

THE ROLE OF ARCHITECTS IN SYSTEM THINKING

'The relevance of systems in the design process in a fast changing world'

AR3A160 Lecture Series Research Methods
Graduation studio Architectural Engineering
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*'Architects can reimagine themselves and their profession
as something greater; not merely the designers of buildings,
but designers of systems.'* – Tim Brown, 2014

INTRODUCTION

'Systems-thinking is a relatively simple premise: to approach solving a problem by considering all the inputs as part of a connected whole. But systems-thinking meets with a very complicated reality when you need to actually accept and execute that premise.' (Miller, 2017)

This statement comes from Mark Miller, CEO and founder of MKThink, an 'ideas company' for the built environment. They apply design thinking to optimize the creation, operation, and repositioning of healthy, high-performance spaces for healthy, high-performing people. Because the modern world is driven by technology and is characterized by rapid successive changes, the built environment needs to adapt in order to accommodate these changes. It needs to mend the disconnect between the traditional approach to architecture and dynamic, social and technological systems (Miller, 2017). With the advent of the internet, information is available within nano seconds. This again results in an overload of information. The system thinking approach can help to deal with information. But how can these systems be applied on architecture and what role do architects play when systematic approaches are being used as design methods? My graduation studio, architectural engineering, aims on improving the quality of the built environment and make it more sustainable. The studio is divided in a 'make' direction and a 'flow' direction. In addition, either the 'making' or 'the energy and material flow' is used and applied as a basis in different contexts (Asselbergs, 2017). The focus of this graduation project is on material flow in the context of Amstel III in Amsterdam. The area is going to be transformed from a formal business area into a dynamic work-live area with a focus on sustainability and circularity (Gemeente Amsterdam, 2018).

Through the course Lecture series research methods I have gained insights into design processes that I have never had before. I can even, in retrospect, recognize design methods within previously completed design projects in my bachelor's and master's at the faculty of Architecture. During the masters I purposely chose for a variety of design studios. The reason behind this was the different approaches of design methods within the studio, what I then interpreted as 'different design skills.' Where in the MSc 1 studio of dwelling the approach was very much on typology and the approach of the MSc 2 studio of interiors was more on the feeling and experience of different spaces, the flow direction of the studio of architectural engineering had a system approach of research and design. During the master I also did a project at the faculty of Civil Engineering, where design approaches are much more functional and therefore problem-solving is only used in a functional way without taking other aspects, as for instance user experience, into account.

Therefore I can relate to the lecture of Fransje Hooimeijer, where different system approaches are addressed as a design methodology. She introduces the lecture with the fact that the city is still part of nature. Pollution within the city can still be reversed and that we should not consider it in a problematic way. She tries to answer the question on how technology can be part of the design process again, how it can be integrated better and smarter applied. The design process is not predictable so it is important to understand when and how to use certain data to inform a design and visualize this data so that it can really support a designer. Nowadays technology is not represented in a way that it is visual and, according to Hooimeijer, when it is not visual in a design it is not there. She concludes her introduction on the difference between approaches of civil engineering and urban and architectural design. Where civil engineers ask themselves the question how they can fix the problem, designers ask themselves the question how the new future will be (Hooimeijer, 2018). In this paper I will try to solve the question of how a system approach of design methods can be useful for architects during the design process and what role architects have in this.

DISCUSSION

'Architecture should shift from the goal of rigid object creation. The ROI of Buildings should be seen in a larger context, rather than be treated as singular managed assets. Systems thinking presents a lens to recognize and see how our built world exists within social, environmental and business realities, which are changing at a rate that traditional architecture can no longer support.' (Miller, 2017)

Miller implies that buildings should not be seen as individual objects but as part of a whole. In

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order to design individual objects, a systematic analysis must therefore be carried out. This entails that in a specific area not only the surface but also the subsurface has to be analysed. The infrastructure above ground and underground effects the architecture, but also the ecological systems, financial systems and social systems can influence the built environment. All possible physical and non-physical scales are therefore considered. By contrasting these aspects in a system, this can lead to new insights for the design. Hooimeijer explains two examples of such systems concerning the same data. In this example the natural system is being analysed in relation with the human system through all different scales. Figure 1 shows a more visual diagram where figure two is a more structural diagram reflecting on value comparison of the different aspects.

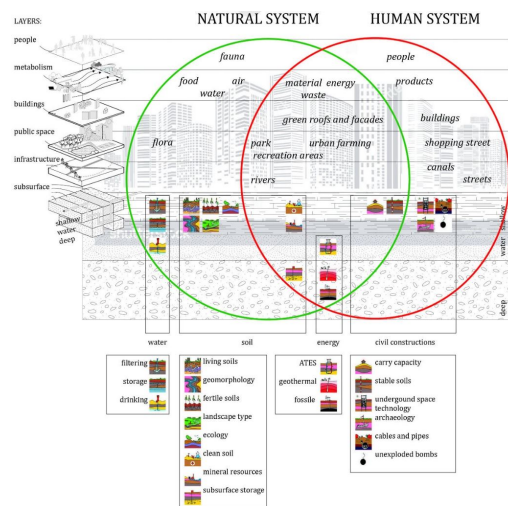


Image 1. A visualization of the relationship between the natural and human system

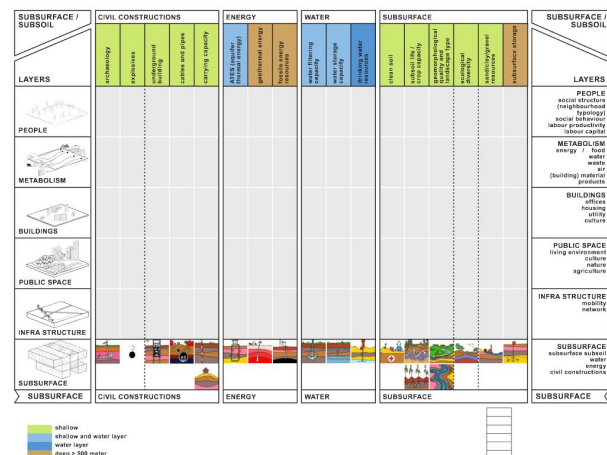


Image 2. A value comparison of the relationship between the natural and human system

A design method that aims on circularity in design is one of energy and material flow analysis. This method can be used on different scales: from cooking food to separating waste and from disassembling a building to analysing resources in a certain area. Material flow analysis (MFA) is a systematic assessment of the flows and stocks of materials within a system defined in space and time. It connects the sources, the pathways, and the intermediate and final sinks of materials. It is mainly based on the law of conservation of material – the amount of material does not change in any process, no humanmade experiments nor natural changes can create matter. The method is a useful decision-support tool in resource management, waste management and environmental management (Brunner & Rechberger, 2004).

By understanding these managements, a more sustainable and livable built environment can be realized. Physically, MFA can help with decisions in material use. Non physically, MFA can help with the design of certain systems in the built environment, which then again expresses itself in physical designs. The research I do for my graduation is part of a graduation project that aims to develop architectural interventions that facilitate change in consumer behavior to reduce material use and waste and stimulate reuse and recycling. Therefore a system design method as MFA can help in my design process. In the studio the 'flow' theme is approached as systemic design: understanding the flows in an environment and defining their system. This approach helps to communicate processes and helps to choose and prove which physical intervention creates the biggest positive

impact. Systemic design includes visual communication and imagination of the mutual benefits in programme, space and materialisation. The added value of this approach for the future architect is that he/she no longer is stuck to the position of 'just' materialising other stakeholders dreams, but is enabled to take part in and even initiate processes that will create their future commissions (Jongert, 2017).

REFLECTION

Research based on systems and strategies is not a new design method as a stand-alone method. However with the fast changing and technology driven society these systems have become a must in the design practice in the more recent history. In 1990 Amos Rapoport addressed the concept of environmental design. He approaches the built environment in a very systematic way.

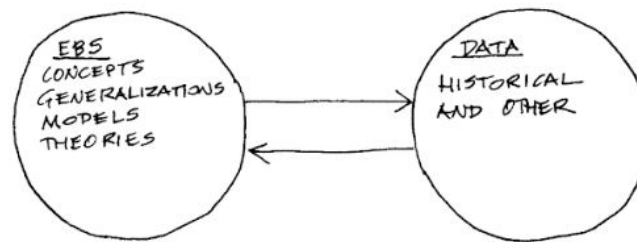


Image 3. The relationship between EBS and data (Rapoport, 1990)

Before one can study the history of something, the nature of that something needs to be defined; the subject matter of the domain needs to be identified (Rapoport, 1990). Rapoport argues for an environmental behavior study approach to investigate the history of the built environment. He aims at developing a more rigorous and valid way of studying the history of built form and ways of using historical data in any theory of environmental design. Within this approach design is seen as a science-based profession, not as an art based profession. He suggests studying the history by analysis rather than by copying and imitating and defines that as a new approach in the study of the built environment (Rapoport, 1990).

Because the recorded architectural history provides examples of manifest building typologies, this is what we now take as an example for the architecture of the past, while this is only a very small part of the buildings that were ever built. It is therefore not relevant to only take these examples as a starting point. In this, architectural history is a very small domain and this small domain emphasizes the visible products. In environmental design the domain is the whole environment, all environments in all cultures covering the full timespan. It includes not only the fixed feature elements and the relationships among them, but semifixed feature elements and non-fixed feature elements, that is, people and their behaviour, generally and relative to the built environment. It is thus about people, buildings, objects and landscapes. *'It must go beyond building – they need to include systems of settings of which buildings form only a part'* (Rapoport, 1990). Figure 4 visualizes this system in a very simple way.

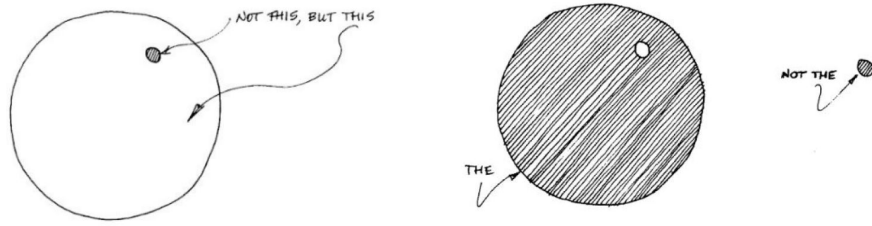


Image 4. The relationship between the domains of environmental and traditional architecture (Rapoport, 1990)

Rapoport considers systems and networks in the environment in retrospect. The Greek architect and town planner Doxiadis has been working on systems as a starting point for architecture in the past and even goes much further into this subject. In 1958 he founded the Athens Technological Institute as a research centre and architecture school based on the idea of global statistics. The idea was to think at the largest possible scale by domesticating vast amounts of global information. If the data could be controlled, cities could be controlled. Courses in statistical analysis became 'indispensable' for architectural training. Spatial patterns would follow from detecting patterns in the flow of information. Design would begin with precisely calibrated charts rather than artistic sketches (Wigley, 2012). It integrates the natural, biological system with the technological system. Together it yields a biotechnical organism. The real dimension of cities according to Doxiadis is not space but time. If a city simply grows radially outward from its centre, pressure increases on the centre until it collapses. He claims that if modern architects are serious in their commitment to function, they will have to reduce their fixation on shells, what he understands as distinct structures, and become responsible for networks (Wigley, 2012).

A recent vision on the position of the architect in these types of systems is 'De Nieuwe Architect.' Discussions took place about the position of the architect in this rapidly changing time, whereby a distinction was made between the specialist and the generalist architect. With the advent of networks in the profession of architecture, the position of the architect as a building master has changed to the architect as a designer of systems in the built environment. Generalist architects are seen as social and societal problem solvers throughout their designs (Asselbergs & Doorn, 2014).

The vision of the Dutch architect Jouke Post is an example of system thinking in architecture and taking responsibility for societal problems within the profession. In 1999 he designed a remarkable office building. Office buildings can last on average for around 50 years, but very often they are demolished or thoroughly renovated before they reach their 20 years of existence. It's a waste of money and a burden on the environment. That's why he designed the 'XX building', that will be at its end of life in exactly 20 years. It then falls apart almost automatically. A lot of pressed wood and cardboard is used since it can easily be recycled. Post assumed that most buildings have an expected lifespan that is incorrect and that a lot of waste material remains that is useless, which is bad for the environment. With his building there are no expensive costs for demolishing or renovating, there is no environmental pollution and there is no deterioration. This way of sustainable design touches the economical and societal problems, also he addresses the aspect of time and still, the building physically is a nice design in exterior, interior and in use. He establishes a link to the business park in the Merwe Vierhavens in Rotterdam. According to him it is an example of how science parks will look like in 20 or 50 years if you design buildings that physically last longer then society accepts it (Rooijakkers & Tie, 1999). Scaling design problems up to a bigger picture can help to establish such architecture. What was then defined as 'sustainable design' is what we now understand as 'circular design.'

POSITIONING

As the statement of Miller in the beginning of this paper implies, systems-thinking meets with a very complicated reality when you need to actually accept and execute that premise. System thinking in the design practice can be useful if you have a certain role in mind as an architect. The graduation studio architectural engineering focuses on a number of aspects. The aim is to solve social and societal problems through sustainability and circularity in the built environment. The starting point of the design project must result from a certain technical fascination. Therefore, I focus on the energy and material flows in an area.

It is remarkable that all the sources examined imply that system as a design method also involves a different position of the architect or designer. However, during my bachelors and masters I have never used such a design method and that is why I find it difficult to translate this method to architecture, especially since this method isn't only focussing on physical design but also, if not for the biggest part, design of systems. In all other design processes I would have never related to this methodology, however it does fit the type of design project I am working on.

The problem with systemic design in architecture is that it's a very functional approach on the bigger scale. When using this method, the architect becomes a generalist and has to gather people with a certain expertise to reach its goal. In the studio I can directly compare this with the 'make' students. In the 'make' direction research is being done on, for instance, circular building connections in a specific material. The research is manageable and is very focused on physical materials; students become experts on specific building technics. However, when the goal is to solve societal problems the system method is very useful.

Still, the system method entails another difficulty. It is focused on being able to structure a lot of information and then to be able to use this information in your design, but because it emphasizes the enormous amount of information it is very hard to keep a focus.

Furthermore, in my opinion, architectural expression has a lot to do with typologies, spaces and experience, systemic design is therefore not the only method that I will use during my graduation project. However, a graduation project is a very comprehensive project that touches a lot of subject areas and expertise and therefore I think systemic design is a good starting point for the design process.

Finally, I want to emphasize that in my opinion, there is no such thing as the average architect. I think that we should except that all architects can have their own expertise but still call themselves architects. In addition to the fact that I see many advantages in systemic design, there are also many disadvantages and yet I relate best to this design method, because my goal in my graduation project is to solve a relevant societal problem. Nevertheless this doesn't mean that I think that architecture in general should have a systemic approach, it is just the way how I approach architecture in my graduation project as an architect to be.

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