Signal processing in the production of architectures of control

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SIGNAL PROCESSING IN THE PRODUCTION OF ARCHITECTURES OF CONTROL

Taufan ter Weel

DOCUMENTATION OF THE ARTEFACT

The proposed sound installation facilitates a continuous process of modulation and spatial distribution that behaves stochastically in relation to the input signals and commands it receives. A little noise in the system allows for feedback to emerge. Signals extracted from the presentation space are processed in real time. More specifically, it focuses on electromagnetic signals on the one hand, and structure-borne noises and resonances on the other. Telephone pick-up coils sense electromagnetic fields, the ultrasonic waves produced by wireless transmissions, conversions and computing processes. Contact microphones attached to far-reaching tubes and solid structures transduce impact sound and resonances, such as noises from elsewhere, the expansion and contraction of the material itself, and resonating objects in a feedback loop. This background noise, sensed beyond the audible range (in terms of frequency and distance), indicates the ontological dimensions of the processes constituting this local environment.

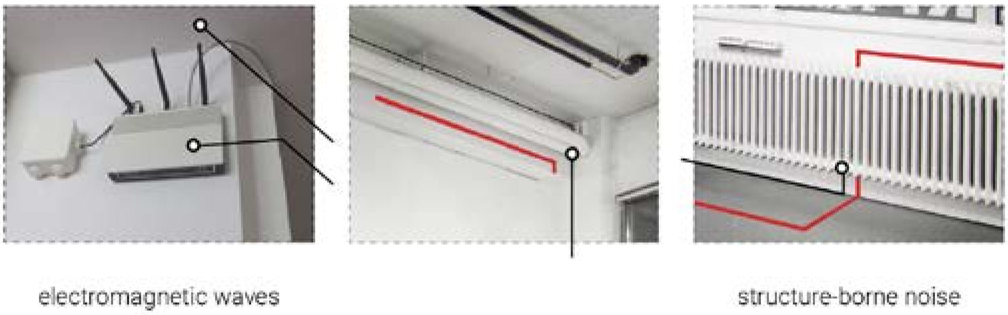

FIGURE 1: concept drawing (modified image; original from: https://www.kit.ntnu.no/en/content/galleri-kit)

The input signals are modified and spatially reconfigured. They are processed and distributed by means of a modular system which involves a set of primary control functions: modulation, filtering, conversion and probability distribution. These control functions are interlinked and cross-modulate in relation to the input. Loudspeakers are treated as single sound sources and redistributed signals feed back into the system. A small modulation at one position can have significant implications for modulations elsewhere or the listening circuit as a whole. The abstract machine can adapt to different environments and the sound installation involves no pre-recorded and represented material.

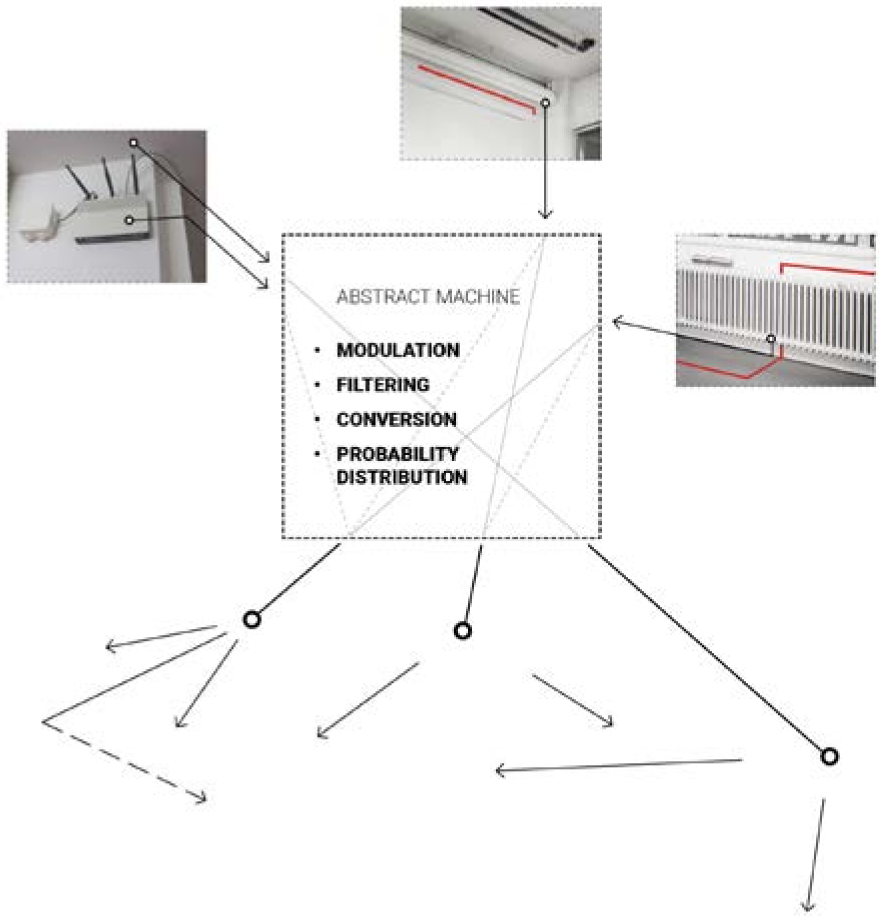

FIGURE 2: operational diagram (abstract machine)

RESEARCH STATEMENT

In present-day societies of control, mobile technologies make ubiquitous telecommunication possible and satellite-based radio positioning systems (such as GPS) enable global navigation, geolocation tracking and location-based responsiveness — as well as asymmetrical warfare by remote-controlled machines such as drones. Extensive infrastructural networks of undersea and underground cables and a proliferation of antennas, circuits and processors facilitate the vast acceleration of data transference and circulation of capital. Social media govern social relations while surveillance seems to become unconfined with the Internet of Things. Algorithms are designed to automate decision-making and gatekeeping as well as to distribute information, whereby they channel desires as well as fears. To keep pace with the progress, our bodies become increasingly dependent on machines, which require compatibility and continuous updates — keeping so-called users locked-in. In the context of this concrete entanglement between abstract machines and social bodies, or abstract space-time and social realities, how could we address the problem of spatial control in order to recuperate the recognition of the right to actively engage in making our habitat? and develop the means to do so?

It may be important to distinguish between different levels of control, with respective scales and temporalities. On the one hand, we can identify the formation of new and more advanced global architectures of control, supranational entities which operate at the intersection of geopolitics and urban governance, and are predominantly technology-supported as well as market-driven (e.g. see Castells 1996; Sassen 2002). On the other hand, these architectures of control operate to a large extent at the level of interactions and relations between people and machines, whereby the latter govern access to resources, spaces and infrastructure, and modify perception and spatio-temporalities.

As 'planetary-scale computation' increasingly transforms modern geopolitics, Benjamin H. Bratton (2016) proposes a specific diagram to map the shifting political geography and better understand the technologies that enable the formation of what he identifies as 'accidental megastructures'. His model 'works from inside out, from technology to governing systems', a conceptual framework derived from 'the multilayered structure of software, hardware, and network "stacks" that arrange different technologies vertically within a modular, independent order' (Bratton 2016: 3-4), cutting across and mediating between different layers: earth, cloud, city, address, interface and user. In line with Bratton, I would also argue that it is needed to develop design approaches that allow for moving across different levels, scales and temporalities. This requires abstraction and a sense of modularity. In contrast to Bratton, I focus here on signal processing rather than specifically on computing. It can be defined as the processing of signals, of physical carriers of information, which is incorporated in all electronic devices.[1] The emphasis of this approach lies on signal more than interface and process more than structure as mediator between bodies, machines and spaces. It suggests a different modality, which is not incompatible, but rather a modest attempt to mediate between time-discrete functions and time-continuous waves, movements and everyday rhythms.

The aim of the presented work and my current research in general is to contribute to the specification of the inner workings and implications of the formation of these advanced architectures of control by means of signal processing as analytical and

1 Signal processing – The processing of signals by means of hardwired or programmable devices, the signals being regarded as continuous or discrete and being approximated by analog or digital devices accordingly. *A Dictionary of Computing*, Oxford University Press (2004).

compositional tool which allows for moving across different levels, mediating between body-machine relations and socio-spatial practices. It does so by constructing a conceptual and contextual framework focused on the relations between technological developments in signal processing with respect to waves, abstractions of space and time, and technical operations and ensembles that indicate particular relations between central control functions and socio-spatial articulations (see Fig. 3). It seeks to contextualize specific architectures of control and resistance enabled by signal processing technologies from the late nineteenth century up until now (especially, transmission, radio-control and navigation as well as information processing), and map formations which cut across different scales and temporalities, from global circuits to urban spaces to body-machine relations, and affect socio-spatial relations and particular communities.

How is signal processing incorporated into the production of architectures of control? What does this reveal about their inner workings? What are the socio-spatial implications of their formation? How can we develop conceptual devices and instruments to rethink and transform their operating systems? These systems are designed and to a large extent need to be addressed through design, which in the context of this work is situated in architecture and spatial practice at large.[2]

2 To avoid terminological confusion it may be needed to distinguish between two different definitions: architecture as spatial design practice and architecture as general organization of a hardware and software system, derived computer science. In this work, architectures of control refer to spatial control.

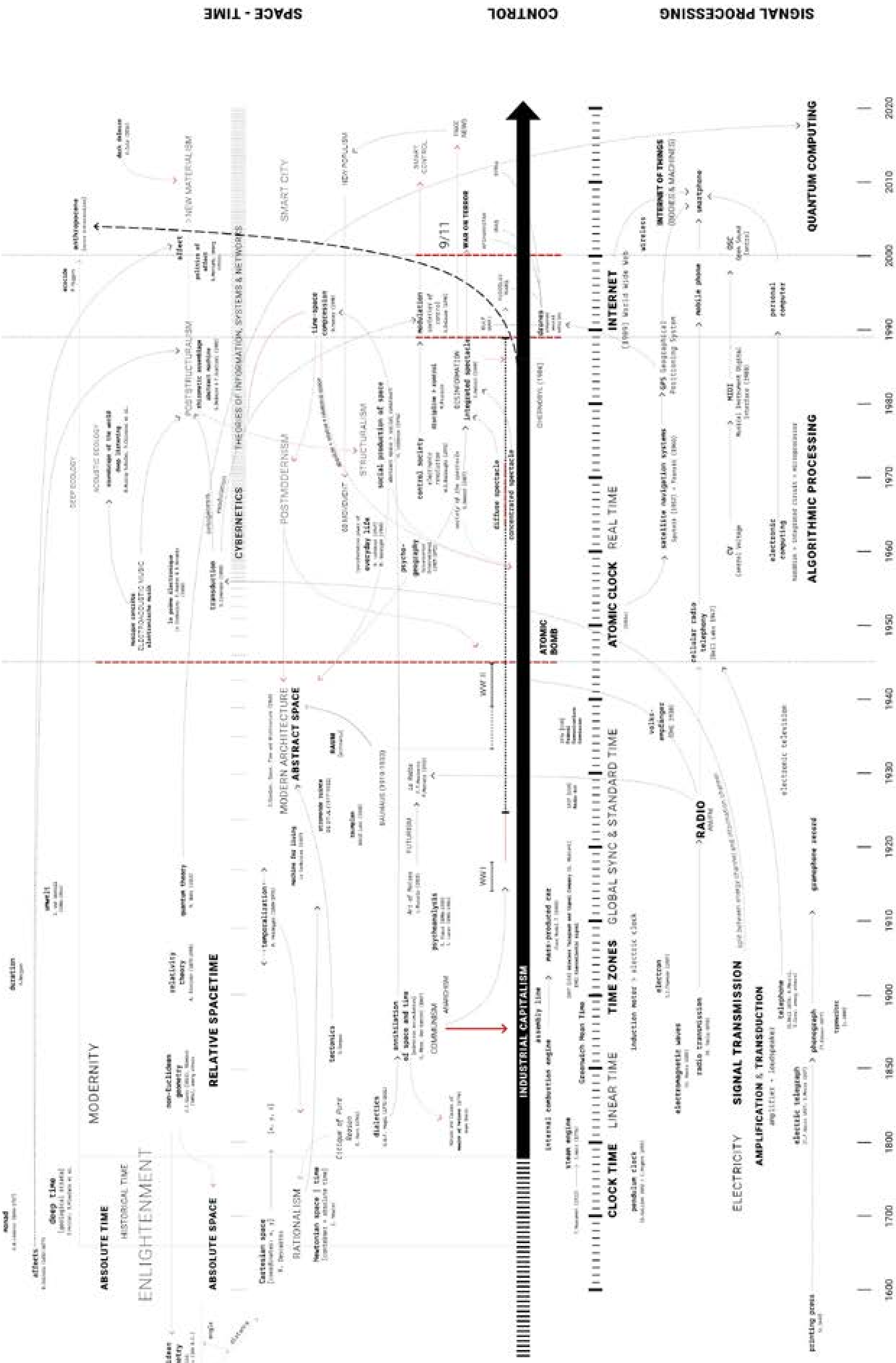

FIGURE 3: diagram of conceptual and contextual framework: signal processing, control and space-time

A signal is the physical carrier of information, of content and expression, transmitted through a medium. It requires the combination of a modulating wave that contains the information and a carrier wave. With the development of electric telecommunication from the late nineteenth century onward, the term signal became more significant (Niebisch 2009: 338). Gilbert Simondon (2017 [1958]: 144) pointed out the importance of the advent of signal transmission, of electric currents and electromagnetic waves as 'vehicles for information'. 'Their ability to be modulated makes them faithful carriers of information, and their speed of transmission makes them rapid carriers.' He argued that this caused a 'profound change in the philosophy of technics' characterized by the increasing importance of 'the accuracy and fidelity of the modulation transmitted by the information channel' (143-144). Coupled with the increasing precision of clock time, from mechanical to electric to atomic clock, signal transmission enabled the development of radio-navigation systems, such as the satellite-based Global Positioning System (see Mackenzie 2002). Technological advancements in communication and radio-navigation cannot be disentangled from geopolitics and military industry. Therefore, it is important to take into consideration the relationships between military and civil technologies. In this research, signal processing refers to producing, transmitting, receiving and processing signals, in order to communicate, express, exchange, navigate, localize, or interlink these functions — for instance in locative media.

Drawing upon Michel Foucault's ideas, Gilles Deleuze (1992: 3-7) argued that the crisis of disciplinary 'environments of enclosure', from World War II onward, initiates the gradual transition to the 'societies of control', which operate through continuous 'modulation' rather than through confinement. We may recognise this mode of seemingly unbound and real-time control enabled by technological advancements in signal processing. Yet, in retrospect it appears that in the last decades (in particular after 9/11) this did not replace disciplinary environments of spatial enclosure but rather reinforced, modified and amplified them (see Crary 2013: 71-84; Rasmussen 2013).

Although the implications of electronic media are widely discussed in architecture and the various discourses on space, some dimensions of the problem of control and the social realities produced by it seem to remain overlooked. First, the increasing dependency on signal processing machines and transmission networks, coupled with the decrease in clarity of their inner workings, which is in part inherent in their expanding complexity, may create yet unknown (or not yet clearly noticeable) types of normalization, uneven distribution, segregation and exclusion. Second, signal processing significantly modifies our sense of space-time. It allows for seemingly unconfined communication, navigation and localization (which in turn changes habit, perception and lived space-time) but simultaneously enables spatially diffuse or ubiquitous forms of centralized control. Last, the incompatibilities and opposition between different theoretical and philosophical angles, in particular between dialectics and new materialism, which already emerged with postmodernism and post-structuralism and evolved further with the ontological turn, seem to distract attention away from certain key aspects of control. It might be of vital importance to allow different modalities of thinking in order to remain critical while being sensitive to the changing modes of operation. We may argue that the theoretical incompatibilities that make it impossible to act on the present lie precisely at the points of conversion between continuous processes and discrete numbers. Overcoming this impasse requires a spatial theory and practice that is both analogue and digital, which may be found in the concept of abstract machine.

Abstract machine most commonly refers to the abstract model or operational diagram of a computer system, which is a time-discrete control mechanism (based on a quantized concept of time and space — an integrated and synchronized abstract space-time). Gilles Deleuze and Félix Guattari expanded this definition to any abstract diagram of a system (whether it is mathematical, algorithmic, financial, socio-political, or else) that is reduced to functions and matters and therefore 'independent of the forms and substances, expressions and content it will distribute' (Deleuze & Guattari 1980: 156). Abstract algorithms, however, articulate everyday rhythms. Think of search engines or social media algorithms that direct attention and become habits, for instance, or chatbots learning from social media feeds or other input regardless of content and expressions.[3]

The proposed artefact is a concrete abstraction that effectuates an abstract machine based on the following control functions, which derived from the aforementioned conceptual framework: modulation, filtering, conversion and probability distribution.

3 For instance, Microsoft's AI chat-bot that started to generate racist statements 'learned' from Twitter posts within one day; see Elle Hunt, 'Tay, Microsoft's AI chatbot, gets a crash course in racism from Twitter', The Guardian (24 March 2016).

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