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How can big data contribute to the efficiency of the architect's work process?

Data and architecture. "The architect may no longer be needed" - Koolhaas.   Illustration: Mesut Ulku

Introduction

We often are not aware of it, but everywhere in the world people are measured and 'scored' to predict their future behaviour. It can be observed in recent decades that data has become one of the most significant source of information in this era which encompasses our daily habits such as swiping, liking and emailing. However, these daily gadgets that we are using in our social life, such as lamps and wearables, are informing our understanding of our daily activities, thus accumulating data. Thanks to this pool of big data, credit rating agencies can predict and calculate what we do with our money, if we commit fraud or even have the ability to track our daily behaviour, to measure our health. These predictions can also be brought forward in other aspects of our daily behaviour, such as the way we live, the way we travel, or the groceries we buy; every track record of our daily activities are linked to big data sources is linked to servers and cloud networks.

When reflecting on the foundations of our environment concerning data, architecture and urban design both play a critical role. More clients become interested in linking our daily pattern to architecture and urbanism to improve the design and presence of desired facilities on a quantitative level. Take, for example, the entertainment company Walt Disney Co., where the production company applied location tracking devices to optimise the sales-performance of the park. The collection of big data however, does not stop with smart equipment and other 'invisible' systems. Architects and urban planners have also acknowledged the application of big data that manifests itself in a physical setting. Although not much has been written about the application of big data in the built environment, during my study at the TU Delft, I noticed that architects tend to structure their findings on technological developments from a stylistic and philosophical perspective.

This understanding of big data as a source in architectural discourse can be reflected in my City of the Future, Cross Domain studio, resulting in the starting posi-

tion of my position paper from contemplating how we can design a city of future demands. During my graduation project, I worked closely with the Amsterdam Municipality as the main stakeholder for an investigation into the Amsterdam Sloterdijk area, located in the Havenstad district, where they anticipate problems due to the expected placement of 70.000 new households over the next 30 - 40 years. However, these expected numbers does not only represent the great scale of the project; looking towards 2040 or 2050 also brings uncertainties with the rapid change of technology and upcoming new ways of transportation, like the autonomous vehicle.

When reflecting on the traditional practice of an architect, I experienced often endless processes of redesigning a project due to the changing needs of society and other expectations of the client. Although this process of trial and error has been regarded as the norm in the architectural field, technology can help to close this gap of inefficiency. Moreover, I have observed an interesting growth in the use of big data as the primary source in realising a project with fewer flaws and at a higher efficiency rate compared to the traditional method. This observation has already emerged in companies such as MVRDV and Perkins+Will. They take advantage of technology whenever there is the opportunity, by encouraging a multidisciplinary interaction between the architect and the data engineer.

I therefore also share the belief on the changing position of the architect in an era of technological developments. A particular field of architects are changing their position as a "data-technician." It is known that the architect is to be the synthesiser of information, the decision-maker in the design process. Nowadays, I noticed that the position of architects is understood as mixed-consultant between different parties, where big data plays the main role in this shift.

Despite this advanced development in the efficiency of the architect, it also raises the real issue addressed in this research paper: How much is data able to play a role in this profession? Also, is big data influencing the position of the architect? As a result, the main question of this study is as follows:

How can big data contribute to the efficiency of the architect's work process?

Method

This position paper deals with the changing position of the architect in an era of technological developments. The method employed is based on the analysis of prominent architects who are using big data in their practices; I will argue whether preliminary axioms about this position, collected by theoretical frameworks and literature, are valuable for architectural design research. As a result, I aim to establish insight into the possible applications of data in the research by design process, in order to create an empirical foundation for optimising design efficiency.

The complexity of big data in the architectural discourse calls for a carefully selected strategy, which contributes to the efficiency of the design process. Initially, the term big data can be understood as an extensive set of quantitative values, that can be processed computationally to understand its patterns, trends and similarities in different fields. This practice can also be tracked back to the changing architecture industry, where I as a student, I experienced first-hand that designing buildings no longer is dependent solely on pen and paper. In fact, with access to specific data, architects can design in a more safe and efficient manner. At present, there are many ways that big data is used as a tool in our profession. The methods of dealing with data will be demonstrated as follows.

An architect that uses data to inform design is the Rem Koolhaas. In his book *Elements of Architecture,* He embraces the changing position of the architect, that is currently in a progressively diminishing sphere of importance, as buildings has become more involved with

technology as a framework during the design process. In his book, an example was given of this technological advancement, where a window of a building that was traditionally built by a craftsman, has now become a product designed by engineers and technicians where the size and structure are based on data-related outcomes. Koolhaas shares his vision on the changing responses of this profession. Therefore, he noticed that the scope of the architect is reducing significantly because of technological advancement, resulting in the increase in liability and legal aggression which leads to the diminishing responsibility of the architect . "The architect may no longer be needed."

On the contrary, special attention to the method of using big data was stated by Koolhaas, indicating that our speechless buildings are on the verge of learning to 'understand' peoples behaviour. This verge of 'computational' architecture enables the profession to represent an incredible change in architecture. During the Venice Biennale of 2014, together with Nest CEO Tony Fadell, Koolhaas rounded off his speech with the conclusion that technological benefits such as big data is representing the avant-garde of architecture. The architect, therefore, mostly tends to diverge towards a repetition of typological history due to the constrains in freedom. In my opinion, Koolhaas and Fadell embraces technological developments because of the monotonous recurrence of our historical and architectural ancestors. Besides, I also believe that he recognises technological innovations as a benefit to evoke new opportunities.

Data as extreme

While Koolhaas addresses the use of big data as a tool to break historical recurrence, the architect Winy Maas from the Why Factory studio conducted research on the full efficiency of big data in architectural discourse in his book *City Shock*. Both latter architects are profound in their work and expertise in which they put great influence to our society, but do not share their architectural representation.

While working on the project in the Why Factory at the TU Delft (2017), I had the opportunity to conduct research on the most effective and efficient method of using data to design a housing block. This housing block is designed without any architectural/human intervention to create the 'optimum' in building design for the people. While creating this optimum arrangement, the building was able to 'understand' the people's algorithm and demands, based on their activity, in the end producing a tailor-made space. If the algorithm recognises a pattern of dancing in the multiple rooms, the system will provide the most comfortable way by, for example, enlarging the living room (dance floor in this case). Due to this creation, the data-driven design can create a comprehensive understanding of everyday experiences and needs. Moreover, Maas stated that designing buildings with numbers can be used in the case of 'extremising scenarios'. Designing by using data lead to frontiers, borders, and ultimately inventions. Rather than the 'classical way' of designing urban outskirts or architectural buildings, the 'data-building' cannot be seen as a design or mix regarding context and relations. The building is described by information; which has no input on prescribed ideology, representation or context. In my opinion, the work of the architect in this project has become mainly valuable on a social yet anthropological level. Since the design was mainly done by computational input, the architect in the case had to change his position towards the social scale. Here it is made clear that preliminary analysis such as conducting survey's and researching typologies has become redundant. The architect can conduct the research at a higher efficiency rate with a top down approach through quantitative data.

Data as a flaw

Understanding the benefits of big data, I also noticed the contrasts by using this source in architectural practices. This contradiction has been formulated by Professor Jakob Nielsen, who addressed the danger of big data as a lack of framework and transparency; a pool of open to manipulations. More data also offers more pos-

sibilities for advertisers and media companies to track our behaviour, values and desires. One example regarding the misuse of data is in the recent U.S. Presidential Election,. Because of an error unveiling data misusage during the election, it caused many Democrats to stay home. According to the New York Times, this increase of bad data could have been prevented by improving the underlying assumptions of the polls. Examples like this shows that data can be seen as a very vulnerable source that needs to understand its correlations and not causations.

In architectural practice, both Maas and Nielsen stated that data should not fully influence the behaviour of a building. First, data still shows many contradictions due to lack of data or decisions that centre on people. Second, no data or compassion will supplant the way that a designer needs to decide on how to translate data into design. It can be said that intuition likewise plays a fundamental role in decision-making in quickly changing environments. Just like the failure that happened during the U.S. Election, there are still countless cases of misused or misinterpreted data. Also according to Nielsen, relying too much on data will also have terrible effects on our society.

Professor and writer Edward Tenner illustrate these effects in his book of *The Efficiency Paradox*. Although Tenner does not share any architectural relation, he noticed that big data contribute to a more efficient process, but will make us less efficient in the longer timeframe. By removing all the trials and errors, like what is happening in architecture as well during the design process, the platform of efficiency will only limit us to confine within existing patterns. Tenner gave the example of film producers, in which they use data to find out the most popular genre, which leads to more profit in the film industry. As AI (Artificial Intelligence) already optimised the whole process based on existing data, it does not cater to the needs of the adapting environment and changing taste of the public, resulting in the production of mono-genre movies. For architecture, if we

can design on a more extensive and quicker scale, are we willing to sacrifice the enjoyment and the lessons learned from making these mistakes?

Data as an opportunity
To acknowledging the importance of data-architecture in this era, the fundamental underlying question for all theorists and practitioners relies upon the position of the architect. According to the philosopher Stephen Davies, technology and architecture have been widely discussed by prominent architectural theorists and practitioners, like Le Corbusier, Loos, Venturi, Libeskind, Tschumi and Gehry, who understands the notion of architecture as the foundation for the exploration on the essence of what architecture is. Therefore, they see technological growth also as a study in the quality of architecture.

In 1977, the social critic Ivan Illich argued that the broad influences of digital technology can be understood as the end-of-times for professional class skills such as accountants, lawyers and architects. However, rather than a broad democratisation of the expertise through big data and automation, it enables the architect to "transform the work of human experts". Architects will no longer be the "gatekeepers" of professional knowledge or judgment. Due to the advantages of working towards the understanding of the human factor, the increasing complexity of building problems will also put more pressure on the position of the architect.

In light of the current 21st century, Richard and Daniel Susskind argued in their book on The Future Of Professions, that technological growth will not make architects redundant. In fact, since architects design just a fraction of the total built environment, this trend cannot be seen as harmful for the society. Susskind argued, however, that architects should be aware of this process as it is easy to lose control and influence that will limit our design aspirations to more progressive results. On the other hand, Illich and the Susskinds acknowledges the different influences on architecture, they also no-

ticed great opportunities that can be developed into new opportunities.

Results

When analysing the recent theoretical frameworks, I came to understand that conducting big data in architectural research leads to a greater certainty throughout the design process. Where architects like Koolhaas and Maas are acknowledging the benefits of data in architecture, I discovered the constraints like Nielsen addressed. To find the contributing factor of data efficiency in architecture, the answer to the main question is therefore necessary.

The good

With the research question in mind, I can see a direct link with Maas' vision on the efficiency rate of big data. Resulting from his vision of the fully-data-based Why Factory project, the data can create an extraordinary benefit for the long term. A timeframe that is continuously trying to fit into the urban envelope. Based on his research of on the most optimal housing block, conducted by an algorithm that can 'read' peoples demands, big data can be re-scaled to define the new boundaries of the city. Furthermore, Maas' perception goes even beyond a single building. Resulting from the technology that can upgrade the classical approach of defining the boundaries of the city. If for example, there is an understanding that the urban size is equivalent to a maximum of one hour of travelling, new technological developments can be employed to broaden the border of the urban size within its given timeframe. Many years ago, thanks to bicycles, the city development was based on a distance of 20km. However, with the introduction of the automobile, people are able to enlarge this distance up to 80km respectively. Due to quicker mobility, meta-cities, hubs and other data-related urban envelopes, according to Maas, the city can span up to 400km. Peculiarly, the city is able to connect 400 x 400 km = 160.000.000.000m2. Although these numbers can be regarded as superficial, it reveals the invisible possibilities, creating much denser and populated cities all around the world.

The results of fully depending on data show that the process can be seen as an efficient source for architects. Even though the best designers in the world are not able to predict human behaviour and interaction, Nielsen noticed a gap in the lack of knowledge between designer and the user. Therefore, Nielsen believes that the research for a targeted audience should be prepared for a range than what is visible. Here, data can be seen as the 'remedy' for designers to reach the most likely demands of the users. Thus, creators can no longer make decisions based on their intuition, and instead meet the user's requirements to apply tailor client experiences.

Therefore, using data in architecture must be seen as a source, not as a role. It allows architects to decide not out of pure intuition, but based on an empirical foundation for the design. The architect is the synthesiser of information, working with different consultancy. has Architects have entered a new dimension of designing which is nothing different than creating a tangible and visible form.

The bad

When considering Maas' extreme scenario, the results of this development also demonstrates the discrepancy in our society, shown as a quantitative value rather than qualitative. The results of the Why Factory project unveils an interesting finding of intelligent and innovative solutions for ever-changing environments to maximise customisation and adaptation within a building envelope. Although this experiment shows fascinating results of how to optimise space, it also highlights that there are potential dangerous and destructive possibilities of big data, that can subtly (and not subtly), change almost every condition in our modern life. Even though Koolhaas embraces this notion, it can be acknowledged that this development in architecture does not require any historical or typological background. However, I do see the importance of type in architectural practices. Today, a significant part of the people of the world population

lives in cities. By 2050, the United Nations expects 2.5 billion more people that will be living in cities. This growth is the result of more choices concerning housing, consumption, transportation, education and employment opportunities, but also to avail different opportunities. Due to technological improvements, migration and globalisation, cities are all starting to look the same. Ironically, writers such as Franklin Foer have denounced this growth of technology in urbanism. The writer sees digitisation as a a global hazard to our humanity.

Although Foer appears to be strongly against technology, he does not advice to change the working environment or to throw away your smartphone. What he advocates is described consent fed by understanding of the agendas of the largest technology industries and what they will do to reach their goal.

Discussion

It can be said that data is the new oil. Not only in architectural practice, but in almost every profession. From healthcare to retail and logistics. Big data is effective in quantifying the global problem, where there is the need to accommodate thousands maybe millions of people over the coming years. The solution towards optimising living standard has become available. Maas also illustrated the possibilities of big data and other technologies, where the borders of the city may be unlimited. Quantitative numbers are both the consequence and cause of what the world looks like. The more numbers our world will control, as is happening with big data, the more they will change our world. Architects can be seen as the pioneers, and even according to Nielsen, the remedy for big data. Because of the inefficiency in the decision-making process, technological developments can accelerate this process that will skip the errors beforehand.

However, it can be questioned if big data can contribute to the efficiency of the architect's work process. It is still controversial whether data in the long term will make the work of the architect more efficient. Although the architect can use data as a source to get more understanding of the target group, Tenner brings up a strong argument on the missing gratification, resulting in one essential element in architecture; the element of making the mistakes. The trials and errors in the design process are therefore necessary for the architect to avoid further limitations. *"It can be said that success never teaches you anything. Mistakes however, are worth it for plenty of reasons."*

While the municipality of Amsterdam sees data as an opportunity to increase the efficiency to discover the best appropriate buildings possible. Resulting from this research, it can be said data will benefit from a resource we collectively create. The technology helps the architect to set the parameters of possibility ranges. Furthermore, it frames our potential futures, but it is still incapable to select the best option available for us.

For my future project in Havenstad area, I therefore believe data is able to frame our potential futures, but is still incapable to select the best option available for us. Furthermore, I believe changing our habits and interests is a natural yet ordinary for humans to do, due to our evolution of economic, cultural and technological factors - which explains why technology can only be used as a frame or tool for design, but can never replace it completely.

Architects are the synthesiser of information. The society is our resource.

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