FLOW STUDY ANALYSIS

An position paper on using flows as method to create a symbiosis between technical, social and architectural necessities

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I INTRODUCTION

The Research Methods Lecture course was an intense experience. Even though I am a Masters student I was never educated explicitly (accept for one course during my bridging semester) on how to conduct a structuralized research. Let alone to be aware of what I was actually doing and even less on the position of my research in a broader scientific field of research methodology. So my overall experience with the course was an eye opener on research methods in general.

Besides the course being useful for the discovery of different techniques and research strategies the overlaying aspect that I found most fascinating was the awareness of the process in general. With this awareness of being able to take a distance from the things I was working on I could think more clearly about my end goals and what methods to use to get there. On the other side this constant searching for the best method occasionally turned into inner conflicts and uncertainties. The awareness of the ability to use heuristic techniques were new for me and a way to overcome a lot of hesitations during the process. Eventually every action will create something. So if the end goal is made explicit, one can always relate if the steps taken will navigate towards the desired answer.

Another thing I learned was to frame my research within a broader field of architectural research methods. This frame created a good stabilization for the research overall. Occurring doubts could be related to a defined system and methods could be easier distinguished to lead the research towards desirable results.

Being a part of the Architectural Engineering studio *Valuable Neighborhoods* my fascination lies with the huge potential of symbiosis between technical (sustainable) systems and social connections that form a benefit for the communities involved. Especially with the current energy transition there are a lot of changes going on and a lot of adaptation of new techniques will be implemented upon our used way of living. In the Netherlands the focus lies on reducing the demand for heating and replacing natural gas for sustainable heating systems by 2050[1]. Another ambition is to produce 70% of all electricity from sustainable sources in 2030[2]. Current design practice suffers from the segregation of activity and specialization. This has led to designers becoming dependent on external specialists and losing one of their primary capacities: to integrate.

Governments and municipalities are often looking from a top down approach and on the larger scale to create the most efficient systems. On the other hand, inclusive citizens are encouraged to initiate local sustainable projects from a very bottom up approach. This often works with privately owned buildings or housing, but knowing that almost 30% of the total housing stock in the Netherlands are owned by housing corporations[3], these very small initiatives are sometimes harder to realize. The situation is especially complicated in Dutch post war neighborhoods.

For my research I'm focusing on the post war neighborhood Slotermeer located in Amsterdam Nieuw West. Slotermeer is one of the neighborhoods within the General Expansion Plan of Amsterdam (1933). Once a Walhalla for the Dutch middle class, currently a complicated environment with outdated spatial principals, social problems and a wide variety of nationalities and age groups inhabiting these neighborhoods. Another aspect is that the housing is often in need of urgent renovation. Professional plans are presented to guide these neighborhoods through the energy transition, but none of the plans have a direct benefit for the social problems within these communities. This is in my opinion a missed opportunity.

My research focusses on the plans that are made for the Couperusbuurt neighborhood. The current plans[4] are based on fragments of this neighborhood, while I propose to expand these plans to a neighborhood wide solution. The spatial consequences of the technical solutions could be integrated with neighborhood essential functions, to create a symbiosis between the regional sustainability

[1] Ministerie van Economische Zaken en Klimaat. (2019b, 12 november). *Gebouwde omgeving*. Geraadpleegd van https://www.klimaatakkoord.nl/gebouwde-omgeving

[2] Ministerie van Economische Zaken en Klimaat. (2019, 12 november). *Elektriciteit*. Geraadpleegd van https://www.klimaatakkoord.nl/elektriciteit

[3] Centraal Bureau voor de Statistiek (CBS). (2020, 11 februari). Voorraad woningen; eigendom, type verhuurder, bewoning, regio. Geraadpleegd op 12 mei 2020, van https://opendata.cbs.nl/statline/#/CBS/nl/dataset/82900NED/table?fromstatweb

[4] Broersma, S., & Dobbelsteen, van den, A. (2018). Roadmap Amsterdam - City Zen. Geraadpleegd van http://www.cityzen-smartcity.eu/wp-content/uploads/2019/12/city-zen_d4-6_roadmap-amsterdam-v1-5_181103.pdf

ambitions and the local community necessities. The research question that accompanies this vision is: What technical solutions are necessary for a locally centralized mini grid system in a Dutch post war neighborhood and what are the spatial consequences of this system?

II RESEARCH APROACH

Since the area for the overall design research was already defined by the studio I felt it was a logical choice to begin with a context led research method. Just as Lucas explained this approach was used to define conditions that could be found elsewhere.[5] Just by looking at the neighborhood plans of the Western Garden City the repeating types of building configurations could be recognized. This allowed for a further research into finding the generic types to have a good idea on what kind of buildings are present in the context.

To extract a generic type a frame was defined inside the area. Together with the knowledge gained from a literature study on the Western Garden Cities, it became clear that the original buildings in the whole area were built around the same period. The framing has prevented me to investigate all the buildings in the whole area and could be seen as a heuristics technique. The validity is backed up with the literature study. Eventually six generic types of buildings could be distinguished. To be sure, a few random samples were taken from outside the framed area to check the validity.

The goal of the research was to investigate if fragmental schematic systems, already created in the Roadmap 2050[6] document, could be extracted to a more generic system that can also be scaled up to a more inclusive, local system to benefit the neighborhood. Knowing from the literature studies that the ambition is to stop the usage of gas and reduce the electricity demand, the heat and electricity grid were chosen for further investigation. Before diving into further research, I contacted a researcher who worked on the roadmap document and was involved in creating the proposed systems. To him I presented my ideas and we discussed the possibilities of such a system. With his confidence in my proposal I could continue with the research. The next step was to investigate the exact amount of heat and electricity that was going through the grid and what differences improvements could make, therefore a quantitative method needed to be found.

The INSIDE Flows method by SUPERUSE Studios is based around creating a systematic understanding of the working of flows in our environment and using the knowledge of these systems to give a positive contribution to design.[7] It's an analytical method of quantifying flows in a well-defined system. By conducting the flow research on electricity and heating through the total amount of earlier defined generic types of buildings, a flow diagram could be constructed. This diagram shows the amount of the heat and energy that goes in to the system of each type of building, monitors how the input navigates through the system and shows the resulting flows that exit the system. Losses can be identified and improvements can be implemented in logical places in the diagram to check their potential benefits. Besides, systems can be linked to create a local system for a more beneficial flow of resources and prevent valuable waste flows to exit the system unused.

The flow diagram shows how much resources are necessary to create a sustainable heat and electricity system in a neighborhood and what sustainable technical systems need to be added for the best results. This is, however, not all the desired knowledge of this research. To answer the research question *'What technical solutions are necessary for a locally centralized mini grid system in a Dutch post war neighborhood and what are the spatial consequences of this system?'* a final step had to be addressed. What are the spatial consequences of the new systems.

By knowing quantitatively what amounts of resources are needed for the system, and knowing what systems need to be added to facilitate a sustainable heat and electricity flow, the physical dimensions of these systems can be extracted. This is done by contacting manufacturers of these

[5] Lucas, R. (2016). Research Methods for Architecture. London, U.K.: Laurence King Publishing Ltd.

[6] Broersma, S., & Dobbelsteen, van den, A. (2018). Roadmap Amsterdam - City Zen. Geraadpleegd van http://www.cityzen-smartcity.eu/wp-content/uploads/2019/12/city-zen_d4-6_roadmap-amsterdam-v1-5_181103.pdf

[7] Jongert, J., Dirkx, L., Venhuizen, H., van der Burgh, M., & Van der Burgh, M. (2013). Inside Flows. Den Haag, Nederland: Inside, Royal Academy of Art in The Hauge.

systems and presenting them with the quantitative values of my research. With their expertise they could guide me towards suitable machines that could actually process the demands necessary and the spatial consequences for a locally centralized mini heat and electricity grid system could be determined.

III THE EVOLUTION OF THE FLOW

The flow study conducted in this research is, as mentioned before, an analytical research method. The study of flows is not a new phenomenon. It derives from ecology and is adopted by the emerging scientific field of industrial ecology (IE)[8]. Lifset and Graedel explain that the industrial part is partly self explaining. It focusses mainly on the manufacturing process and also on product design. Companies are being held responsible for reducing environmental harm as they posses the technological expertise to improve the processes and products in general. The ecological part of the term refers to the fact that non-human natural ecosystems have a way more efficient way of recycling and energy cascading. Within these systems there are networks of exchange which benefit many mutual relationships between different species. This phenomenon is also called symbiosis.[9]

If we look at the developments of the practice through time, we can discover that the manufacturing or producing of almost any type of product was based on a linear flow. There was a general and popular assumption that there was an 'unlimited' amount of resources (fossil fuels, e.g.) and after the manufacturing process the waste can be dumped. Nowadays we apply the ecological principle of round put to create a cyclical (closed) process that is more in balance with natural systems. The ambition is to bring the industrial systems as close as possible to complete recycling of all materials without producing any waste.[10]

In addition, industrial ecology places human technological activity in the context of a larger ecosystem to support it.[11] If we take a little more distance and focus on the main principals of Industrial Ecology there is a wide range of variety of other research principals and methods. Like for instance the closing of material and energy loops. Now for my research this is also one of the main objectives. By creating a heat and energy system for a neighborhood the aim is to eventually exclude harmful waste and reuse as much as possible to create a circular system. Since the mentioning of circularity, my research could perhaps also be framed within the field of the circular economy, but this will derive too much from the specific analytic approach of the flow method.

In an Inside Flows publication a few examples are presented which also show the involvement of flows throughout history and within complex contemporary projects. The first example I want to address is the one of the Dutch Windmill. Because there was no technical support back in 14th century the windmill is an early example where the available energy flows are connected with labor and the use of space.[12] Without harmful materials a symbiosis with nature could be achieved. Another example is shown of a more resent project from 2012. An ecological interstice between two buildings in the city of Paris. The space, being a greenhouse, powered by solar panels creates an environment for gardening, an open market and a compost laboratory, but, besides ecological sustainable functions it also operates as a theater or a place for storytelling. Within the project physical and energetical flows are being used in an optimal way, but the project also enables knowledge and cultural flows.

What can be said after investigating the origin and development of flow studies is that in the Industrial Ecology sector the flow study are purely focused on industrial processes. This is of course a

[8] 2012Architecten. (2009). Recyclicity; Industrial ecology applied in the urban environment. Geraadpleegd van https://issuu.com/2012architecten/docs/recyclicity_research

[9] Lifset, R., and T.E. Graedel, 'Industial Ecology, goals and definitions', Chapter 1 of Ayres, R. and L. Ayres, 'A handbook of Industrial Ecology', Edward Elgar Publishing Inc, 2004

[10] 2012Architecten. (2009). Recyclicity; Industrial ecology applied in the urban environment. Geraadpleegd van https://issuu.com/2012architecten/docs/recyclicity_research

[11] 2012Architecten. (2009). Recyclicity; Industrial ecology applied in the urban environment. Geraadpleegd van https://issuu.com/2012architecten/docs/recyclicity_research

[12] 2012Architecten. (2009). Recyclicity; Industrial ecology applied in the urban environment. Geraadpleegd van https://issuu.com/2012architecten/docs/recyclicity_research

great and necessary development since industry in general is a large factor of the created global pollution. When the flowstudy methods were introduced into the built environment we can immediately notice that new, nonphysical flows are starting to play a big role. INSIDE FLOW categories them as physical flows (users, food, nature, traffic, i.a.), energetical flows (electricity, heat, sound, light) and valuable flows (knowledge and information, money, identity and culture). These additional flows play, besides a technical role, also a role within a social environment. It's good to remember that although the social aspect is introduced, the method is still analytical and based on quantitative data.

IV ARCHITECTURAL POSITION

After conducting this small investigation towards my own research I see myself relating with some of the talks that were provided throughout this course. Firstly I would like to refer to the systematic approach of F. Hooimeijer. In her essay on *drawing the subsurface* in which she questions the role of the architectural representation of the sub-surface in the application of innovative technology she refers to the practice of Landscape Urbanism and the concepts of 'the machine landscape'[13] where she quotes Gray (2011) 'In pairing landscape with urbanism, landscape urbanism seeks to reintroduce critical connections with natural and hidden systems and proposes the use of such systems as a flexible approach to the current concerns and problems of the urban condition.' I think this has a close relation to my general research question and I see a close relation with the flow study method as well.

I very much agree with the INSIDE Flow methods to systematically understand the working of flows in our environment and using the knowledge of these systems to give a positive contribution to design.[8] I believe it is an absolute necessity for an architect to be aware of the systems that are present within the area where a possible intervention or rehabilitation / renovation development will be added. Besides awareness of these systems it is key to adapt the design in a way that it won't harm and, desirably, could cooperate with it to create a closed circle of resources. A quantitative method is therefore essential.

On the other hand I believe that the architect has a larger responsibility than only closing flows in a context. Therefore the social aspects of the area need to be addressed as well. How can these interventions, besides creating an environmental benefit with the surroundings, also incorporate beneficial functions for the society. This brings me back to my case study of Slotermeer. After conducting the research on the technical necessities and their spatial consequences it is now time to collect a better understanding of the existing urban fabric and how the social developments have been progressing throughout the years. For these researches I believe qualitative methods of research would be very helpful. This brings me to the next point of my architectural position.

Within architecture I believe that most of the times during a design, qualitative researches play a significant role as well. Even though there are cases within architecture where literal translation of quantitative data led to a spatial design, I believe the architect has the power and the tools to elevate the collected data into a creative spatial vision.

In the studio of Architectural Engineering there is a good feel and balance for the integration of technical aspect with architectural principals. As described on the internet page of the TU Delft master studios, Architectural Engineering seeks innovative and inspiring architectural solutions for environmental and societal issues. The studio is driven by the need to think differently about the current building culture. Understanding existing potentials, knowing the possibilities of renewal and discovering how to design, innovate and change are the central themes.[14]

[13] Mostafavi M and Najle C (eds.) (2003) Landscape Urbanism: A Manual for the Machinic Landscape. London: Architectural Association.

[8] 2012Architecten. (2009). Recyclicity; Industrial ecology applied in the urban environment. Geraadpleegd van https://issuu.com/2012architecten/docs/recyclicity_research

[14] TU-Delft. (z.d.). Architectural Engineering. Geraadpleegd van https://www.tudelft.nl/en/education/programmes/masters/architecture-urbanism-and-building-sciences/msc-architecture-urbanism-and-building-sciences/master-tracks/architecture/programme/studios/architectural-engineering/

To come back to my initial design question of which the research discussed in this paper is focused on, I stress the importance of symbiosis. Besides providing only technical solutions that fit one particular purpose or system, as a designer and architect the broader context need to always be kept in mind to create a symbiosis between different existing systems and the natural environment. Analytical quantitative methods, like flow studies, can help to get clear insight into the existing systems and their functioning.

But for an architect the work field is broader than just the systematic aspects of an area. By doing a quantitative research on flows through the existing building stock of a neighborhood technical and spatial requirements for sustainable systems could be extracted. Now these requirements are the base to design a beneficial social environment for the neighborhood community to also improve the social and spatial circumstances within the Dutch post-war neighborhood of Slotermeer to create a desired symbiosis between all the existing systems.