USING RESEARCH TO DESIGN FOR A 'WICKED' WORLD
Using heuristic techniques to advance wicked design problems

Martijn Vos
4289536

Chair of Urban Design, "Transitional Territories"
Thesis "Reconnecting port and city: Revitalizing Dunkerque through repurposing of obsolescent energy infrastructure"

I   MAPPING NON-SPATIAL DATA

Groat & Wang[1] identify a common theme within architectural academic environments when it comes to research, i.e. that is that there is a tendency in thinking that science is only based on facts and quantitative data, which implicates that design can't be considered research, given its intuitive aspects. However, they argue that there are many similarities between design and research, and that both can exist within each other's ontological and epistemological domains.[2]

        The architectural design practice floats at the crossroad between art and engineering, accompanied by social, cultural and political elements and more. Architectural design thus involves both qualitative and quantitative elements to be successful. With this in mind, we can't just design based on our intuition, nor just on rationality. In Salomon's article about the emergence of the research studio he concludes that within research studios creating technical competence can be integrated while retaining possibilities to develop artistic skills.[3] Within such research studios, heuristic techniques can be transferred in a more structured manner to students in the form of group work or guided individual research on a common theme. Since designers are working across domains during their career, it is essential to develop knowledge on structuring research to avoid too broad scopes, which could lead to weak design solutions. During the course I started to realize that we are mainly working with wicked problems, and that awareness about these problems could help in overcoming them. Rittel & Webber defined problems wicked when they are ill-defined and are lacking a single operationalization.[4] I'm still working with wicked problems during my personal project, but I started researching them during the first stage of the graduation.

        Due to the setup of our interdisciplinary studio our research phase is continuous and parallel with the design phase. Our studio focusses on the North Sea and North Sea coastal zones. We first started with collaborative research that was divided in six lines of inquiry, where ours focused on the projected and desired changes of capital in the North Sea context. During the first analyses of this topic and the related systems, we started to identify the 'wickedness' of the issue. Architects and urbanists work on problems that have spatial impact, but the underlying rules and data don't always relate directly to the spatial scale. Approaching design problems from a wicked problem perspective may help to translate intangible things such as social qualities or political issues into more integrated design solutions.

        We first defined 'capital' during the collaborative research phase and decided to focus mainly on oil & gas and mineral value/ supply chains. This is also the theme of my ongoing personal research, where I take this to an architectural level by proposing possible solutions for repurposing refineries in port-cities to reconnect disconnected ports to their cities. This involves a lot of social, political and economic analysis, with data that is difficult to visualize. That's what drove me to formulate as a research-methodological question:

How can data and theory visualization spatialize and advance wicked sustainability problems in design?

The main challenge for the research process was to make this intangible thing called 'capital' tangible, mainly through spatial diagramming and mapping. The way this mapping and diagramming is done, is critical for the way we and others perceive the research, especially in the light of the nature of wicked problems.

II   VISUALIZING RESEARCH TO UNDERSTAND WICKED PROBLEMS

The Transitional Territories studio is part of a bigger research project, which included a four-phase research structure: Catalogue, Cartography, Deconstruction and Projection. Within Lucas's 3 research approaches[5] of Context, Methodology and Theory-led research, our research was methodology-led, as we used a wicked problem approach. Following Lucas's methodology-led approach, theory is implicit or embedded in the methodology, where theory-led research is often cross-disciplinary and related to other fields.[6] This applies directly to our research, not only because we were a multi-disciplinary group of researchers (architects and urbanists), but also our focus was not only on

architectural matters. In fact, it looked at the built environment from a very broad perspective, researching relations between social, political, economic and engineering phenomena.

Given the complexity of the research topic and with our limited knowledge on matters such as oil & gas production, it was most suitable to take an outsiders point of view during the research, in Lucas's book described as an 'etic research account'.[7] With our research scale, we believed we could gather the largest amount of relevant data with this perspective.

From this point of view, we tried balancing the quantitative and qualitative research techniques. The catalogue and cartography phases were based on state-of-the art facts and focused on gathering as much data as possible on different scales. It included a literature review to understand the systems that we researched, and this information was translated into analytic and 2D/3D diagrams explaining them. During the cartography phase the catalogue products were used to search for territorial-scale quantitative data about our capitals. Subsequently, GIS (Geographic Information System) software was used to create layered maps of this data with the North Sea countries as base layer. Graphically highlighting of information about our systems helped making the data visible on a spatial level. During the third phase we introduced theory about wicked problems and capitalism to deconstruct the mapped data into maps with projected changes for the capitals. We combined our maps into new synthesizing maps which were supported by spatial-temporal diagrams that showed how sustainability, fed by capitalism, has gone wicked over time, by performing historical policy and economic analyses. Comparable historical cases such as the German coal boom were used to argue for the scenarios that were created in the last phase, where we used speculative North Sea maps and speculative scenario drawings to sketch potential futures. This was accompanied by a manifesto, which presented the underlying theory with conclusions. We used the layered approach that was presented in Fransje Hooimeijer's lecture[8] on spatial narratives on a territorial scale. We used this approach to deconstruct our system layers to get insight about the nature of our problem. We used it on a different scale than she presented in the lecture, by applying it to more fields than just infrastructure. In the next paragraph I will describe the historical development of the wicked problems and give some examples on how research is done into state-of-the-art heuristic techniques that can help in dealing with wicked problems in (urban) design.

III   FROM WICKED PROBLEMS TO DESIGN INTERVENTIONS
Around 1960 Thomas Kuhn introduces a theory that challenges the objectivity of research paradigms and states that scientists work from models that are based on community paradigms[9]. Kuhn emphasizes that scientists often do not know the underlying set of rules and assumptions of a paradigm and that scientists can agree on the existence of a paradigm without agreeing on the set of rules.[10] Therefore, paradigms can't be fully rational and unequivocal. Later during that decade, Herbert Simon sets apart the design profession from science in The Sciences of the Artificial, by stating that design is always aimed at creating artefacts that are adapted to human needs, while natural sciences focus on natural laws.[11] In that era and context science was not so much linked to societal systems that, which reduced his arguing about design research to a formula.[12]

In the 1970s Rittel & Webber first disconnected the planning profession from the rest of science by stating that a standard scientific problem definition does not account for planners, due to the modern, complex open societal systems in which they operate.[13] In their paper, they define 10 properties of wicked problems that planners should take into account. This was an important change in design thinking. In the 1990s Buchanan generalizes wicked problems to all design tasks, contrary to solely planning. Buchanan writes that designers must create something that does not exist yet, in the context of wicked problems, where the development path of the wicked problem is uncertain, which create a difficulty when designing.[14] Buchanan argues there cannot be a rigid boundary between different design disciplines or between different sciences when it comes to dealing with wicked problems. He concludes that we must recognize and work with the uncertainties of design, since design has no special subject matter like other sciences and can be applied in any area.[15] Koskinen et al. add to this that modern, constructive designers do not 'see design as an exercise in rational problem solving', but that design researchers use their imagination to create and build new realities to test their theory,[16] which is especially relevant when working with wicked problems.

In more recent times, wicked planning and architectural problems are linked to sustainability more often, because sustainability arguably is a wicked problem. Wicked problems are often planning and policy issues that directly influence the design profession. In 2003 van Bueren, Klijn & Koppenjan[17] linked wicked problems to networks and policy games. They used an analytical framework for networks to analyse wicked environmental issues and show interdependencies between actors in policymaking. From 2005 GIS geodesign[18] was introduced as a tool for planning in design, coupling design proposals with simulations based on GIS data. Being able to identify interdependencies between actors through network diagrams, combined with geodesign can be a strong basis when arguing for architectural and urban design decisions. Because architectural and designers are often working in the public domain, these visualization tools can help deconstructing wicked problems. Maher, Maher, McAlpine, Mann & Seabrook recently published a paper about how barriers in the advancement of sustainability theory can be overcome by combining conceptual frameworks, visuals and communication networks and conclude that a general paradigm shift about sustainability can be achieved by combining these tools into digital artefacts for the public domain that contain strategies for addressing sustainability barriers.[19] There is also research available that shows how using Virtual Reality and motion simulation in combination with GIS opens up ways to combine data from different types of sources on the spot and immediately test results.[20] This can be compared with current Building Information Modelling techniques that are widely used by architects and engineers.

IV   TOWARDS AWARENESS OF WICKED PROBLEMS IN DESIGN

Within Groat & Wang's three research paradigms that are summarized by Sattrup[21] our research can be classified under the emancipatory research paradigm. This paradigm positions the researcher not only as a person that describes a set of problems, but as someone who actively tries to participate in finding ways to change power relations through highlighting the historical and social context of the research objective[22]. This approach applies especially to our research studio. We are essentially trying to deal with wicked sustainability problems through spatial interventions. With this active engagement in mind, I position my group and personal research mainly within the issues that were presented in the spatial narratives talk. The working through the scales, the usage of different representation techniques to explore design options or clarify wicked problems fits my research perfectly. Fransje Hooimeijer presented several ways to make the intangible issues inherent to wicked problems tangible for designer, client and public. She also pointed out how difficult it is to mediate them, e.g. by the example of ground water, or the usage of sand in the construction industry.[23]

The wicked problems approach could also be integrated with the ideas that were presented within the praxeology talk. However, this fits my personal research more than my group research, because of the scale. I'm currently starting the analysis of my project site and understanding the genius loci is critical for a successful intervention, but because of my approach I have to define the spatial narratives first to be able to use the ideas from praxeology. [24] I believe that the awareness of working with a wicked problem can help making more informed design choices. To achieve this, the translation of theory into projects is crucial for the success of dealing with wicked problems. The architect, or any other type of designer must also be engaged in the network and policy games around wicked sustainability issues, as they are the ones that need to implement the proposed operationalizations. However, we must realize that in the end most of the designer's exercises have a 'wicked element' to them. I thus argue that we shouldn't overcomplicate theory around wicked problems, but that we should use the approach as a tool to structure and communicate complex design problems with the purpose of holistic design with better integrated design solutions. Wicked problem analysis can best be used to find focus in the design process, rather than using the outcomes to 'solve' the wicked problem. After all, as mentioned in the literature, a wicked problem doesn't have a right or wrong answer, but only better or worse solutions.

ENDNOTES

1   Linda Groat & David Wang, *Architectural Research Methods* (New York: Wiley, 2013), 22-23

2   Linda Groat & David Wang, *Architectural Research Methods* (New York: Wiley, 2013), 24

3   David Salomon, Experimental Cultures: On the "end" of the Design Thesis and the Rise of the Research Studio. *Journal of Architectural Education,* 2011, 65, no.1: 42. doi:10.1111/j.1531-314x.2011.01172.x

4   Horst W.J. Rittel & Melvin M. Webber, Dilemmas in a General Theory of Planning. *Policy Sciences,* 1973, no.4: 160. Contrarily, they call problems in natural sciences 'tame', such as mathematical problems.

5   Ray Lucas, *Research Methods for Architecture* (London: Laurence King Publishing Ltd, 2016), 11-13.

6   Ray Lucas, *Research Methods for Architecture* (London: Laurence King Publishing Ltd, 2016), 14.

7   Ray Lucas, *Research Methods for Architecture* (London: Laurence King Publishing Ltd, 2016), 10.

8   Fransje Hooimeijer, *AR3A160. On investigating Spatial Narratives. Week 3* [Lecture], 2019.

9   Thomas S. Kuhn, *The structure of Scientific Revolutions* (Chicago: The University of Chicago Press, 1962), 43. Kuhn describes community paradigms as a set of recurrent and quasi-standard illustrations of various theories in their conceptual, observational, and instrumental applications.

10   Thomas S. Kuhn, *The structure of Scientific Revolutions* (Chicago: The University of Chicago Press, 1962), 44-46

11   Herbert Simon, *The Sciences of the Artificial,* (Cambridge, MA: MIT Press, 1996), 111

12   Ilpo Koskinen, John Zimmerman, Thomas Binder, Johan Redström, Stephan Wensveen, *Designing Research Through Practice: From the Lab, Field, and Showroom,* (Waltham, MA: Elsevier, 2011), 42

13   Horst W.J. Rittel & Melvin M. Webber, Dilemmas in a General Theory of Planning. *Policy Sciences,* 1973, no.4: 160.

14   Richard Buchanan, Wicked Problems in Design Thinking. *Design Issues,* 1992, Vol 8. No. 2: 19

15   Richard Buchanan, Wicked Problems in Design Thinking. *Design Issues,* 1992, Vol 8. No. 2: 16

16   Ilpo Koskinen, John Zimmerman, Thomas Binder, Johan Redström, Stephan Wensveen, *Designing Research Through Practice: From the Lab, Field, and Showroom,* (Waltham, MA: Elsevier, 2011), 43

17   Ellen M. van Bueren, Erik-Hans Klijn, Joop F.M. Koppenjan. Dealing with Wicked Problems in Networks: Analyzing an Environmental Debate from a Network Perspective. *Journal of Public Admnistration Research and Theory,* 2003, Vol. 13, No. 2: 211

18   Carl Steinitz, Beginnings of Geodesign: a personal historical perspective. *Research In Urbanism Series,* 2016, Vol 4., No. 1: 9. Steinitz defined geodesign as an iterative design method that uses stakeholder input, geospatial modeling, impact simulations and real-time feedback to facilitate holistic designs and smart decision."

19   Ray Maher, Melanie Maher, Clive A. McAlpine, Samuel Mann, Leonie Seabrook, Overcoming barriers to sustainability by combining conceptual, visual, and networking systems. *Sustainability Science,* 2018, No. 13: 1357-1373

20   Jurgen Rossmann, Arno Buecken, Martin Hoppen, Marc Priggermeyer, Integrating Virtual Reality, Motion Simulation and A 4D GIS, *Research in Urbanism Series,* 2016, Vol, 4., No. 1: 41

21   Peter Andreas Sattrup, *Architectural Research Paradigms: an overview and a research example* (Technical University of Denmark, 2012), 6. The three research paradigms are Postpositivist, Naturalistic and Emancipatory, where postpositivism is the traditional scientific approach based on full objectivity and the idea of a single reality, and the naturalistic paradigm acknowledges that there can be multiple realities and makes use of qualitative and quantitative data.

22   Linda Groat & David Wang, *Architectural Research Methods* (New York: Wiley, 2013), 92

23   Fransje Hooimeijer, *AR3A160: On investigating Spatial Narratives. Week 3* [Lecture], 2019.

24   Marieke Berkers, *AR3A160: On investigating Spatial and Social Practices. Week 2* [Lecture], 2019. The genius loci, or 'spirit of the place', can be found by immersing into the 'praxis' of a city and its people. Because my project focuses on a global issue, the spatial narratives come first. I will use elements of praxeology in a later stage of the research trajectory.

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