# The architect as advocate for environmental progress: Multi-scalar Research Methods for terrestrial and architectural design in the debate of climate change

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**I      Introduction of a multi-scalar method within a cross-domain studio**

A methodology, or a set of methods, can help one to understand the processes within the field of architecture. Contradictory to other sciences, Architectural research and design processes are often not a linear process, rather a constant interplay between both. In my opinion, a method or methodology is not a way to get to the right answer but rather to ask the right (design) question. The methodology should not restrict but rather open relevant discussions on the topic, the set of tools underpinning the method could then support the research for the answer. The Lecture Series on Research Methods presented a theoretic background for research methods from which I was able to build my Research Methodology, take a position and write a reflection.

During my graduation project, I search for a spatial and functional symbiosis between technical and social artifacts within polluted and disrupted industrialized areas. The sub-surfaces are contaminated by anthropogenic activities and the constructs in industrial areas have exceeded far beyond the human scale. In this research, a closer look is taken on these artifacts to find a balance and co-existence between the *Technosphere* and the *Biosphere* in terrestrial as well as the architectural domain.

The region of Rotterdam is depleted and exhausted for local, regional and global interests. The site chosen for my project is the energy landscape of Shell-Pernis in the Port of Rotterdam. The energy landscape consists of refineries, power plants, and other chemical industries which caused the sub-surface to be heavily contaminated and extreme heat stress to appear. Whilst climate change and environmental issues are a well-discussed topic, it has become obvious that one can no longer accept the energy landscapes to be the afterthought of our everyday life. To keep them at bay from mankind and nature, the industry of energy production has been camouflaged, grouped, dispersed, isolated, diluted and dismissed.[1] Thus, the design objective of my graduation project is to diminish this demarcation between industry, nature and mankind in the Port of Rotterdam by architectural and terrestrial design. Can a future world be developed wherein industry, mankind and nature understand each other and co-exist in a symbiosis instead of in separate worlds? Can I, as an architect, take responsibility to support this transition by projection planning and provocative design?

In this paper, I debate my casus relating to the works of Lakatos as derived from the Landau and Anderson papers, wherein the meta-theory of "architectural design as a system of research programs" is revised. In doing so I am able to describe the theory behind my research approach, my architectural position and the nature of discourse and beliefs in the zeitgeist of today. Following, my set of methods or methodology consisting of multiple tools is described. As I find myself in a cross-domain studio of landscape architecture and architectural engineering a multi-scalar approach preferred. Hence, I chose to reflect on the methods of Cartography and Mapping in order to establish the framework for my further studies. The context of today's scientific culture plays a key role in the consideration of these methods, which is substantiated by the Archaeology of knowledge and Foucault's meta-theoretical ideas on discourse and discursive practice. At last, I oppose a holistic approach of visualization and the concept of 'constructed ground' of Hooimeijer, in which not solely mapping the surface but also the subsurface serves as a source of opportunities and challenges.

**II      Research programs and multi-scalar methodology**

The aim of my research is to comprehend the relation between large-scale wicked problems to site-specific solutions. My position within this research is derived from the wicked problem of climate change in relation to the decisive factor in which man has engaged in the deliberate creation of the industrial dimension, which in turn led to the accelerated deterioration of the natural environment. Now, man has to take a direct approach to apprehend the natural environment from an even further diminishing role, by conservation and amendment of the role nature plays in relation to man-made objects.

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[1] Pasqualetti, Martin J. "Reading the changing energy landscape." *Sustainable energy landscapes: Designing, planning, and development* 7, no. 11 (2012).

The *hard core* as Imre Lakatos[2] states in The Methodology of Scientific Research Programmes, forms the set of beliefs that remain unchanged throughout the whole process of research; a strong basis that remains the foundation for further studies. The heuristic technique that gives effect to the *hard core* within the research process is then divided into a set of negative rules (the rejection of the bourgeois ideology by Marx) and a set of positive rules (formal rules as proportional systems, classical rules, etc.)[3]. Applied to my casus an important set of negative rules can be amassed into the following: the rejection of large-scale consummation of nature for economic purposes by mankind. From this negative set then a positive ruleset can be derived: projects should add to the conservation and amelioration of the natural context. The positive rules are the rules where I as an architect search with and act upon, as they direct the modification of the hard core and the auxiliary hypothesis.[4] As an anomaly appears the positive heuristic may be revisited together with the auxiliary hypothesis, however the negative rule remains to protect the hard core.

After the hard core of my project was defined, I started formulating the first problem statements. Researching maps and data on quantitative information about the Netherlands, I found that considering GHG emissions, the region of Rotterdam is most predominant polluted and according to further literature research this is due to the industrial activities within the Port of Rotterdam. As I started to explore the Port of Rotterdam and the environmental status quo as well as the companies contributing to the economic and industrial activities it was found that GHG emission are part of a larger problem which I could not directly solve within the scope of my project or discipline. These anomalies in my hypothesis led to a so-called *problem shift*. The site of Shell-Pernis is the most contaminated site of the region along with the area coping with most extreme heat stress, thus these environmental problems should be solved rather than GHG-emissions.

This shows that the positive heuristic leads to the reasoning to choose the site of Shell-Pernis, where the largest and most equipped machinery and constructions are developed as a result of conscious decision making for economic incentives consisting of the processing of crude oil into energy, fuel and other oil-products.

The landscape of Shell-Pernis is researched by the methods of cartography and mapping of quantitative and qualitative information in order to obtain a set of terrestrial design principles. The following steps are taken within the research process: (1) A research is performed regarding historical maps of the soils and above-ground activities (i.e. industrial activities, pollution, subsoils). A reaction to these questions derived from historical research is one of the auxiliary hypotheses: Bioremediation is a way of naturally rehabilitating the degraded soils of Shell-Pernis, whilst amending and conserving the direct natural environment (hard core). (2) This led to a set of case-studies of plans of similar projects wherein heavily contaminated sites are enhanced by nature and eventually inaugurated to the public in similar climatic conditions (e.g. De Ceuvel, Amsterdam, Westerpark, Amsterdam). (3) In order to  direct this research to an outcome of a set of terrestrial design principles an additional method is applied: A quantitative analysis to the contamination and to what greater or lesser extent they appear in the subsoils combined with qualitative research, where do they appear and what is the quality of the soils? From there the amount of bioremediating activities that need to take place on the site can be decided (i.e. how many plants need to be planted, what kind of plants are suitable for which area of the site?). The combination leads to the outcome of mapping the contaminants, subsoils and where natural or technical interventions should be implemented.

## III       From global to local with mapping, cartography and general visualization

The term of Cartography embodies the study and practice of making maps and is one of the most ancient forms of communication, a fundamental tool which makes it able for the human mind to understand the universe and its spectrum of scales. The oldest maps dates back to around 2300 BC and are preserved

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[2] Anderson, Stanford. *Rational Reconstructions and Architectural Knowledge.*
[3] Landau, Royston. *Notes on the concept of an architectural position.* Architectural Association School of Architecture, 2015.
[4] Anderson. *Rational Reconstructions and Architectural Knowledge.*

on Babylonian clay tablets. In the 16th century the first world maps were drawn by Gerardus Mercator, a leading cartographer of this time who developed a mapping projection method based on mathematics. From the 18th century onwards more detailed cartographic representations were created through the increasing emphasis on original survey and the current mapmakers were openly critical of their predecessors map, in this case maps were only the representation of the known.[5] The critical view of the map makers led to the development of increasingly accurate maps during the 17th, 18th and 19th centuries. The modern cartography is based on ground observations and remote sensing, caused by the use of aerial photography which emerged after World War I. From the 1970's to the 1980's Geographic Information Systems (GIS) caused a shift within the paradigm of Cartography.[6] Cartography has moved from being both the database as the display of the geographical information (on paper) to a separation between the database, the analysis and the display, physically as well as conceptually. [7] Thus the map is more than ever, not the work of one creator but composition of information gathered and revisited by multiple authors from different disciplines.[8]

In general, mapping unfolds potential as it visualizes territories every time with new consequences. On the other hand maps are also able to simply show what is already known, however, Corner mentions in The Agency of Maps and Carthography that this considered as tracing rather than mapping.[9] When the map becomes a representation of the imagining and projecting of alternative world, they can be seen as a design tool rather than a historical tool within the landscape and architectural domain. Since it is not just a link between theory and design but also the design itself. Besides, Corner states: "*Mapping is neither secondary nor representative but doubly operative: digging finding and exposing on one hand and relating, connecting and structuring on the other. Through visual disclosure mapping both sets up and puts into effect complex sets of relationships that remain to be more fully actualized.*" Thus through mapping it is possible to visualize and actualize the relations, opportunities and challenges that occur within a specific area[10], though it is of importance to recognize the changes throughout the cultural history and embody the Archaeology of knowledge. The Archaeology of Knowledge explains the intricate relationship between the theories and the field from which they have come and the results that they have produced. Important to arrive at the context where this discourse takes place in, is  are the 'guiding conditions', "*for showing general classes of things that make up his cultural whole, and which are responsible for the production of discourse. These are, the positivity, the historical a priori, and the archive.*"[11] The terms can be defined and applied to the casus as follows: (1)The positivity: the period in which a map is created, which could lead to it having a different meaning and significance if found in another positivity. (2) Historical *a priori*: internal rules which characterize the discursive practices of the positivity and which mean that periods have a logic of their own, meaning that the rules of mapmaking will be different depending on the time that is observed. (3) Archive: the arrangement of contexts of different periods by which the rulesets of mapmaking have changed over time. Foucault's theory explains Corner's statement that the agency of mapping not solely shows what already exists and what the opportunities and possibilities are, but also *actualizes* the potentials.[12]

At last, I'd like to build upon to the more holistic approach of Hooimeijer of mapping the subsurface as well as the surface from which provocative design strategies and projective scripts can be obtained. Where only mapping lacks the knowledge of the subsurface, the "Constructed Ground" Framework can offer insight to the challenges of the sub-surface (e.g. heat stress, pollution, infrastructural damage and shortage of space) as well as solutions (e.g. solutions to flooding, reduction to heat stress) [13]. Similarly, Corner mentions in "the fields operation mode" the fact that pairing the domain of landscape with

[5] Harley, J. B.. The Map and the development of the History of Cartography.

[6] Aber, James S. 2019. "History Of Maps And Cartography". *Academic.Emporia.Edu.*

[7] Aber, James S. 2019. "History Of Maps And Cartography". *Academic.Emporia.Edu.*

[8] Smith, Catherine Delano. "Why Theory in the History of Cartography?" *Imago Mundi* 48 (1996): 198-203. www.jstor.org/stable/1151274.

[9] Corner, J. *The agency of mapping: speculation, critique and invention.* (1999): (pp. 213-252).

[10] Corner, J. *The agency of mapping: speculation, critique and invention.* pp. 213-252

[11] Landau, Royston. *Notes on the concept of an architectural position.* Architectural Association School of Architecture,( 2015).

[12] Corner, J. *The agency of mapping: speculation, critique and invention.* pp. 114

[13] Hooimeijer, F. L., and F. Lafleur. "Drawing the subsurface: Integrated Infrastructure and Environment Design: Intelligent SUBsurface Quality 4." *Intelligent SUBsurface* (2018).

urbanism, connections with hidden and natural system can be revealed, which can serve as a flexible approach to the current problems and concerns. Combining the biosphere with the Technosphere it is possible to create more resilient designs in cooperation with ecosystem services, climate and urban systems. To achieve such cross-domain and cross-scale design Hooimeijer[14] states that mapping the technical profile is able to represent the natural and technical artifacts within a specific site in multiple categories (e.g. civil construction, water, energy and soil/ecology). The visualization of the technical profile can lead to the understanding of the natural systems from a large regional scale to a small detailed scale.

To conclude, whether it is mapping, cartography or illustrating the (sub)-surface, visualization in general is often referred to as the mother of all design tools, which shows its great importance. With mapping and the visualization of sections, a considerate representation of a specific territory or site can be created whilst enabling linkages between scales.


## IV      Rationalist advocate for environmental progress

Whilst researching and designing I find myself to advocate for environmental reform and the promotion of change in a period where the climate crisis is the main topic of the political debate. Landau[15] introduces a way of approaching and characterizing out of which beliefs of an architect come to be formulated. Reflecting on my own research, the dominant debates of time have influenced the concept phase and the search for a design question. For example, the wicked problem of climate change and the need for green and clean energy landscapes, the discussion of population growth and on-going urbanization wherein space is limited and land is becoming more valuable. From these debates, the *hard core* of my program is set and my position in formed: in the zeitgeist of today I find myself taking the position of the *activist* as well as the *rationalist.* Which operates seamlessly within the studio of Architectural engineering as it is ought to have a certain fascination for innovation. Thus one is asked to take an activist position towards a topic and a rationalist approach of deductive reasoning, in which I aim to create new knowledge based on self-evident principles.

Whilst researching technical aspects of the subsurface and the surface, I seek for a provocative design that challenges to think beyond the visible. I start with a clear target and vision of what my project in Shell-Pernis should append to mankind and nature within a time of fossil resource transition. This vision goes against the oil-consuming society of today and even more so, against the means of Shell and their irresponsible economic growth. In this activist sense, I can relate to Marx, who chose to take a position of rejection of the bourgeoisie ideology which thus led to the outcome of a positive heuristic. I take a position in which I criticize the status quo; I reject the large scale degradable consummation of nature for economic purposes by mankind. Likewise, as Marx, I chose for the power of rejection, an activist position that will lead to positive change. From my *hard core* negative rules, I ensue the positive heuristic: The architectural and terrestrial interventions should add to the conservation and amelioration of the natural context. During the whole period of my graduation project, I stay true to the hard core heuristics, in case they disperse the aim of the thesis can be perceived as a failure.

Avermaete[16] writes about the architect as activist when a professional skill is used to represent a disempowered community and to obtain spatial justice. In the context of my casus, this disempowered community is represented by nature and the spatial area in question illustrates the contaminating energy landscapes. An example of an instance of the activist position was led by a group of architects (Scolari, Huet, Krier etc.)  who developed the concept of the "antiindustrial resistance" and "the reconstruction of the European City". On one of the pamphlets, Krier wrote*: "go back and imitate the best preindustrial examples in their proportions, their dimensions, and their morphologies, as well as in their mode of production using traditional materials and craftsmanship rather than the industrial mode of production."*

[14] Hooimeijer, F. L., and F. Lafleur. "Drawing the subsurface: Integrated Infrastructure and Environment Design: Intelligent SUBsurface Quality 4." *Intelligent SUBsurface* (2018).

[15] Landau, Royston. *Notes on the concept of an architectural position.* Architectural Association School of Architecture,( 2015).

[16] Avermaete, T. The Architect and the public: Empowering people in the Postwar Architecture Culture. HUNCH14 2014.

I do agree and take the position of rejecting the conventional industrial act (e.g. their dimension). However, in my opinion, we should not "go back to the preindustrial" as Krier states in the activist project for the reconstruction of the City, but we should go forward to a combination of green industries that coexist with nature and mankind. Krier's positioning on the antiindustrial can be declared by the fact that during his period of activism, climate change was not the main argument of the debate.

Finally, I find myself more in the position towards the of the rationalist rather than the empiricist, as my approach is deductive and based on theoretical knowledge. Krier, who is possibly more renowned for his provocative remarks than his architectural works, is likewise an architect I can relate to in the rationalist sense. His percept of human-scale urbanism, classical architecture and anti-industrial building forces can be retrieved from his drawings and writings as illustrated in image 1.[17] I can relate to Krier's rationalist approach in which his *hard core* is consistently present in his illustrations and texts. Whilst I express my positive and negative rules differently (maps, drawing, photo's), my hard core is, similar to Krier's hard core; inviolable.
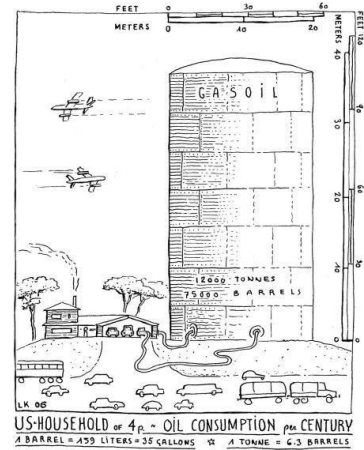


Image 1: Operational Energy (source: Léon Krier)

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[17] Landau, Royston. *Notes on the concept of an architectural position.* Architectural Association School of Architecture, 2015.