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This paper aims to introduce the particular methodology of the author's and their colleagues at TU Delft Chair of Landscape Architecture. This approach is characterised by theories, methods and techniques converging towards design research and research by design. The relation and interaction between these research domains is illustrated with examples from research and education establishing design research and research by design as a coherent methodology.

technical, cultural and economic substance. The form involves the way in which the parts are assembled into a composition (Steenbergen et al. 2008).

The profile of Landscape Architecture at TU Delft is made up of three constituent domains, interrelating research and education (Steenbergen et al., 2010). They showcase the field of operation:

- **Architecture and Landscape** continues to develop the theoretical and methodological bases by investigating contemporary landscape based architecture, the use of new methods and techniques such as GIS and other advanced software, and the role of mapping/drawing in landscape architectonic research and design (examples: Steenbergen & Reh, 2003; Steenbergen et al., 2008; Nijhuis et al. 2011).
- **Dutch Lowlands** addresses the implicit architectural quality of man-made polderscapes, the Dutch lowlands seen as a design laboratory to tackle worldwide questions of water management, and the Fine Dutch Tradition as a framework for landscape design that ingrates civil engineering, architecture and urban development (examples: Steenbergen et al., 2009; Bobbink, 2009; Wit, 2009).
- **Urban Landscapes** explores landscape as form and artefact of the urban realm. It deals with constructed open spaces within the city, the landscape structure, underlying urban patterns, the landscape of urban hinterlands and the interstitial spaces between cities. In this approach landscape is seen as that what

The specific focus of Landscape Architecture at the Faculty of Architecture, Delft University of Technology is on the understanding of the formative elements behind the (urban)landscape and on the development of design methods and strategies, which can intervene and direct development of the landscape. Landscape Architecture considers the landscape as a composition of natural, cultural, urban and architectonic elements in relation to ecologic, social and economic parameters and can be understood by means of morphological research (Steenbergen & Reh 2003; Steenbergen et al. 2008). According to this way of thinking, there is a relationship between the content and the form. Content is everything that comprises the landscape architectonic object, its material, topographic,

lies underneath, the site or substratum, which is the point of departure for all design and planning (examples: Wit & Aben, 1999; Steenbergen & Reh, 2011).

This 'Delft approach' is characterised by theories, methods and techniques converging towards design research and research by design. This paper aims to introduce this particular methodology. In paragraph 2 we start with a brief introduction to the involved research domains, their variables and their relationship. Next in paragraph 3, by using examples we elaborate on the research domain of design research including plan analysis and comparative research, followed by research by design including design experiment and experimental design. Finally, we finish with some concluding remarks.

research and research by design constitutes of the following activities (Steenbergen et al. 2008).

-Design research: plan analysis, comparative research

-Research by design: design experiment experimental design

These respective research domains and their variables are positioned in table 1.

Plan analysis includes the analysis of all aspects, components and layers of the composition of a chosen landscape or landscape design in a certain context. Typological research includes the comparison of several landscape architectural compositions to establish their relationships to one another and convertibility, by means of distinguishing composition elements, composition schemes and transformations (adaptations and

| CONTEXT | | OBJECT | |
|---------|-------------------|------------------------|---------------------------|
| | | <i>Determined</i> | <i>Variable</i> |
| | <i>Determined</i> | Plan analysis | Design experiment |
| | <i>Variable</i> | Comparative research | Experimental design |
| | | Design research | Research by design |

Figure 1. Design research and research by design determined by object and context (source: Steenbergen et al., 2008)

2 DESIGN AND RESEARCH IN LANDSCAPE ARCHITECTURE

Design research (analysis of existing designs or precedents) and research by design (formulation of new designs) can be understood as variable relationships between object and context (De Jong and Van der Voordt, 2002). In fact the two research domains cannot be seen apart from each other: design research is an indispensable step in research by design. From this point of view we can consider this approach as a form of heuristics (way to find), a science that lead to new discoveries and inventions by taking a methodical approach (Steenbergen et al. 2002). It is a solid basis for knowledge based and creative design (Nijhuis, 2010). The process of design

transformations of the type, or evolution and differentiation of the type) (Steenbergen, et al. 2008; Nijhuis, 2010).

Design research, and especially typological research is characterised by a process of generalisation by focusing on, and limiting oneself to, essentials and leaving out particulars (Steenbergen, et al. 2008; Nijhuis, 2010). Klaasen (2007) puts it like this: "In the case of [landscape] design a scientific approach involves the dissociation of objects of design from a specific design context, i.e., the designing of [spatial compositions or models (types of spatial organisation principles with certain diagnostic characteristics)] - resulting in [models] 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” (Nijhuis, 2012).

In research by design, the researcher links the formal characteristics of the object under investigation and a new problem or situation. The purpose is to investigate these characteristics and identify their possibilities (Steenbergen, et al. 2008; Nijhuis, 2010). Design experiments include experiments in which particular composition elements or composition schemes are isolated and placed in another particular context. If this is done in order to investigate the context, we can speak of experimental transformation of the topography. If the accent lies on the transformation of the composition element or the composition scheme itself, we speak of experimental transformation of the type. Finally, experimental design includes experimental compositions of new urban landscapes, in which methodical use is made of design research and design experiments (Steenbergen, et al. 2008). The next paragraphs show how this heuristic approach is put into practice.

3 DESIGN RESEARCH:

ANALYSIS OF EXISTING DESIGNS OR PRECEDENTS

3.1 PLAN ANALYSIS

Design research is about analysis of a landscape or a landscape architectonic design in such a way that you can creatively use the insights you have acquired in a new design. The drawing plays a crucial role to distinguish different ‘layers’ in the design: basic form, spatial form, metaphorical form and programmatic form. These four aspects are the most general concepts that lay out the relation between the various aspects of the architectonic form and its perception in a systematic way (Steenbergen, et al. 2008)

Basic form

The basic form is the way in which the topography of the natural landscape or the man-made landscape is reduced, rationalised and activated in the ground plan of the design. In our example of the world heritage site Beemster, a lakebed polder in Northern Holland, such analysis reveals the geometrical construction as a relationship between the naturally formed lake, the central rectangle of 2 by 3 squares and it’s extension into the alternating congruent grids of circulation and drainage patterns.



Image 1: Basic form: analysis of the of the Beemster lakebed polder

Black lines: basic rectangle (grondvlak)

Dotted lines: geometrical framework

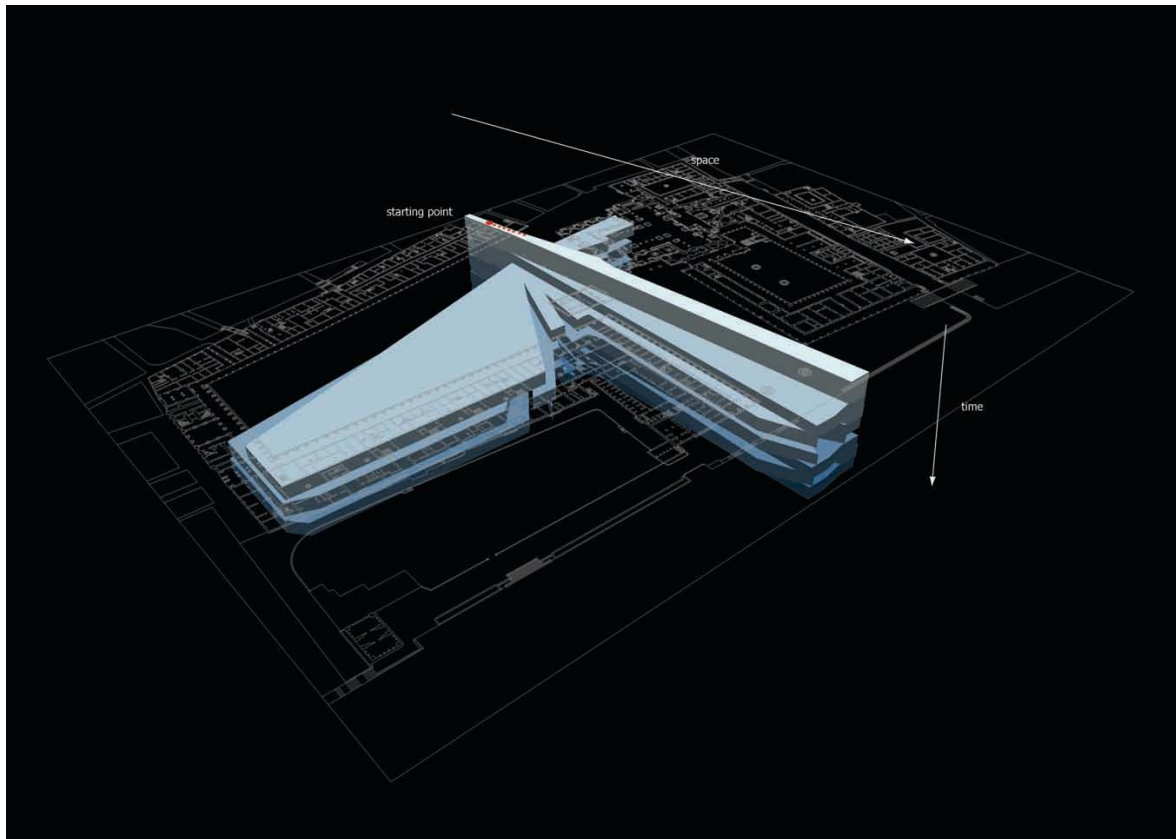
drawn on geological map in grayscales

(source: Steenbergen et al., 2009)

Spatial form

Spatial form is the form and operation of three-dimensional landscape space, which creates a spatial dynamic. This might be, for example, the framing of a landscape or urban panorama, or the construction of a spatial series along a route, making the route a picturesque landscape composition.

In the case of San Marco Square in Venice visual space analysis with GIS makes us understand the effects of this unique space in numeric analytical way. Computer generated imagery is showing the depth of viewfields of a movement trough the gate below the clock tower in time. The result is a so-called Minkowski Model (named after the German mathematician Hermann Minkowski 1864-1909 see: Nijhuis, 2010).



*Image 2: Spatial form: analysis of the Piazza San Marco, Venice
(source: Nijhuis, 2010)*

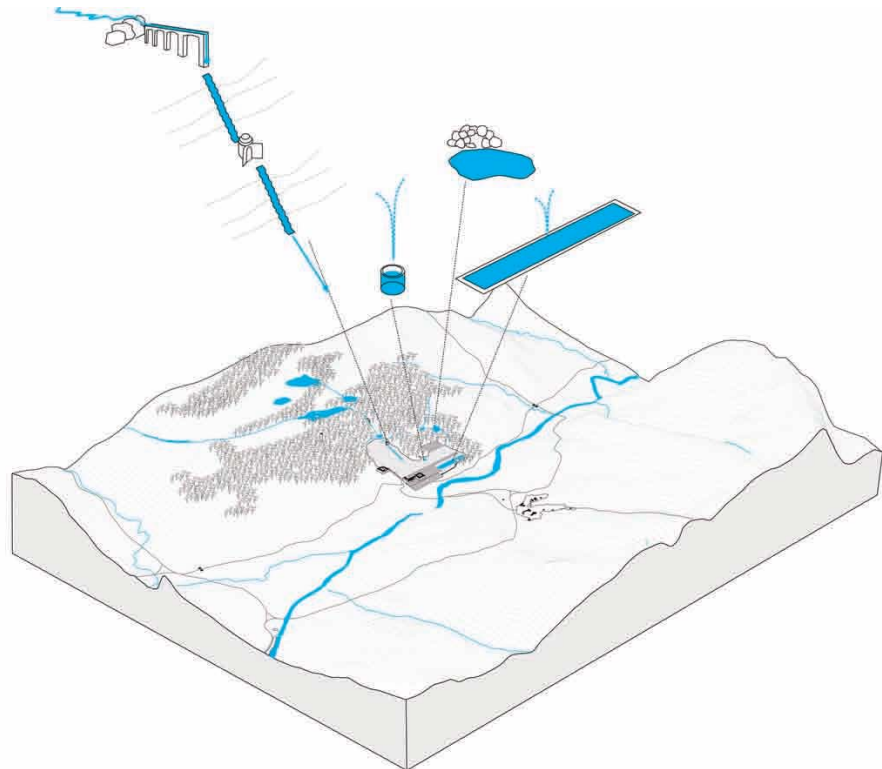
Metaphorical form

The metaphorical form is the way in which iconographic and mythological images and architectonic structural forms are connected with one another and with elements from nature, such as water, the relief and vegetation. It is the systematisation of various references to origins and to other worlds.

Within our example drawing the water system and the water elements of Chatsworth House in England are pointed out. House and gardens were constructed during the 17^e century near the river Derwent, which was drained by digging a series of reservoirs, which doubled as fishponds. Some of them still exist besides more formal water elements,

which are positioned in such away that they articulate the site and its quality very strongly. Archetypes and its symbolic of life and death (well, spring, streaming river, bridge) are translated into an aqueduct, a cascade, a rectangular Canal pond, a fountain, a fish pond etc. They become part of the landscape architectonic composition, which can be experienced by moving through the garden.

Image 3: Metaphorical form: water form analysis of Chatsworth, England (source: Bobbink, 2011)





*Image 4: Programmatic form: analysis of Central Park Manhattan
New York (source: Steenbergen et al., 2008)*

Programmatic form

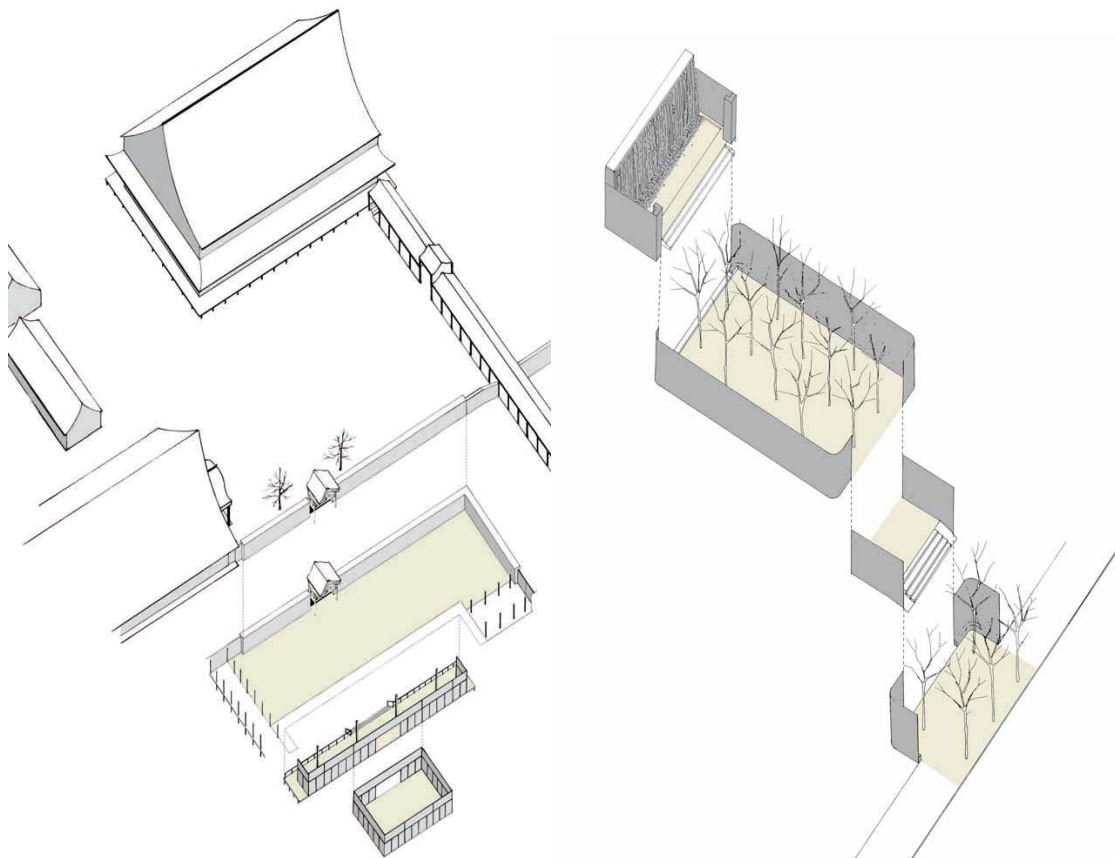
The form of the programme makes the functional zoning and the organisation of the programme in relation to patterns of movement explicit.

Programmatic form intersects with all the other formal aspects mentioned before. Combined they form the landscape architectural composition. An example like Central Park in New York certainly can be analyzed in the four formal aspects mentioned. Note that in Landscape Architecture oftentimes the program is resulting out of all the previous formal layers. Program is not to be confounded with use, as it is not per se useful to visit a park and usefulness is oftentimes not a prerequisite for design, but it can be a result.

3.2 COMPARATIVE RESEARCH

All of the knowledge we have of design is stored in compositions. In typological research one can compare compositions in order to make formal schemes and design aspects visible in their relation to the social and cultural problem posed. The type is to be regarded as a scheme, which is derived from reducing the whole of formal variants to a common basic form (Steenbergen, et al. 2008; Nijhuis, 2010)

When comparing two or more examples we are able to differentiate generic form from specific form and understand which elements are inherent to spatial garden experience in general or applicable for any metropolitan condition of a large city like New York or Kyoto and which are related to a local context of the modern Manhattan or the Imperial City.



Images 5a&5b: Comparative analysis of Tofuku-ji temple complex, Kyoto (left) and Paley Park, New York (right) (source: Wit, 2010)

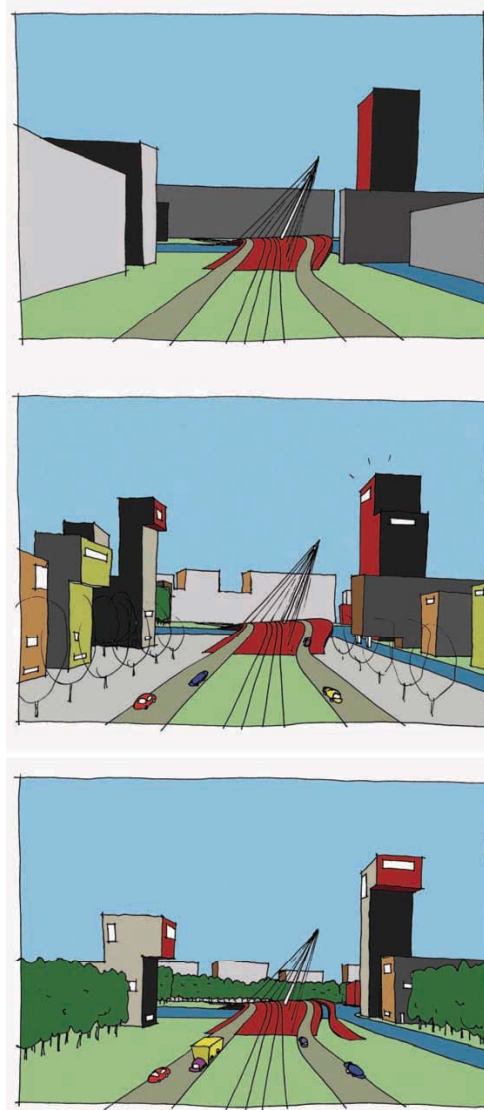
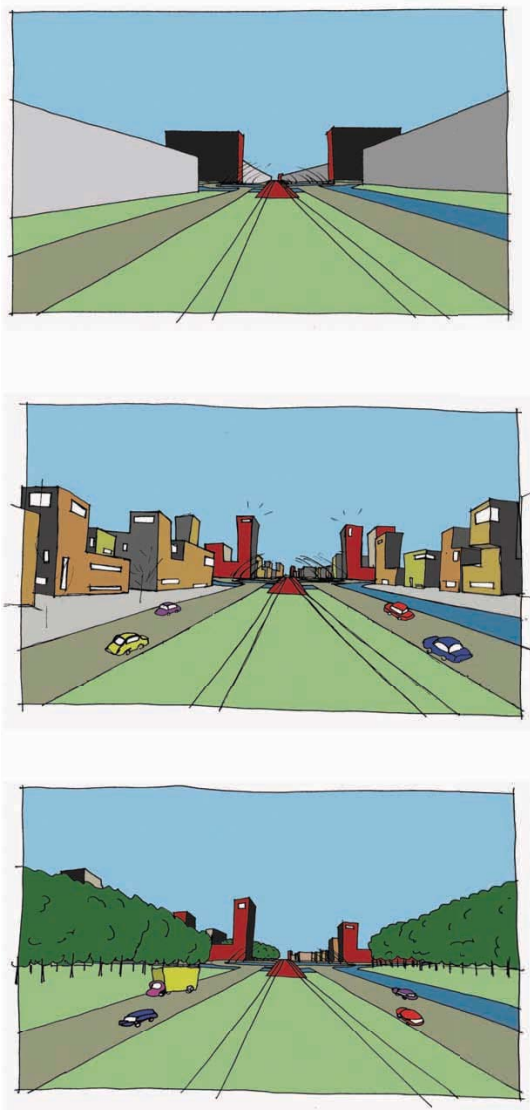
4 RESEARCH BY DESIGN: FORMULATION OF NEW DESIGNS

4.1 DESIGN EXPERIMENT (TRANSFORMATION)

A number of actual experiments are devised through which the given space can be investigated. An experiment consists of taking composition elements, or a composition scheme, from a chosen example and applying them in the situation involved. By analysing the internal rules of this composition and taking them as the basis for a critical consideration of the problem, one can discover how a new design-in-the-making relates to the known examples (Steenbergen, et al. 2008; Nijhuis, 2010)

In hand drawings based on photographs the scenography of the Great Avenue of the English Landscape Garden of Castle Howard is projected onto the 20th century Amsterdam suburb Sloterplass. The experiment is resulting in a design of buildings, fountains, planting and road layout designed as one coherent spatial composition with the eye-catching and dynamic bridge pylon as a translation of the obelisk erected in York.

Images 6a to 6f: Design experiment Amsterdam-Sloterplass, the Netherlands. Re-composition of a classic villa in a high-rise scheme drawing D. Majdandzic (source: Steenbergen et al., 2008)



4.2 EXPERIMENTAL DESIGN (MODELING)

Experimental design aims at making an integral spatial proposal. In preparing an experimental design, systematic use is made of plan analysis, typological research and goal-oriented design experiments. Working in this manner could be compared with heuristics, a science that leads to new discoveries and inventions by systematic methods. Design thus becomes a form of heuristic research, geared to exploring a possible or predictable future and the methodical discovery of the right composition (Steenbergen, et al. 2008; Nijhuis, 2010)

Ideally a complete design integrates all the formal aspects and recomposes them in spatial complexity. The object-related and typological knowledge is interpreted, combined, transformed and molded into a creative new spatial composition.

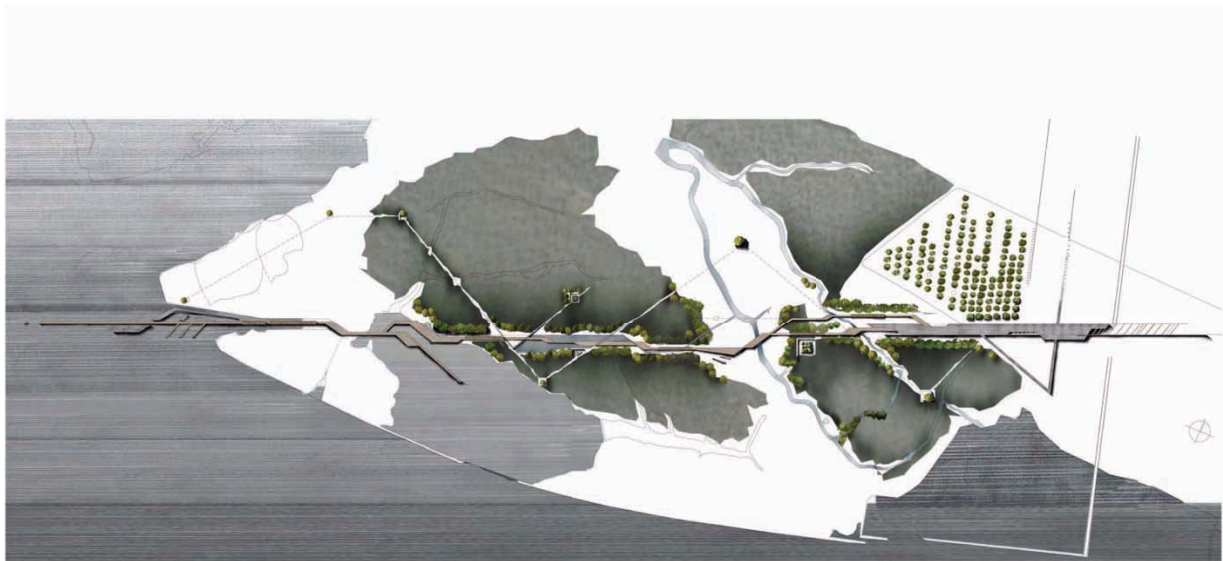


Image 7: Experimental design for an observatory for sweet water tidal landscape and indigenous zoological garden in the Biesbosch (MSc Student Work 2009 Ioannis Tsoukalas, Rober Mayr, Mai Yoshitake Tutors Saskia de Wit, Fabiana Toni, Daniel Jauslin)

5 CONCLUDING REMARKS

We can consider landscape architecture as an object or goal-oriented interdisciplinary approach that breaks down complex problems into ‘sectors’ or ‘compartments’ (which are studied by single specific disciplines) or ‘themes’ (that are subject of an object-oriented or goal oriented approach) (Antrop 2001). As such the focus of Landscape Architecture at the Delft University of Technology is on the understanding of the formative elements behind landscapes and on the development of planning and design methods and strategies, which can intervene and direct developments. The development of the research domains of design research and research by design and their variables are crucial in this odyssey. These research domains cannot be seen apart from each other: design research is an indispensable step in research by design. Together they constitute a heuristic approach for knowledge based and creative design.

Within this framework, the morphology of a landscape or landscape design is not an accident or incidental phenomenon, but the result of a developmental process (formal process). All morphogenetic, technological, functional and also cultural and ecological aspects are expressed in that form; the form of the landscape includes all other aspects and is the expression of their organisation: the landscape architectonic composition. Knowledge of the landscape form becomes even more important to the extent that the programme becomes more general, global or uncertain. Then the landscape form gives one something to hold on to in order to be able to ‘steer’ the process and to be able to test the transformations for an insight into the physical qualities of the place.

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