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The role of hybrid contributions**

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Building with Nature as a cross-disciplinary approach: the role of hybrid contributions

1. Expanding the realm of inquiry

The incentive for this publication was to expand the realm of enquiry around the topic of Building with Nature (BwN), for two main reasons. First to gain an interdisciplinary, and therefore deeper, understanding of BwN as an object of study. Secondly, but no less important, is an understanding of how *different forms of knowledge* contribute to our learning regarding BwN. When we understand the contribution of several academic disciplines and knowledge from practice, we may eventually get to the point where we can identify how they can collaborate successfully to contribute to BwN as an interdisciplinary field.

Finding strategies for successful cooperation is needed for a second generation of BwN to evolve. Despite the promotion of interdisciplinary learning at the strategic level of universities, a genuine progress on the operational level has lagged behind. An unwritten consensus in the scientific field of trans- and interdisciplinary learning (TD&ID), is that progress is hindered by two

main obstacles: bias against interdisciplinary scholars in the recruitment and assessment procedures of academic departments (the operational powerhouse of the university) and key differences in the language, methods, notions of validity, and general culture between disciplines, in particular between the exact and social sciences. Different disciplines therefore operate in isolation, which results in a limited, and sometimes even biased, view on a shared subject of study. This knowledge fragmentation undermines society's regard for academia, and worse, contributes to humankind's failure to address grand challenges, like climate change and inequality.

As showcased by the contributions in this publication BwN is addressed from different disciplinary backgrounds and domains. However, the approaches all feature inter-, multi-, and transdisciplinary characteristics that prove that BwN is a complex knowledge field that needs the cooperation of scientists, engineers, designers, artists, etc. In fact, it shows that BwN is not merely a field that can only be understood from a single point of view, or separate views next to each, but that it entails a more comprehensive and hybrid approach in which natural processes, infrastructure, spatial qualities and societal perceptions are considered part of the same.

2. Art, Design, and Science

A useful distinction for types of knowledge relevant to understanding the interaction between the involved disciplines is offered by Lee (2011). She distinguished Art, Design, and Science as core knowledge domains that relate to reality in different ways (figure 1). While the nature of Art is to *question* reality, Science seeks to *explain* it. Design's nature is ultimately to *change* reality. When we consider Art, Design, and Science as knowledge domains of a radically different nature, we can understand and position the contributions in this book and how they relate to each other.

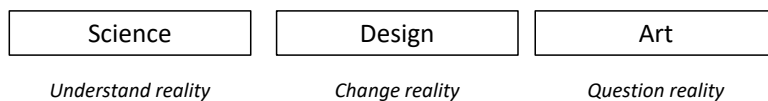


Figure 1. The three different knowledge domains and their inquiry according to Lee (2011)

However, when we apply the framework of Lee, it is not to classify or separate the contributions and the related disciplines, but to show the overlap or focus. Therefore, we visualised the three knowledge domains as a force field, in which disciplines can operate between different knowledge domains, given a specific focus or discipline (figure 2).

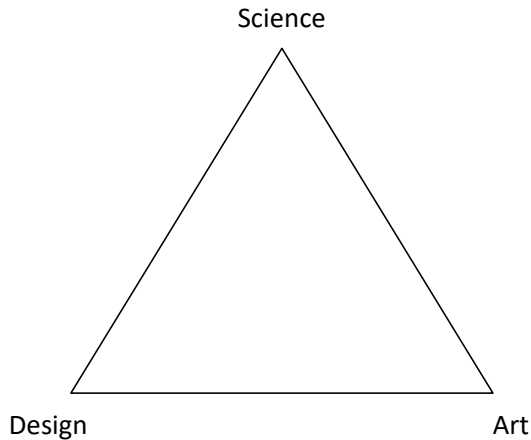


Figure 2. The three different knowledge domains as force field

When positioning the contributions of this book in the force field, different clusters of hybridity can be derived from the various approaches to BwN (figure 3).

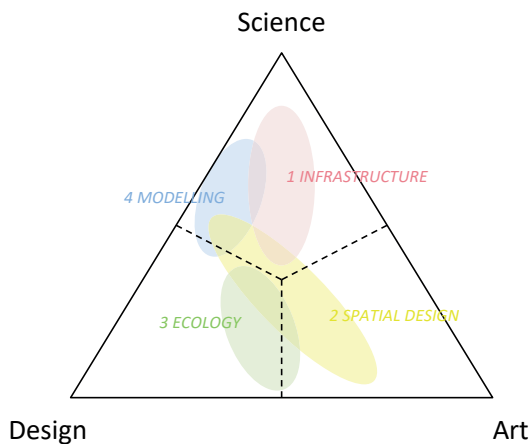


Figure 3. Positioning of the chapters of BwN perspectives

The positioning of the contributions is arbitrary but gives an impression of the nature of the chapters. A first glance at the mapping of the chapters shows that most contributions originate from the exact field of science -*explaining reality*- (chapter 1 and 4). Considerable effort is made to gain an understanding of dynamic systems and the control of it, via modelling and management. Spatial design (2) of BwN is represented by both landscape design and ecology, with specific contributions making the crossover from science to design. Art is under-represented in this publication. As a pioneering field, many art projects arise from the Building with Nature philosophy, but blossom as an autonomous discipline, separate from academic output.

However, they play an important role in the societal dialogue and embedding of BwN, questioning the new realities that come from large-scale system interventions.

When taking a closer look at the contributions within each chapter, certain directions for interdisciplinary knowledge and collaboration can be seen. From the field of science and engineering, two directions for interdisciplinary knowledge can be observed.

First of all, there is the movement from fundamental science on BwN (understanding reality) towards the modelling of this complex and dynamic reality. This is represented by the contributions 'Beach-dune Modelling', 'A novel coastal landscape model', 'Natural solutions' and 'A systematic design approach', which illustrate the sequential steps from fundamental knowledge (*understanding* reality) towards the modelling of BwN (*representing* reality) to the prediction of BwN processes (*projecting* reality); and finally, to an assessment of BwN solutions (*evaluating* reality) and a resetting of the values related to BwN (*redefining* reality). This cycle of understanding, representing and redefining BwN as reality, will not only improve the understanding of BwN as a technique itself, but also makes way for applied science and design, where models are used as key interdisciplinary tools between specialist knowledge, spatial design, and management.

Secondly, a closer understanding of BwN as a complex system also raises new questions. On the one hand, there is the scaling issue (De Vries et al) – redefining BwN as reality. Secondly there is the operationalisation of BwN. This involves other types of knowledge, such as the embedding of BwN as infrastructure (Brand & Hertogh), or interdisciplinary team-roles for the management of BwN (Klaassen et. al) establishing Building with Nature as a learning community. It shows that with the redefinition of BwN, interdisciplinarity is no longer an option, but a necessity.

The design perspective in this publication is represented by two chapters: Spatial Design and Ecology. Both chapters contain contributions with a direct crossover to science, such as 'Urban Dunes', translating the understanding of sedimentation processes to design principles. The contribution 'Odums dark bottle' refers back to the early days of ecology research as a systems approach, illustrated by design practice. The contribution of 'BwN in landscape practice' shows how ecological understanding has become an integral part of landscape design practice, changing reality. Ecological notions are integrated in the design of the human habitat, not just adding functionality, but also generating beauty, another feature of design.

All three articles state that for BwN to incorporate a full systems approach, the anthropological aspects of BwN should be addressed. This by including communities in the understanding, advocacy, and decision-making of BwN projects and the inclusion of the urban system in future solutions.

The need to involve the anthropological layer in BwN is also emphasised by the contributions 'Building with Landscape' and 'Pioneering Sand Motor', operating from the art perspective to question the reality of BwN. Both raise public awareness for BwN techniques in response to climate change and sea level rise. In 'Building with Landscape', a series of installations at the Oerol-festival, on the island of Terschelling, were used to first change reality – a clear feature of design. To create the individual installations, anthropological or cultural interpretations and reflections were used as valid input alongside scientific facts – another design-feature. These installations were not only meant to connect the technique within its spatial and social context (as landscape architecture), but also to make it public in events, such as Oerol, to discuss its value in an open debate (*validation* of reality). This induces a second round of interpretation and reflection, that demonstrates the explorative reasoning that Lee associated with design. It can also be seen as a different road to understanding, *to explain BwN in societal terms* – a feature of science.

What evolves from these observations is that BwN, as an approach, does not function on the basis of dividing disciplines. They all showcase a degree of hybridity in their approach, whether in their multi-, inter-, or trans-disciplinarity, or through the overlaps of their different knowledge domains.

3. Convergences for BwN as an interdisciplinary field

'Convergence' is the deep integration of knowledge, techniques, and expertise from multiple fields to form expanded and (perhaps) new frameworks for addressing scientific and societal challenges and opportunities (NSF, 2016). Ultimately, convergence is a process that aims to streamline different types of knowledge into consensus on the true nature of particular challenges and how they should be dealt with effectively. When looking at the directions of development in the chapters, we can recognise four frontiers for the convergence of knowledge as takeaways for the future development of BwN: the merging of models; expanding the frame of reference; human inclusion, and the integrative role of design.

Merging models

In the Models-section, a shared understanding seems to emerge on how the existing models of sub-systems can be merged in order to get a closer representation of the reality of BwN ('Landscape Model', 'Beach-dune Modelling'). This understanding was established by the merging of existing models for subsystems that were created within the discipline of coastal engineering into a 'seamless' landscape model, but also by demonstrating how different the resulting decisions are when ecosystem values are over or underestimated ('Eco-system benefits'). This not only enables engineering to assess the impact of interventions to other subsystems, but also to represent and project BwN processes within their context, as an important tool for spatial design. Vice versa, within the process of spatial design, valuable testing grounds become apparent, that can be validated by modelling. Ultimately integrated models help to fill the gap between specialist knowledge, spatial design, and decision-making as complementary parts of the process.

Expanding the frame of reference for Building with Nature

A second, less obvious convergence is demonstrated through the perceived benefits of Building with Nature. This is a tangible shift towards an acknowledgement of both the contextual and cultural dimensions of Building with Nature – induced by design practice. However, implementation demonstrated that even with dual objectives, Building with Nature interventions have consequences for elements of the overall coastal system that were not considered. Such consequences – in particular the perception and recreational use – could complicate or improve a new generation of Building with Nature-projects. Managing the existing 'frame of reference' for BwN was the challenge for the 'Assessment of effectiveness', 'Ecosystem-Benefits' and 'Scale-resolving'-contributions.

Human inclusion

Several contributions point out a knowledge gap in BwN regarding the effects of human occupation in nature-based solutions. As Wijnberg et al. (2020) have put it: "A clear mismatch arises from the absence of buildings and human activities in current numerical models simulating morphological developments". This is the missing step in the modelling for integrated BwN-solutions that serve the interests of nature, flood protection, and society at large. The true nature of BwN is thus more than a matter of understanding different natural processes – as human behavior interferes with these processes, and thus makes the performance of BwN less predictable.

Secondly, for broader societal acceptance, BwN solutions need to develop from technical artifact to a new generation of coastal landscapes, including

its cultural layer; as pointed out by 'Building with Landscape' and 'Pioneering Sand Motor'. This requires a separate dialogue and process for the technique to be perceived and integrated in society. The interdisciplinary understanding of Building with Nature seems to be that, while existing BwN projects perform rather well (their secondary objectives in particular), human occupation patterns, perception, and use are vital, yet non-operationalised elements, that can determine Building with Nature's future success.

The integrative role of design

Overall, the design and art contributions have emphasised the contextual and cultural dimension of Building with Nature. This contextualisation also features in the contributions from Science, albeit less prominently. Strikingly, 'contextualisation' of Building with Nature was also observed as a product of the engineering roles in collaborative design-processes ('Engineering roles').

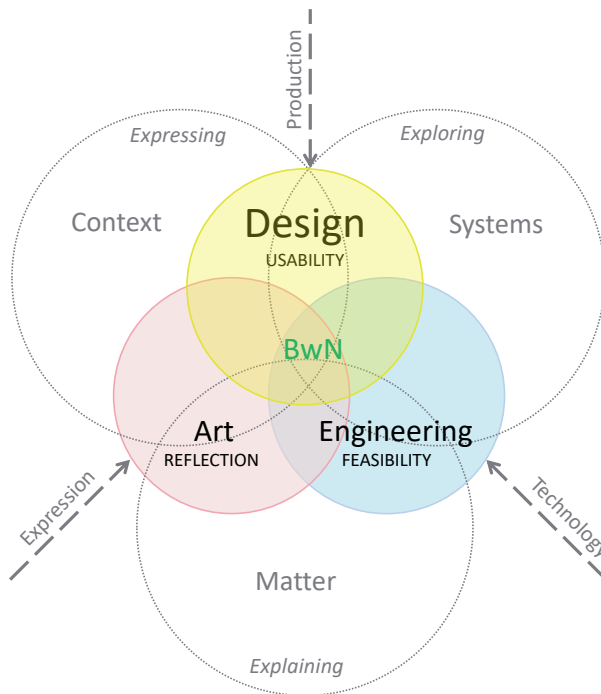


Figure 4. Integrated design as an *exploratory* discipline, connecting with both art as an *expressive* discipline, and science as an *explanatory* discipline (after Lee, 2011).

Looking in particular at 'Urban Dunes', it appears that design can expand the scope of our understanding, in this case combining the functionality of urban development with Building with Nature approaches. 'Urban Dunes' has also offered a point of departure to operationalise human occupation patterns

in Building with Nature-models. In 'On-site installations', the engagement of cultural values and therefore the harmonisation of coastal protection and public approval, is promised (though no empirical evidence is given). Possibly, through its applied nature ('to change reality'), design can also provide a bridge between science on the one hand and society on the other. By translating and incorporating dispersed specialist technologies into spatial solutions, it opens up BwN to a wider context, and simultaneously provides a contextual and social feedback loop to science, such as the development of waterfronts. The integrative capacity of spatial design will enrich our understanding of BwN since contextual and societal values are added to the scope.

To conclude, the field of practical sciences demonstrates a wide range of approaches geared towards converging knowledge production and application. Several contributions exist where 'understanding reality' is developed beyond a single, universal explanation that can be verified simply as true or false. For example, 'BwN as integrated infrastructure', 'Engineering roles', and 'Odum's dark bottle' all aim to explain BwN by re-interpretation of former knowledge. They seek to change our understanding via an explorative narrative, in search of new values that redefine BwN. 'Building with Landscape', (land-) art projects are used as input to learn about man's perception of (Building with) Nature, while in 'BwN in landscape practise', design-projects are used for a similar purpose. They demonstrate the new layers of understanding BwN to enrich our quest for sustainable coastal landscapes. Science, after all, does not have the monopoly on knowledge.

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