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Voorendt, Mark

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Mark Voorendt

DIALOGUE HYDRAULIC ENGINEERING AND SPATIAL DESIGN

REFLECTION

In practice, the disciplines of landscape architecture/urbanism and hydraulic engineering have become more specialized during the last decades, gradually growing apart. The gap between governance and ecology seems to have become even larger. This leads to discussions about who should take the lead in a design; and, if the design approach is not fully integrated, this can lead to sub-optimal systems. This could lead to less societal acceptance of the solution, as well as to inefficient use of financial resources.

Recent initiatives at the Delft University of Technology aim to bridge this gap. Various research programs aggregate multiple disciplines, like the National Science Foundation's programs on multifunctional flood defenses and on the Sand Engine; and also its BE-Safe program, which investigates methods to assess the contribution of vegetated foreshores to reduced flood risk.

We also encourage students from different backgrounds to work together. The new BSc-minor Integrated design of infrastructures is a good example; another is the involvement of architecture and spatial planning students in fieldwork on coastal engineering. Ecology has become integrated into various MSc engineering courses, such as Ports & inland waterways and Coastal engineering. In 2015 a massive open online course (MOOC) Building with nature was started. However, one initiative preceded all of this: The inter-faculty Delta Interventions graduate studio already started in 2008 (under the name Climate Adaptation Lab).

Delta 'interventions' refers to changes in natural processes that take place in deltaic areas. Hydraulic engineering aims to formulate and resolve water-related problems in order to contribute to the wellbeing of people living, working and recreating in these areas. More specifically, it deals with societal needs like protection against flooding and droughts, regulating water for agriculture and industry, and providing infrastructure for safe and efficient waterways and ports. In addition, hydraulic engineering considers structures that exploit water and offshore wind power for the production of electricity.

Increased prosperity has contributed to the awareness that a healthy, attractive and sustainable natural environment is of major importance for a livable delta. The Department of Hydraulic Engineering of Delft University of Technology therefore encourages a modern, integrated strategy which considers more than just engineering, where economic aspects, the development of nature, and the multifunctional use of space all play important roles.

Hydraulic engineering combines scientific knowledge with practical experience to design and implement interventions in the natural environment, with the ultimate goal of enhancing prosperity.
To design functional, acceptable and affordable solutions, engineers need specialized knowledge about various systems and processes. In addition, they need to ask the right questions: why? (the hydraulic background and problems), what? (solutions to the hydraulic engineering problems), and how? (implementing the solutions).

A good mix of science, technology and design is a pre-condition for successful results. The relevant disciplines must work together in a design team in order to solve the societal, the engineering, and the spatial problems in urbanized deltas.

The Netherlands has a long tradition of intervening in natural processes. This has offered the opportunity to develop new insights and knowledge, resulting in improvements of designed structures and systems. For instance, it has led to the insight that a consistent and strict hierarchy can help to manage and develop landscapes, enhancing the design process and increasing its effectiveness.

Landscape architect Dirk Sijmons distinguishes three layers in spatial design (Sijmons & Venema 1998):
1. Hydraulic engineering and water management;
2. Infrastructural planning;
3. Planning of the built environment.
Sijmons states that in urbanized deltas, first things should be dealt with first. Protecting the land and managing the water represents the primary existential condition for these low-lying areas. However, Sijmons observed that discussions on spatial planning often start at the third layer, neglecting or juxtaposing the other two layers; this turns the logical hierarchy upside down, causing many problems in spatial planning. Sijmons also explains that putting water management first, on the other hand, does not imply that spatial quality is just a luxury; spatial planning is still necessary to achieve primary policy goals like safety and accessibility. The Quality Team of Room for the River showed that striving for spatial quality sometimes led to considerable cost savings and sometimes even sped up slow administrative processes.

To incorporate the expertise and experience of various disciplines, an integrated design approach is needed. Such a design considers the system as a whole and not just as a collection of parts. This kind of approach is believed to be more cost-effective and sustainable. The Delta Interventions design studio offered an excellent opportunity to test and further develop the method of integrated design. Successful and less successful attempts to make a holistic design were studied to find out which design aspects make a difference. This is a specific example of research by design, because here we studied the design process itself.

Since the Delta Interventions graduate studio's inception, hydraulic engineering students have participated in various ways. Practical scheduling and planning issues often determined whether students only participated in workshops, followed part of the Delta Interventions program, or worked together on their graduation project. Early projects include the design of a parachute-shaped screen barrier, and a multifunctional storm surge barrier including a restaurant, swimming pool and other leisure facilities.

More recently, students and staff have participated in the New York and Houston-Galveston projects, which are described in other parts of this book. Their main goal was to find functional, affordable solutions. The students included as many relevant aspects as possible in their designs to evolve ideas and concepts, which they then developed into different strategies to reduce flood risks; finally, they made these strategies concrete, by designing actual systems and structures.

The Delta Interventions graduate studio has shown that an integrated and sustainable design approach works well. It is an excellent example of how people from different disciplines can work together to solve societal problems in a dynamic environment.