, the potential damage to lives and goods increases: the impression is therefore false. Especially in times of poor maintenance of the dykes (war, recession) this becomes only too obvious.

(...) In the 50 years after 1953, huge investments in trade, industry, and infrastructure were made. The population increased very considerably. Individuals took many decisions to invest behind the dykes. The government not only did nothing to prevent this development but, on the contrary, favoured this development.

(...) Storms that do almost no harm in a natural situation, turn into catastrophes when dykes are breached. This has been the rule for a thousand years.

(...) The huge dams may be technical masterpieces for control of the tidal dynamics of the sea, but they fail to control the socio-economic processes they unleash, and their existence is irreversible. **The chance of flooding is reduced; the potential damage is enlarged, so the net result is zero or worse."**

NGO report (Saeijs et al. 2004)

"Costs for room for the river are higher than those for levee upgrades. But it has to be noted that **upgrading levees alone is eventually a dead-end road, and will lead to increasing risks** for consequential damages of possible floodings."

major regional policy document (de Jong et al. 2000)

"Ecologic recovery of our entire river system is possible. This recovery simultaneously offers great opportunities to solve other problems. Related to this I would like to mention, considering the political debate, **breaking the vicious circle of the river dike enforcements."**

foreword NGO report (Helmer et al. 1992)

"It is increasingly recognised that engineering responses alone cannot accommodate the future frequencies and impacts of flooding. Moreover, the mere use of **large infrastructure, particularly flood protection, has the risk for 'technological lock-in' or for 'investment trap'**, creating a path dependency that reduces the opportunities to take alternative or complementary measures."

scientific publication (van Herk 2014)

"Municipalities build in areas vulnerable to flooding, today and even more in the future: deep polders, regions with settling soil and groundwater seepage, or areas directly behind high levees. This is not only a consequence of the relatively short planning horizon common in current spatial policy-making. Also the repetitive emphasis on civil engineering measures contributes. Levees are raised step by step, surface water is pumped away ever deeper. This results in a slow increase between ground levels and maximum water levels, and slowly **we reach the limits of the system."**

policy research report (Pols et al. 2007)

Figure 9 Illustrative quotes to the idea of The Spiral of Risk.

The captions give the document titles (for the major national policy documents) or the type of document (for other types of documents).

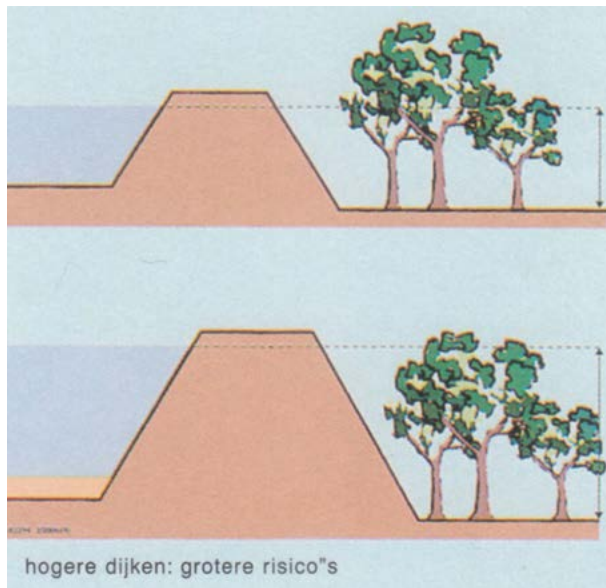


Figure 10 'Higher dykes, larger risks' (DG Water, 2000). See also figure 12

<i>Types of measures</i>	<i>the Spiral of Risk</i>	
Disaster management	generally favoured	<i>The related concepts 'Safety Chain' and 'Multi-level Safety' emphasise disaster management.</i>
Local measures and risk zoning	generally favoured	<i>Measures behind the dike are considered ways to break the Spiral of Risk.</i>
Upgrading dikes	generally disfavoured	<i>Higher dikes are core to the Spiral of Risk. Wider dikes are favoured over higher dikes.</i>
River widening and deepening	generally favoured	<i>Lower high river levels reduce inundation levels and substitute higher dikes.</i>
Redirecting flows on a higher scale level	generally disfavoured	<i>Storm surge- and river discharge distribution control objects are part of the dike system.</i>

Figure 11 A brief overview of the types of measures favoured and disfavoured in the context of the illustrative quotes to the idea of the *spiral of risk*

This concept of a vicious circle relates to a fear of relying too heavily on technology. It is sometimes called *technological entrapment* (Van Herk, 2014), or the *spiral of risk* (Rijcken, 2007). The idea has three parts: (1) investments to reduce flood probability and potential flood damage enhance each other eternally, (2) this should be stopped and (3) this can be stopped.

Flood probabilities often contribute to decisions to settle or invest somewhere, and settlers tend to want to further reduce flood probabilities when they develop. This can come to a halt for some time, for example when flood

protection is over-dimensioned and growth slows down. There will always be maintenance however, so when this is taken into account we may speak of being entrapped in never-ending effort. But should this really be avoided? The historic transition from hunting and gathering towards agriculture and industry is a tremendous entrapment, yet acceptable to most of earth's inhabitants.



Figure 12 Part of the *spiral of risk* idea is that dyke heightening provides a 'false sense of safety'; risks would increase because higher dykes lead to higher inundation depths. In this reasoning, damage is confused with risk. For Dutch rivers, roughly, a 40 centimetre higher water level has a ten times lower probability of occurrence. According to the *stage-damage curve* for an average dyke ring, a 40 centimetre higher inundation depth yields less than 10 per cent more damage. As risk is probability times damage, the new risk is $0,1 \times 1,1 = 0,11$ as large as the old risk. With dyke heightening, risk decreases more than ten times faster than damage increases. Safety is the inverse of risk. A sense of *absolute* safety may not be justified, but a sense of *increased* safety when a dyke is heightened, surely is

Several options have been presented to break out of the vicious circle of levee enforcements. For example, lowering high water levels – first by excavating the agricultural flood plains, then by relocating the embankments away from the river (Helmer et al., 1992; DG Water, 2006; PBR, 2013). In the Netherlands, if these types of measures would be implemented to the fullest there would still remain an average of 7 to 8 meter difference between the design water levels and the embanked land (Silva & Van der Linden, 2008). Slightly lowered water levels will not stop the spiral of risk from spinning.



Figure 13 New neighbourhoods on mega-mounds to avoid an increase in flood damage and thus flood risk (designed by landscape architects Stroming. Images taken from: Aerts et al. 2008)

A second way out of the vicious circle could be offered by additional flood risk reducing measures on scale levels lower than dyke rings, like risk zoning, abandoning areas, flood-resistant buildings, mounds (figure 13) or evacuation plans (Saeijs et al., 2004; Pols et al., 2007). This idea influenced two popular concepts: the *Safety Chain* (Ten Brinke et al., 2008) and *Multi-Layered Safety* (DGW, 2009; Hoss et al., 2013). Much can be said about which aspects of these concepts make sense or not, and which aspects are related to values and politics. The essence is that throughout the world a pragmatic approach to flood risk has always been to focus on the most effective measures, instead of spreading measures between scale levels as a goal in itself.

In the Netherlands, investments in prevention (mainly dykes) cover a small area and protect a large area, and when they work, they work completely. Measures inside the protected area (like flood-proof buildings) however, have to be applied in vast areas, and have a limited total effect when the preventive scheme fails (Jongejan et al., 2012; ENW 2012). Figure 14 illustrates some of these principles. When a country has arrived at a point where sufficient prevention requires no more than maintenance and occasional upgrades, this is from a pragmatic perspective, not an *entrapment*, but a safe haven. The illusion is not *complete safety*, but that the spiral of risk should and can be broken.

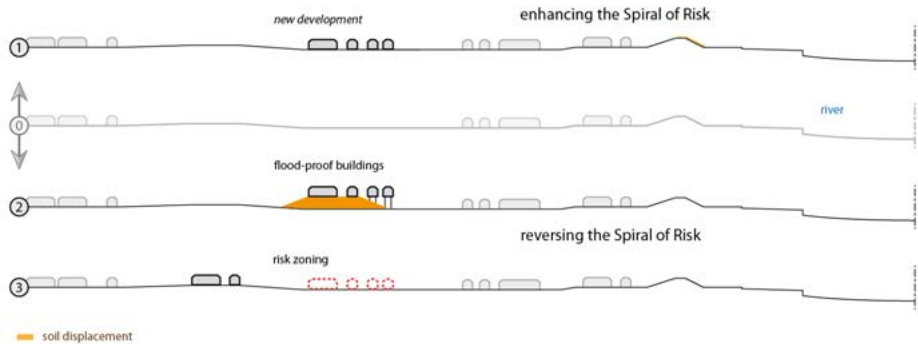


Figure 14 The *spiral of risk* idea suggests that the interdependency between flood protection and economic development is dangerous and can be reduced, for example by flood-proof buildings and risk zoning. Looking at properly scaled typical cross-sections, knowing that a Dutch dyke ring is easily 25 kilometres wide (on the scale of this drawing another *ten meters* to the left), it appears that flood-proof buildings (option 2) protect only new developments and quickly require much more soil displacement (or effort) than dyke heightening (option 1). The idea of *risk zoning* (option 3) is that higher areas are favoured for development over lower areas. This dyke ring floods, say, with a probability of 1:1000, and flood damage as a percentage of building costs may be 40 per cent for option 1, twenty per cent for option 3. Yearly flood risk relative to the building costs now differs between option 1 and option 2 by 0,02 per cent. In practice, the benefits of risk zoning will be crushed by other considerations for development, such as land value and proximity to infrastructure

The spiral of risk idea is potentially harmful in many ways: in an attempt to break the vicious circle, tax money earmarked for risk reduction is spent on projects while cheaper alternatives for more risk reduction are neglected; flood-proof building regulation and zoning add unnecessary red tape to city and landscape development, public awareness campaigns to change the behaviour of citizens end in vain, hammering on potential flooding deters foreign investors, etcetera. This is a sensitive topic in current Dutch policy-making – it is stressed that these are *potential* pitfalls.

3 – Moving with nature

In a report for the Fourth National Water Plan, a group of senior consultants write, *“the river fights back”*, referring to the swollen rivers of 1993. They ask: *“when we build, operate and manage infrastructure, do we choose to connect to natural processes, or will on the contrary, the oppression of natural processes be our starting point?”* (Projectteam NW4, 1995). The cabinet’s position on water management states that:

“The natural coping capacity of the delta has largely been lost. With technical means like raising dykes and pumping alone we reach the limits of what is possible. (...) The restrained natural forces will sooner or later be stronger than man. This can be avoided by no longer working against nature, but working with nature.” (DG Water, 2000)

An essay published by the ministry of spatial planning and the environment contains another example:

“Moving with water means that where flows are too strong, we will give; where sediment accumulates, we will take. [...] The Netherlands will thus achieve its natural water order, and will no longer be a giant prosthesis.” (Van Schuppen, 2007)

The Delta Commission of 2008 recommends that new developments should: *“move with natural developments, induced by climate change and other natural processes. We build and develop the country as much as possible in harmony with ecological processes.”* (Deltacommittee, 2008)

The recent annual Delta Program reports mention ‘moving with natural processes’ a few times, and use the term ‘natural flood defences’ more than ten times, especially in the 2013 report (Deltaprogramma 2010; 2011; 2012; 2013). Figure 16 shows a typical example of a natural flood defence. The quotes were often practiced in a context of certain popular or preferred measures; see figure 17 for an indication.

"[The Netherlands have to] develop along with climate change. Moving along with-, and making use of natural processes where possible, leads to solutions to which man and nature can gradually adapt. [...] Attempts to control nature will demand ever larger (and more expensive) effort. [...] We [should] **build and develop the country as much as possible in harmony with natural processes.**"

Deltacommittee (2008)

"(...) a natural stream is excavated, 60 meters wide and 1,2 meters deep"

web post (Coalitie Klimaatbuffers 2014)

"**The natural coping capacity of the delta has largely been lost.** With technical means like raising dikes and pumping alone we reach the limits of what is possible."

Anders omgaan met water (DG Water 2000)

"We are trying, less than we used to, to curb and restrain the forces of nature, but rather we try to better understand and guide them."

newspaper essay (Geldof & van Hilten 2006)

"(...) one might say that **Mother Nature**, old and wise, extends her hand to show us how we should and how we shouldn't interact with her.

All we have to do is listen and pay attention and follow her advice.

We must simply 'be her guest'. Let's not forget that she has 3 billion years more experience than we have, and was doing a wonderful job long before Man entered the scene. In fact she produced us!"

popular scientific book (Saeijs 2008)

"The Netherlands thought they had won the battle against the water: the Delta works are done [...] and the rivers have been laced up with dikes and dams. The water is caught in asphalt, steel, basalt and concrete, but maintenance costs increase day by day. At the same time, the Netherlands are sinking, because of the intense pumping and **natural processes like sedimentation and peat growth have been halted.**"

web post (Coalitie Klimaatbuffers 2014)

"Everywhere in the world, the reaction of people is the same: if something serious happens, you want to restore the old situation. For the consequences of Superstorm Sandy this is exactly the wrong reaction. **Working against nature is not a solution.**"

web post (Ovink & I&M 2013)

"In the policy concerning flood control and water management, 'hard core' civil engineering approaches are discussed and substituted by approaches which emphasize resilience and working with nature. (...) [This] approach has been applied predominantly in rural areas while in the urbanised western part of the country a more traditional combination of 'hard core' hydraulic engineering and urban planning seems to be the best option. (...) Two serious high-water situations in the river area in the mid-1990s enhanced **the idea that the era of controlling nature was finished.**"

scientific publication (Meyer 2012)

"The system is not capable to handle extreme circumstances (...), and it is therefore required that we give space to water and **restore natural processes.**"

Watervisie (DG Water 2007)

"Connecting to natural processes by restoring the resilience of water systems will provide important guidance for future water management"

Vierde Nota Waterhuishouding (V&W 1998)

"A delta without dykes is safer than a delta with dykes, because **natural processes will weaken the effects of extreme storm floods.**"

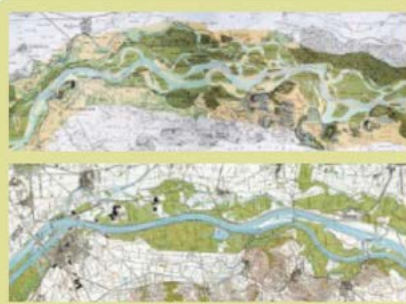
scientific publication (Smits et al. 2006)

"Water systems need playground to cope with unforeseen developments. For the rivers, this means water conservation in the entire catchment and expanding the flow profile, in stead of the next round of levee enforcements. (...) We have to **remove unnatural obstacles in the river bed. (...) for the coast sustainable safety means space for natural processes.** The less we fixate the coast by hard constructions such as levees, dams and permanent buildings, the less the effort to keep the coast at its place"

Vierde Nota Waterhuishouding (V&W 1998)

"Moving along with water means: where flows are too strong, we will give, where sediment accumulates, we will take. (...) **The Netherlands will thus achieve its natural water order**, and will no longer be a giant prosthesis. (...) Typical water infrastructure elements are the inlet and outlet for emergency storage areas, broad coastal defenses and room for the river. Housing in areas with 'dynamic water management' are historical typologies such as houses on mounds, on dikes, floating homes and – lest best – the drowning house. (...) It is a mentality of reversal, of paradox: dikes, quays and sluices built to keep the water out, can easily be transformed to function in a system aimed to let the water in."

essay (van Schuppen 2007)



"The natural course of the river has been canalised by man. Now, the river reclaims its original space. Normalisation has, apparently, not been a sustainable solution. The maxim should be: **anticipate and move along with the natural dynamics of the water** and be prepared for the long-term consequences of climate change."

Waterkoers 2 (DG Water 2006)

"(...) **building with nature offers a much better protection than the technical solutions that go against nature.** We are doing this along the coast, for example; sand nourishments so the coastline expands. I really believe in building with nature. (...) You get more stability when you implement both nature as well as technology. Insights about what works best are changing."

newspaper article (Schultz et al. 2013)

Figure 15 Illustrative quotes to the idea of Moving Along with Nature



Figure 16 *Redesign of the Dutch Closure Dam* by landscape architect Hosper (Lammers, 2009). The green land to the left is currently not there; vegetation is to grow over artificial sand nourishments of several metres high. The concept is promoted by the NGO *Natural Climate Buffers*, in which the major Dutch nature conservation organisations collaborate. The NGO frequently uses the terms *natural safety* and *natural flood defences* in their communication, for example towards the Delta Program (SNK, 2014). Also see figure 19

<i>Types of measures</i>	Moving Along with Nature	
Disaster management	not mentioned	<i>In the context of the quotes, disaster management measures were not mentioned</i>
Local measures and risk zoning	some measures favoured	<i>Prohibiting to build in certain areas (zoning) is sometimes called Moving Along with Nature</i>
Upgrading dikes	generally disfavoured	<i>Dikes are considered acting against nature, oppressing natural processes, etcetera.</i>
River widening and deepening	generally favoured	<i>Measures in the river bed are called natural and often accompanied by nature restoration.</i>
Redirecting flows on a higher scale level	some measures favoured	<i>Open estuaries are natural, dams act against nature, movable barriers are in between.</i>

Figure 17 Brief overview of the types of measures favoured and disfavoured in the context of the illustrative quotes to the idea of *moving with nature*.

These quotes reflect a strong interest in nature conservation and restoration, and in something transcending human interventions and technology, but the terms are not clearly defined. What does it mean to connect to a natural process or to give in when a flow is too strong? In the documents, this is not defined, but exemplified by measures, like ones that direct water sideways instead of upwards (figure 18). Other typical measures are coastal sand nourishments (figure 19) and excavated bends to de-canalise rivers. A term cannot be defined by examples however. In the Dutch dictionary, the word ‘moving along’ does not exist, and in the water literature, a working definition is nowhere to be found.

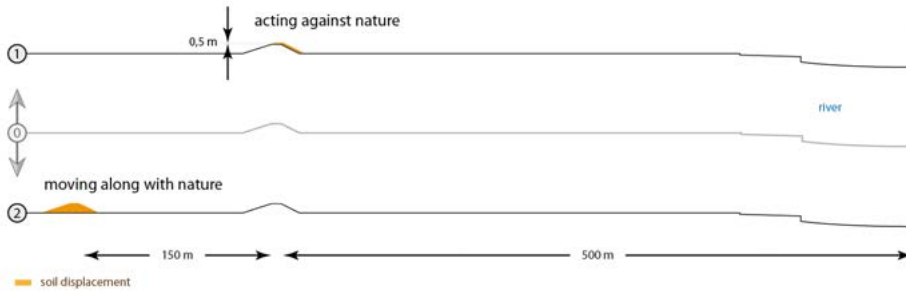


Figure 18 The idea that the flood risk system should *move with nature* favours additional horizontal space over extra space in a vertical direction. According to the formula $Q = C \cdot B \cdot H^{3/2}$, roughly 0,5 metre dyke heightening (option 1) and 150 metre river widening (option 2) give the same additional discharge capacity. Both result in highly man-made river profiles

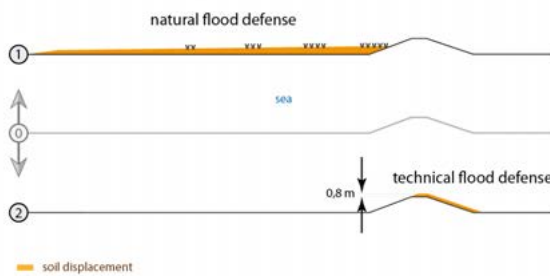


Figure 19 Artificially elevated foreshores along the coast are often considered *natural flood defences*. How much soil is to be displaced by machines does not determine how natural a measure is. There is currently no scientific agreement that option 1 can provide the same protection as option 2

The frequent use of ‘natural flood defences’ might be a serious indication that among water professionals the definition of the word ‘natural’ is changing. Most commonly, something is considered natural when its shape or place has been caused by a force other than induced by a conscious human decision. The forty-four quotes in figure 15 are all made in a context of human interventions: no one advocates making the flood protection system more natural by doing nothing. So what is meant by a natural measure or a natural system?

Let’s consider some contexts in which these terms are practiced. The concept *building with nature* is clearly defined: wind and currents distribute building materials (mainly sand), and/or building components are designed

such that they attract or facilitate flora, fauna and/or entire ecosystems (e.g. Waterman, 2008; Deltares, 2014). Nature is a force or a cause.

Most *room for the river* projects are about lowering or widening the river bed by turning agricultural flood plains into natural parks, digging bypasses and lakes for fish and birds or growing wild vegetation on excavated farmland (e.g. V&W, 2006; Q-team, 2008, 2012). Nature is an occupant of space.

Along the coast under the *dynamic coastal management* policy, twelve to twenty million cubic metres of sand is added to the coastal system each year to maintain a certain geographical base coast line and allow more sand to blow freely through the dunes. This contrasts to an alternative with less replenishments and more dunes fixed in place by planted grass or revetments, which would create a less diverse and smaller dune landscape (e.g. DGW, 2009).

It seems that a *measure* is called natural when it supports a native, diverse or attractive ecosystem. A *system* is natural by the same definition, or when it resembles the way it was before the interference of man. With this additional definition of *natural*, about half of the quotes in figures 13.3 and 13.4 could be removed. The other half refers to the poorly defined idea ‘moving with nature’. Both terms however are likely to arouse suspicion by an observant reader, and this suspicion is why an unclear definition is not only a linguistic flaw, but can represent a serious political issue.

According to epistemologists Collins and Evans the argument for the natural is “*about as unsophisticated an argument as one can find*” (Collins & Evans, 2007). People using the term *natural flood defences* may be suspected to not really know what they are talking about or not to express the real arguments. In the Netherlands, societal interest and political lobby for ecosystem conservation and restoration are strong. To many lobbyists the end justifies the means, and for the environmental lobbyists it is attractive to connect their cause to flood safety, a strategy publicly announced by World Wildlife Fund (Opmeer, 2013). Ambiguous and undefined terms can obscure the fact that a budget for an integrated project is primarily justified by providing safety, but is spent primarily on nature development.

3. DISCUSSION

The search for debatable quotes could have been more extensive but was sufficient to explain and discuss the debatable ideas and show that they are not marginal. More quotes and debatable ideas could be found with deeper searches in the same documents, other documents, or with web searches, possibly extended towards documents from international sources. A strict distinction between different types of illustrative quotes could help to reveal when an idea is formed, when it is taken for granted and when it might have disappeared.

A quoted author might say that he or she meant something else than what appears in this paper. It would be respectful and interesting to interview the authors of each quote or to take an entirely different approach and send a questionnaire about the same ideas to water professionals. This might yield additional debatable ideas or different interpretations of the fourteen selected ones. It would also be interesting to include the background of the authors, like engineering, geography or law, and see if there are correlations with certain ideas.

Still, many water professionals, engineers and others, will recognise the fourteen ideas, and acknowledge that it is healthy to discuss them. Achieving safety and related objectives require reasonings that are able to withstand critique.

After the Dutch Delta Works, new ideas about the flood risk system emerged among Dutch water professionals. These new ideas deserve a critical analysis. In this paper fourteen ideas that can be carefully called *debatable* but are also well known were formulated and scrutinised. Twenty of the most important national policy documents and 26 other publications were searched for quotes illustrating the ideas and to find out whether the ideas are broadly shared or marginal. The three most prominent and controversial ones were selected to elaborate further. Ten quotes were found related to the idea that ‘water should not be our enemy, but our friend’, fifteen to the idea that flood protection entraps us in a dangerous ‘spiral of risk’ which should and can be stopped, 45 were related to the idea that flood risk reducing measures should be ‘natural’ or ‘move with nature’. These numbers suggest that these three ideas have not been marginal.

The general critique to all debatable ideas would be that they present preferred measures as generally logical conclusions without a systematic comparison of alternatives for particular situations. Clearly negative effects such as reductions in safety, deliberate deception of the public or squandered tax money cannot be established, and general beliefs among the decision-makers are not the only factors leading to decisions. In this paper it was chosen not to delve into all considerations leading to the major decisions since 1990.

Behind these new ideas lies increasing societal interest in objectives like an attractive water landscape (water as a friend), reducing our dependence on technology (spiral of risk) and nature conservation and restoration (moving with nature). Some might argue that these worthy ends justify all means, even conceptual weakness in the underlying ideas. Others believe that the *content* of ideas is of minor importance, as long as a proper democratic decision *process* has been followed. This paper revolves around the idea that content matters, and that widely shared ideas about the system in one way or the other have had an impact on decisions. If arguments contain questionable ideas, this weakens the outcome of decision-making: the means justify the ends.

Types of measures	Friend	Spiral	Nature
Disaster management	not mentioned	generally favoured	not mentioned
Local measures and risk zoning	some measures favoured	generally favoured	some measures favoured
Upgrading dikes	generally disfavoured	generally disfavoured	generally disfavoured
River widening and deepening	generally favoured	generally favoured	generally favoured
Redirecting flows on a higher scale level	some measures favoured	generally disfavoured	some measures favoured

Figure 20 Favoured and disfavoured measure types in the contexts of the three debatable ideas. It seems they all favour river widening and deepening, and disfavour dyke upgrades

This survey leads to a couple of conclusions, presented as theses, open for discussion. Under almost all debatable ideas lies a general aversion towards dyke heightening – see figure 20. Throughout history, conceptual thinkers have always pointed out negative aspects of dyke heightening (Van der Ham, 2004), and dyke heightening has met fierce opposition by local habitants (Van Heezik, 2007). Perhaps after the River Delta Plan (1995–2000), avoiding dyke heightening became an objective in itself, and people were less critical towards the underpinning of available alternatives to dykes.

Studying ‘water as a friend’ and ‘moving with nature’ has suggested that people, by merging ecosystem restoration and nature development with flood risk objectives, conceal how important nature really is to them. Perhaps stakeholders are ready for ‘natural’ flood defences but do not dare to take a stand for nature development as an objective in itself, deserving a large national budget.

Perhaps people are attracted to debatable ideas because the flood risk system is not easy to comprehend. Grasping risk and probability is notoriously difficult (Ropeik, 2010; Taylor, 2011) and the interplay between flood risk-related objectives can be complicated. Nowadays more people are involved in the decision-making process than half a century ago, but many stakeholders have little time to learn about the system. It is fast and easy to hitch on to a simple grand idea that appears to have transcended the complexity of the system.

The topical concepts *storytelling* (Hajer et al., 2011) and *framing* (De Bruijn, 2011) explain, and in part support, the power of general ideas. An effective story creates meaning and engages a community; an effective frame wins a political dispute. Narrative persuasion is important to get things done, but

the flood risk system heavily relies on a complicated physical reality, well served by craftsmanship and custom-made solutions. The problems and budgets at stake are large enough for a systematic unravelling of objectives and an overview of the spectrum of possible solutions, before any decisions are made. General ideas distort a well-balanced overview, but they will always be around. New interactive information systems, like the SimDelta concept illustrated in figure 21, might lend the systematic approach a helping hand.



Figure 21 The SimDelta concept (Rijcken et al. 2012; Rijcken & Christopher 2013; DUT 2014) aims at representing the Dutch flood risk system in a clear consistent graphic language. Web technology enables insight and overview. There is room for general ideas, stories and framing, but these are subordinate to fundamental concepts about risk, objectives and solutions

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Not all quotes found are presented in figures 2, 3, 4, 5, 9 and 15. National policy documents in which no illustrative quotes were found, are not added in the reference list. In some documents, more than one illustrative quote was found.

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Flowscapes. Designing infrastructure as landscape

Social, cultural and technological developments of our society are demanding a fundamental review of the planning and design of its landscapes and infrastructures, in particular in relation to environmental issues and sustainability. Transportation, green and water infrastructures are important agents that facilitate processes that shape the built environment and its contemporary landscapes. With movement and flows at the core, these landscape infrastructures facilitate aesthetic, functional, social and ecological relationships between natural and human systems, here interpreted as Flowscapes. Flowscapes explores infrastructure as a type of landscape and landscape as a type of infrastructure. The hybridisation of the two concepts seeks to redefine infrastructure beyond its strictly utilitarian definition, while allowing spatial design to gain operative force in territorial transformation processes.

This academic publication aims to provide multiple perspectives on the subject from design-related disciplines such as architecture, urban planning and design, landscape architecture and civil engineering. It is a reflection of a multidisciplinary colloquium on landscape infrastructures held at the Faculty of Architecture and the Built Environment, Delft University of Technology, preparing grounds for in-depth discussions and future collaborations. The authors explore concepts, methods and techniques for design-related research of landscape infrastructures. Their main objective is to engage environmental and societal issues by means of integrative and design-oriented approaches. Through focusing on multidisciplinary design-related research of landscape infrastructures they provide important clues for the development of spatial armatures that can guide urban and rural development and have cultural and civic significance.