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Variability: Architecture and its Fight against Chaos and Opinion

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Abstract

Digital tools have dominated architectural production for the last 20 years. However, the initial euphoria that accompanied digital design experimentation, and which understood digital media as a liberating force that would free architecture from the bounds that were imposed by extreme standardization and the principles of modern architecture, did not keep its promise. Architecture did not escape externally imposed standards; on the contrary, as the relationship of architecture to digital media is maturing we start to realize that digital tools and protocols are based on even stricter, no-tolerance standards that inevitably produce an undifferentiated homogeneity.

In that context, variability becomes a key concept that can help us (re)invent architecture's unpredictability. Variability, a property that we usually try to eliminate in our attempt to control every aspect of the design process can provide the tools that will help architecture regain it's mythical stature by resisting command and uniformity.

Keywords

Variabilty; Variation; Variaty; Variable

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Digital media and tools were initially welcomed in architectural design as a liberating force. As the means that would free architecture from standardized modes of production – a desire made apparent with the term *non-standard architecture* that was used to describe experimental processes in design through digital media at the early '00s (Migayrou, 2003) – and that would take us away from mass production towards mass customization where each item would be different; a dream of a condition where each product would *vary*. However, common practice with digital tools showed that that was not necessarily the case.

Greg Lynn (cited in Cramer & Guiney, 2000) was already commenting while looking back at the results of the first experiments with digital design at Columbia University that

> (t)hey all looked the same. It's the technology. We were figuring out the limitations of the software. It happened in every other industry: for a while all cars looked like Taurus. It'd be naïve to think it wouldn't happen in architecture.

In other words, Greg Lynn identifies a homogeneity in the produced results which he attributes to the technology, and more specifically, to the unfamiliarity of the architects with that specific technology. However, the development of the relationship between architecture and digital media proved that his observation was not only true for those first experiments, but was also *persistent*. That is to say that homogeneity didn't change as the relationship of digital media and architecture was maturing. On the contrary, as concepts like performance and optimization became more and more related with digital design, homogeneity was constantly enhanced. After all, it was the technology that was responsible. However, not because of the unfamiliarity of the architects with that technology but because of the very nature of that same technology (Gourdoukis, 2019; 2018).

Variability therefore, becomes of interest in that context. As the means to counter the sameness and the homogeneity produced by digital design tools.

Variations, Varieties, Variables

In 1991, Gilles Deleuze and Felix Guattari published the last book that they wrote together[1]. '*What is Philosophy?*' (Deleuze & Guattari, 1994), which was bound to be the last book for both of them, features an extensive examination of philosophy, art and science as the three main modes of thought – the three main vehicles for the production of subjectivity. At the same time 'What is philosophy?' serves as a summary of their work; a distillation of some of their main concepts presented

1. In fact, the book was mostly written by Deleuze: "*Partly because of Guattari's depression, the last book bearing both their names, WhatIs Philosophy? (1991), was written by Deleuze. But Guattari's signature was there for a reason: as a friend said, 'Guattari is in it throughout, in the way that aspirin in water is everywhere.'*" (Shatz, 2010)

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perhaps in their most clear and simple version. In the context of the current discussion, this work has to offer some very useful insights in relation to variability.

In the conclusion of the book, under the title '*From chaos to the brain*', the authors present a very vivid analogy of the way they think of the world and the functions that philosophy, art and science fulfil within it: The world they claim, is made out of chaos. Out of '*infinite variabilities*' against which people need just a little order as the means of protection. They create therefore rules – 'resemblance, contiguity, casualty' – that will keep things together and will impose the desired order. All those rules form our opinions, 'a sort of 'umbrella', which protects us from chaos' (Deleuze & Guattari, 1994). Our world is able to exist under this protective umbrella, seemingly regulated but while chaos is still all around – even if hidden from 'plain view'. However, while that umbrella might be necessary – or better: unavoidable – in order for civilization to exist, Deleuze and Guattari insist that, contrary to what one might assume, the aim of philosophy, art and science is not to help us create the rules that will bring some order into chaos. Philosophy, art and science are not – or should not be – part of the fabric that creates the protective umbrella.

On the contrary, 'philosophy, art and science require more: they cast planes over the chaos' (Deleuze & Guattari, 1994). Their function and ultimate aim is to create holes in the umbrella in order to let some chaos in. The philosopher, the artist and the scientist need to delve into chaos, fight with it and return with what each one of them is able to. The philosopher therefore returns from chaos with *variations*. Variations that derive from the variability of the chaos, and they are therefore still infinite, however they are connected to each other through a plane of immanence. The artist on the other hand, returns with *varieties*. Different sensations that are connected together through a plane of composition. Finally, the scientist brings back from chaos *variables*. Variables allow fluctuation while they eliminate any unwanted, unpredictable variability. They are able to create functions because they are related to each other through a plane of reference. Consequently, philosophy aims at the formation of concepts, art at the formation of sensations and science at the function of knowledge. Accordingly, through philosophy we arrive at concepts and conceptual personae, through art at sensations and aesthetic figures and through science at figures and partial observers (Deleuze & Guattari, 1994).

For Deleuze and Guattari therefore, philosophy, art and science are fundamentally creative disciplines. Each one of them must disrupt established ways of thinking and operating in order to generate something new. They exist not in order to provide safety against chaos, not in order to generate rigid sets of rules that would create a closed system to exist within. On the contrary they exist in order to constantly challenge the certainty of opinion that functions as an almost religious Urdoxa.

One can argue that architecture stand between those three major disciplines. As an amalgamation of science, art and philosophy, is therefore more that all other disciplines an act that deal with variability. The architect too must cross the chaos and return with some variability that will somehow combine variations, varieties and variables. And while recent processes in architecture have dealt separately with all three of them, they were doing so in a mimetic way. Architecture through a more scientific approach is looking at variables, through a more artistic approach at varieties and through a somewhat more philosophical approach at variations. But in all three cases it was trying to keep out the unpredictability that variability implies. Variations, varieties and variable are for architecture the means to control and command. The vehicle that will help the architect to tame the savage variability that he/she has to encounter.

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From Weather Prediction to Command and Autonomy

However, when Deleuze and Guattari argue that the role of philosophy, art and science – and if we try to extend it, of architecture too – is to be always creative and expand our ways of thinking and understanding, they don't actually imply that this is what those creative disciplines usually do. The play with variability in order to produce respectively variation, variety and variables, is what happens when philosophers, artists and scientists operate in extraordinary ways and push the envelop of what we understand – that is when they manage to create a hole in the umbrella and let some chaos in. 'Then comes the crowd of imitators who repair the umbrella with something vaguely resembling the vision, and the crowd of commentators who patch over the rent with opinions: communication' (Deleuze & Guattari, 1994). So the real enemy of the philosopher, of the artist and of the scientist – and we shall add again: of the architect – is not chaos itself; but rather the imitator and most importantly the commentator: 'It is as if the struggle against chaos does not take place without an affinity with the enemy, because another struggle develops and takes on more importance – the struggle against opinion, which claims to protect us against chaos itself' (Deleuze & Guattari, 1994). It is therefore the umbrella that all creative disciplines have to fight against. All the pre-established sets of rules and opinions that claim to provide safety and explain the order of things.

Therefore, a simple observation on philosophical, artistic and scientific practices is enough to convince us that not all philosophy, art and science operate in the ideal way that Deleuze and Guattari describe. On the contrary, more often than not they seem to operate in order to enforce and confirm already established concepts, sensations and knowledge. Let us consider therefore an example from the field of science that illustrates clearly how one can follow the direction of dealing with chaos and returning back from it or choose instead to support existing causes and create closed systems that always verify themselves. [2]

2. Thomas S. Kuhn has analyzed extensively how most scientific work is in fact just trying to reconfirm the rules that define its field of refence instead of trying to move beyond that (Kuhn, 1962).

The story begins shortly after the end of World War II, when a team of mathematicians and meteorologists under the instructions of John von Neumann started to work on a method for numerical weather prediction. Weather forecasting up to that point was based on a more empirical method. The idea for a mathematical model for the prediction of the weather was initiated by British scientist Lewis Fry Richardson in 1922, who proposed that mathematical models can be used in order to forecast the weather. While his attempts failed to provide results, they formed the starting point for the work of Von Neumann and his team that was to follow.

While work on the project was up to a certain extent a cover up for the work conducted in parallel in relation to thermonuclear power and

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weapons, von Neumann seemed to genuinely believe in the importance of the project as he was seeing in the ability to predict and control the weather the possibility for a more efficient weapon. In a note containing the institute's proposal to the navy he was writing: 'the most constructive schemes for climate control would have to be based on insights and techniques that would also lend themselves to forms of climatic warfare as yet unimagined' (cited in Dyson, 2012). He was also genuinely convinced that weather and climate could and would be predicted and controlled as he was confidently noting: 'The part that is stable we are going to predict. And the part that is unstable we are going to control' (cited in Dyson, 2012). As mathematical models for weather prediction required a very large number of computations, the infrastructure of the Institute, including the ENIAC, was used to that end. Slowly the models started to deliver results as to short term prediction. Initial calculations took 24 hours in order to make a prediction for one day. In other words, calculations were predicting the weather at the same time that is was developing. Soon enough however, prediction times were shortened and the research team managed to develop a model that predicted the weather accurately enough for a period of 40 days, after which it was becoming unstable.

At the same time, Norbert Wiener, aware of the project on weather prediction, was insisting that forecasting of weather and climate in a long term timeframe through the use of physics and mathematics was impossible, as the atmosphere, he was claiming, was not a deterministic system (Wiener, 1956). Jule Charney, a member of Von Neumann's team recalls: 'I remember at that time receiving reports from that Norbert Wiener had regarded von Neumann and [me] as practically gonifs – thieves. That we were trying to mislead the whole world in thinking that one could make weather predictions as a deterministic problem. And I think in some fundamental way Wiener was probably right' (cited in Dyson, 2012).

Today it has be proven that weather prediction while possible in short term, is impossible in medium term[3], for a time greater than approximately 30 days. While prediction of climate in a long term is still under debate, it looks like Wiener was closer to the understanding of atmospheric phenomena. What is of importance here however, is not necessarily who was right and who was wrong, but the very different approaches between the two men, von Neumann and Wiener. A difference in approach that underlined what proved to be of much greater importance for today's society: the development of the digital computer.

Francisco Varela has shown (1989)[4] that the different approach between von Neumann and Wiener underlines the whole history of the development of the digital computer going all the way back to its beginning. He dates the beginning of this story in March 1946 and in the now famous 'Macy Conference on Cybernetics', which gathered most of the top

3. The unpredictability of the atmosphere was proved by Edward Lorenz, shortly after von Neumann's death.

4. French translation of: Francisco J. Varela, Principles of Biological Autonomy (North Holland, 1979). Varela's mention on the differences between von Neumann and Wiener appear on the 10th chapter of the French version which does not exist in the original, English version of the book.

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scientist of the post-war era, and gave birth to concepts like biological computations and reasoning systems. Both von Neumann and Wiener were present and held a leading role in the discussions. Varela quotes the account of the conference's president as to the contributions of the two men. On von Neumann he noted:

> We met for the first time in March 1946 with the intention to develop our interest in mathematics and in methods of treating facts and ideas that had concerned us in our fight against post-Hegelian ideologies. The first topic was presented by von Neumann. He described the idea of computers running on a Boolean mode and having as their base the number 2. His general thesis was that such machines could calculate any number and resolve any logical problem, provided it has a solution (cited in Varela, 1989).

Then on Wiener's contribution he says:

> The afternoon of the first day was introduced by Wiener, who in counterpoint, said von Neumann machines, faced with a paradox, enter into endless oscillations (...). Then he began to describe the evolution of machines, from the days of Alexandria until the arrival of the steam engine of Watt; but it differed from all previous controllers, for it had some knowledge of the environment (...). From this, he developed the concept of reflex and then finalized activity (cited in Varela, 1989).

Varela then goes on to commend on the 'striking difference' between the two approaches. 'One talks about a procedure that can solve any problem; the other focuses on the relationship between knowledge and purpose' (Varela, 1989). Von Neumann was looking at processes and operations as ways to solve a problem. Wiener instead was preoccupied with independent, autonomous activities able to generate themselves. 'The view of von Neumann is primarily concerned with heteronomous systems specified from outside. The view of Wiener is primarily concerned with autonomous systems, specified from within' (Varela, 1989).

In this juxtaposition between the two opposing positions 'it is the von Neumann approach that became predominant. It gave birth to information technology, and is associated with the development of most of the engineering sciences; it is this approach that provided the most frequently used metaphor for the brain, that is to say the computer. It promoted the idea of information processing as a central concept of cognitive science and as major task that living systems and machines have to perform one way or another. In fact, these ideas are so prevalent today that any questioning of their validity seems only 'philosophical'' (Varela, 1989). Norbert Wiener's approach on the other hand remained on the sidelines until very recently. And while Wiener's work gave birth to cybernetics, the influence it had on the development of the computer and digital media was very small compared to that of von Neumann.

Digital computers therefore, until today, are based largely on the principles defined by von Neumann's approach. This means that they are designed and built in order to work in accordance with those principles. But maybe even more importantly, von Neumann's ideas defined to a large extend the approach to computation at large. It is an approach that operates on the idea of the 'black box'. There is always some input and some output but what happens in between is not of equal importance. It is an approach that sees computation as a rational process, defined by specific rules and that operates in order to produce solutions to a problem. It operates in a serial manner, where Wie-

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ner's approach favors parallel processes. In other words, it follows a series of consecutive instructions with clearly defined succession where in Wiener we find operations and actions that can happen at the same time and can be related or unrelated to each other. As the example of weather prediction points out, von Neumann's approach operates in terms of prediction while Wiener's is open to uncertainty and unpredictability and one could argue, *variability*. The first is based on closed deterministic processes where the second on open, non-deterministic ones. Von Neumann understands the brain as a computer, Wiener on the other hand the brain as a neural network. Von Neumann's approach is following top-down processes while Wiener's allow bottom-up processes to be established.

The vast differences between the two approaches have also made themselves apparent in relation to the social and political situations of the time, underlining their political aspect. Von Neumann was a central figure in the Manhattan project and a pivotal character for the development of the thermonuclear and the atomic bombs. He was enjoying his relationship with the military and the power and influence that it provided to him. Shortly before his death he advised a preventive nuclear attack on the USSR. Wiener on the other hand, while during World War II worked for the US military for the development of radars and servo mechanisms, he openly criticized the development of nuclear weapons and the use of science for military aims, acts considered as unpatriotic at the time [5].

5. For a much more detailed account of the relation between John von Neumann and Norbert Wiener see Steve J. Heims, John Von Neumann and Norbert Wiener: From Mathematics to the Technologies of Life and Death (Cambridge, Mass.: MIT Press, 1980). Heims in this book makes the point that von Neumann represents an amoral approach to science while Wiener a moral one.

To summarize, we could identify von Neumann's approach as one based on command, heteronomy and serialism; Wiener's one is based on autonomy and parallelism. Von Neumann favors regulation, prediction and control while Wiener openness and bottom-up creation.

Chaoid Variability

The importance of the example of Von Neumann's and Wiener's approaches is twofold. On a first level it illustrates how science can operate according to the process that Deleuze and Guattari describe, as in the case of Wiener. He uses variability as an inherent element of his approach in order to produce variables. The result is an open system that expands our understanding and becomes creative. On the other hand Von Neumann develops a scheme that aims to create stability, control and predictability. It also illustrated that evolution and 'progress' is not defined only by the approaches the push the envelope of existing knowledge. It was von Neumann's approach that became the dominant one and defined the development of the digital computer.

On a second level however, the difference between von Neumann and Wiener is important because it illustrates the principles behind digital tools and how they affected creative processes. The von Neumann ap-

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proach, by dominating the development of digital tools, established them as the means that would eliminate variability. The tools that will remove unpredictability as a property that is unwanted, but above all dangerous, both on an operational and on a political level. Even in the case of the weather: is has to be predicted so it can be used (as a weapon). All variability is dangerous; a threat to established rules, forms and institutions.

When following that line of thinking, we can note that Von Neumann's approach is clearly following the project of modernity. It is based on 'rationality', determinism, a clear relationship between cause and effect, top-down processes defined and controlled from the outside. Computers and computation therefore followed a similar route. Wiener on the other hand proposes elements that contrast with several of those values. Autonomy, bottom-up processes and systems where meaning emerges from the interaction of its elements, from the inside, instead of being imposed from the outside through representation. While his approach didn't prevail in the beginning, the principles he defined started slowly to find their way into the scientific community and emerged on the surface when digital computers started to connect to each other and subsequently were organized into networks. The result was that computers – even though as units were built on the von Neumann architecture, operating serially on the principle of the black box – when part of a network they gained the ability to operate in parallel in relation to one another. And when many of them were operating at the same time, bottom-up, self-organized properties started to emerge. Through that condition, modernity came under dispute. And again, a little bit of chaos manages to come through the umbrella of opinion.

Therefore, as the computer as a tool is a result of the principles of modernity, it should have been expected that not only it follows, but it imposes too those principles on what it produces. That might explain how the products of digital design have a tendency towards uniformity and homogeneity. The digital computer, itself a product of standardization, operates through even stricter standards which define the results – and in that sense the name non-standard architectures might have been a very unfortunate idea.

Thinking of design as the process of crossing the chaos, of creating holes to the protective umbrella of opinion in order to let some of it in, might be an appropriate answer. And then, what becomes of importance is to figure out what the architect is bringing back. If chaotic variability is transformed into chaoid variation by the philosopher, chaoid variety by the artist and chaoid variable be the scientist, into what does the architect transform it? Since architecture exists somewhere between the three, then its product might be after all *variability itself*. Chaotic, infinite variability transformed into chaoid variability that is defined and held together through a plane of construction.

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