Chapter 8
Augmented Co-Design Methods for Climate Smart Environments: A Critical Discourse and Historical Reflection

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ABSTRACT

The research is based on the hypothesis that integrating site-specific and global data into the design process requires a methodological design approach, which connects local to global systems and extends the application of available predefined algorithmic scripts and singular solutions. These tools allow the designer to apprehend and simulate possible future scenarios with unparalleled precision and speed. Computational design thinking will help us master increasingly complex design challenges as well as build a profound theoretical knowledge base to meaningfully integrate current and future technologies. After re-evaluating the principles of the computational pioneers, computationally driven methods for pressing urban challenges through data-informed design speculations are discussed. Cutting-edge design speculations aim to open up new immersive design simulation and participatory processes in environmental design and urban development and give sustainable answers to societal and environmental challenges, ultimately shaping our future world.

INTRODUCTION AND HISTORICAL REFLECTION

Oversaturated with the diversity and arbitrariness of digital and social media and rapidly evolving automized design possibilities, a critically re-thinking of the future of computational design processes is needed. The ongoing process of global urbanization is affecting not only our condition of living, the social, the economic, the political, the cultural, but also the environmental beyond the Anthropocene.

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In contrary to the ongoing discussion in the area of smart cities, we are asked to rethink our relationship towards digital and automated innovations, in order to steer towards a "technologically-mediated relationship with space" (Sayegh, 2020).

If one observes the changing of form language and complexity through technical advancements from an historical perspective, one recognizes the repetitive pattern of direct correlation. Thereby, one concludes that all relevant technical and mathematical achievements, especially with respect to the development from mechanical to electronical technologies, and even more recently the development from the electronic to the digital era, have accelerated the articulation of already present trends in the field of architecture (Oxman 2008).

The interaction of technology with society has given rise to incredible impacts on the field of architecture throughout human history. Marco Frascari describes in his article "An Age of Paper" the importance of the medium of paper and its relationship to the architecture of the 14th century (2017). Here, the medium of paper is compared with the invention of the Internet. The use of paper and its multifaceted usage in architecture, allowed for the elimination of boundaries of time and distance. This analogue element of architecture, which can be understood as the source of data, articulated in different aspects (text and numbers, sketches, images, fiction, instructions…) was almost completely eliminated by the dawn of the digital era, which allowed for the increased capacity of use of digital communication- and visualization possibilities.

The wide-reaching impact of technical developments on society can be especially seen when one compares the length of time of the past four industrial revolutions. While the first Industrial Revolution took 200 years for the invention of steam engines to replace historical agricultural societies, the second Industrial Revolution or 'Technological Revolution' where technical inventions became more widespread took only 100 years. The Third Industrial Revolution, the so-called 'Electronic Era', with a duration of ca. 50 years focused on the invention of computers and electronics. Since around 2010 we are to be found in the Fourth Industrial Revolution, which has accelerated even more rapidly into the beginning of the Fifth Industrial Revolution at the present time (Van Eerden, 2020). All these developments influenced greatly the interaction of technology with society and had wide-reaching impacts on the built environment.

The emergence of steam engines, led to the construction of massive factories to replace menial hand labor, becoming the workplace for hundreds of people, and leading the increased growth of cities. Walter Benjamin was fascinated by the Paris of the 1930s. In his uncompleted book *Passagen Werk*, or *Arcades Project*, he describes the influence of emerging technologies on the development of the city, with focus on the notion of "aesthetic affect" (Benjamin & Tiedemann, 2015). According to Prof. Dr Arie Graafland, "the notion of aesthetic affect" were so important for the philosophers of the Frankfurt School. The Frankfurt School was the first to give serious attention to mass culture, today known as 'Cultural Studies' (Graafland 2012, 14).

This time was marked by a new understanding of time and distance. Connections and communication over longer distances could be made more simply and rapidly through the development of the combustion engine and the telephone. The notion of time and spatial relationships and their interaction were thereby newly defined.

The invention of the computer and other electronic devices quickly led to a quantum leap in our handling of technology, described by van Eerden as a phase of "miniaturizing technology and personal computing" (Van Eerden 2020). This trend, the Digital Era, rose to the stage of being 'hyper-connected' through smart small-scale devices distributed over the whole globe. According to van Eerden, the Fifth