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From Urban to Communicational Problems?

An inquiry into the problematization of digital urbanism

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FROM URBAN TO COMMUNICATIONAL PROBLEMS? AN INQUIRY INTO THE PROBLEMATIZATION OF DIGITAL URBANISM.

Masterarbeit am Institut für Europäische Ethnologie der Humboldt-Universität zu Berlin

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"Data, data everywhere, and not a thought to think" [1]

1. Introduction

Developments in computer capacities have sparked variegated future scenarios, often carrying the narrative that with a new data deluge, long pressing planetary problems can finally be solved. Thus, tech enthusiastic voices have emerged claiming that even scientific theories will soon be superseded by data-driven knowledge production providing a more substantial knowledge basis (Anderson 2008, Prensky 2009, Steadman 2013). Cities too are increasingly imagined and already prepared as the central site for such transformation. Thus, travelling under the label of 'Smart Cities' or 'Digital Cities' they are thought of as knowledge entities not only by corporations that seek to develop urban markets to place their products and services. Also, the state, engineering sciences and a 'new urban science' imagine such technological transformations of current cities by means of 'intelligent' infrastructures as a desirable, even necessary form of urban management in order to tackle future urban (and planetary) challenges. A good city hence, is primarily one whose infrastructure enables the seamless transmission of information, and often interchangeably, of its inhabitants' knowledge. It seems that most pressing urban problems are first and foremost problems of information, communication, or, data. This is at least surprising because while knowledge can be 'true', there is rarely a straightforward, unambiguous answer as on how to act upon it, not even for those phenomena like climate change that are said to have a largely consensual (body of) evidence basis (Proctor & Schiebinger 2008, Oreskes & Conway 2011). I am interested in how that came about and how current problematizations of urban phenomena are potentially affected by it. That is, while much of the dominant critique of 'smart urbanism' puts emphasis on the role tech industries have as driving forces behind these approaches, it tends to ignore a) the historically grown discursive context that made these developments possible in the first place and b), more crucially, forecloses the "actual question of technology" and its agency (Halpern 2014:243).

Thus, this thesis' aim is twofold, for one, it seeks to understand how it became possible to ascribe 'knowledge' such a central role to city planning, so that current imaginaries of digital urbanism (like Smart Cities) can appear as a sensible mode to address urban challenges. Secondly, on this basis, I am inquiring whether such inclination to 'solve' urban problems with information technologies may bring with it a side-effect that reconfigures historically grown urban problems such that they are amenable to the very information technologies and in turn, appear as if they constitute an information problem. Acknowledging that material infrastructures are not only tools that execute our intentional practices of problematization but shape these too, I will do so by tracing the role material infrastructures of information technologies had throughout these processes.

In the first chapter, I will trace digital urbanism to the early 20th century when from the work on telegraphy infrastructures a particular, reified concept of 'information' emerged. Subsequently, the work on specific practical wartime problems of human-machine

1 The quote is taken from Shera (1983:384), punctuation was added. The original quote is: "The computer is here to stay, therefore it must be kept in its proper place as a tool and a slave [sic!], or we will become sorcerer's apprentices, with data, data everywhere, and not a thought to think."

integration allowed for this ‘information’ to co-produce and sustain a cyborg discourse through which accounts of human and non-human ‘intelligence’ or ‘knowledge’ increasingly approximated so that humans could be envisioned as part of social systems governed primarily by communication processes.
Understanding digital urbanism as an epistemological project that in effect also was transposed to the city, the first part will not focus on the city itself, but the knowledge practices through which also the city could be imagined as governed by ‘information’. In an interlude then, I will first examine how information technologies gradually became detached of their iconographic link with the military research complex and increasingly envisioned as tools for social transformation. After this, I will outline how the city in Western discourse became increasingly imagined as the central site to act upon planetary challenges allowing for emerging narratives to promote also the city as a communication system and its problems to be addressed by information technologies. Bridging over to the next chapter, finally, I will analyze the current discourse of digital urbanism in Germany in more detail. This will help to apprehend digital urbanism as part of a historical continuum of a specific (urban) problematization and understand if, and how potentially practices of urban problematization are affected.
With it, I hope that this thesis can offer a different perspective to analyze and criticize digital urbanism that acknowledges the agency of technological infrastructures and thus, takes into account the unintended or undesirable consequences that potentially arise of a ‘digital transformation’ of cities.

2. Theory & Methodology

I would like to first outline the conceptual framework that guides my research in this thesis. That is to say, I am not strictly ‘applying’ one theory to my topic, but rather draw from different theoretical approaches that I deem helpful in pursuing my research objective. This entails situating digital urbanism historically in order to make sense of the increasing importance that is given to knowledge, or the networking thereof, in Western discourse, for the sake of future viability of cities. And examine how in this light, digital urbanism is mobilized in the German discourse and what ‘real consequences’ can be identified. A central hypothesis is, that one consequence might be the foregrounding of communicational aspects of urban problems rather than other aspects.
My interest in the topic emerged, when at my side job at a non-profit association for urban planning, I was asked to do some basic desktop research about Smart City activities in Germany. Familiar with the dominant criticism of the concept, I expected to largely see corporate-driven projects in this regard. And indeed, Information and Communication Technology (from here on referred to as ‘ICT’) industry played a role in many projects, however, similarly science, the state and sometimes civic society mobilized the idea of managing the urban through ICT infrastructures, or state funding programs demanding a citizen-centered Smart City, partly opposing an exclusively corporate Smart City. I thought that the dominant critique of the Smart City was not really able to capture this rather heterogeneous set of different actors, and importantly the material technologies that digital urbanism is composed of. While actor-centric readings of digital urbanism can generate

interesting insights, my impression was that what fell from view, was a particular problematization of the city that was shared across these different communities of practice. Maslow's hammer came to my mind and I thought that too little concern was given to the kinds of problems that this digital urbanism was imagined to solve, be it dominantly corporate, state-driven, or accompanied by research facilities. Accordingly, I felt the concept of the Smart City was rather limiting in understanding these phenomena as in practice the term acts more as an "empty signifier in that conceptually almost any issue of ICT in an urban context may be framed by" (Wolfram 2012:173), making a distinction between for example the Digital City and the Smart City "rather pointless in practice [...] than truly substantial" (Willis & Aurigi 2017:15). Thus, for this thesis I would like to understand the Smart City, or other labels prevalent in the German discourse such as the "Morgenstadt" or "Zukunftsstadt" as synonyms of the discourse of 'digital urbanism', that is an aspiration to transform cities into future cities using ICT technologies. This way, we can also account for the social dimension that the digital carries with it. That is to say that the question is not what part of the city can be digitalized, but instead how cities and their organizational mechanisms are conceptually prepared as if they could, or even ought to be digitalized (Bowker et al. 2010). In this light, I understand digital urbanism as a framework to think about the city that privileges certain problems to be solved by ICT technologies. Accordingly, I understand digital urbanism as a particular "problematization" of the city, one that is not necessarily the 'best' or only way to think of it, but currently an increasingly popular one that, despite the disagreement on how to do it, tends to be taken-for-granted.
Engaging with digital urbanism through a lens of problematization means first asking "how and why certain things (…) became a problem" (Foucault 2001:171). This implies that problematizations are not naturally given: "the objects they identify, the questions they prompt and the solutions that come to be installed in practices (which can themselves give rise to further problems), are historically specific, contingent and mutable, the result of struggles over what counts as the truth and who can speak it" (Huxley 2013:1529). The 'truth' I am concerned in my research thus, is that of assuming that a focus on information or knowledge yields 'better' cities. Inquiring into problematizations then, means "pointing out on what kinds of assumptions, what kinds of familiar, unchallenged, unconsidered modes of thought the practices that we accept rest" (Foucault 1990:154). Put differently, it means asking to what problem, current, taken-for-granted "policies, arguments, analyses and prescriptions purport to provide answers" (Rose 1999:58 as cited in Huxley 2013). To this end, one leading question guiding me is:

> Q: How did it become possible in Western discourse to think about 'knowledge' or 'information' as a constitutive force governing the future viability of cities? Or put differently, what makes us think that networking information or knowledge can contribute to 'better' cities?

I agree with urban geographers Clive Barnett & Gary Bridge (2017:1187) that approaching these questions is not a matter of "simply arriving at clearer, more coherent conceptualizations of 'the urban' or 'the city'," but of "understanding how and why making sense of urban issues becomes salient in the first place". Theoretically this aligns with what Colin Koopman (2013) and the anthropologist Paul Rabinow (2003) have conceptualized as the "history of the present" (Bacchi 2015:2). This is the larger framework of my thesis.

Here, I am interested in how material technologies did not only offer new ways of solving naturally given problems but also transposed a specific problem formation for which it historically 'worked', to other domains which originally were not necessarily thought of to be in the scope of its solving capacities. This is then maybe better captured by Rabinow's understanding of an apparatus:

> "The apparatus is a specific response to a historical problem. It is, however, a dominating strategic response. That initial response to a pressing situation can gradually be turned into a general technology of power applicable to other situations. The apparatus is a kind of formation. What may have begun, for example, as a pressing problem of urban policing may turn into a set of diverse techniques applicable to other populations, at other times and in other places: the apparatus can be turned into a technology" (Rabinow 2003:54).

I wish these theoretical concepts however to read as an inspiration rather than a strict protocol. Problematization allows me to highlight the contingency of current claims made in digital urbanism and opening them up for "genealogical or critical historical sensibility" (Huxley 2013:1528). Such genealogical resp. historicizing work is concerned with the present (Koopman 2013:24). It can contribute to understanding present (formulations of) digital urbanism and the problems it attempts to solve not as the "products of unified histories or singular rationalities" (Huxley 2013:1528) but as "response to specific conditions and within specific sets of presuppositions" (ibid.) which "continue to be present in the formulation of what can or cannot be said about the nature of present problems" (ibid.:1530). More to the point, it means to trace part of digital urbanisms' origins in historical practice with specific problems that at first were not concerned with the city. This is also why a large part of this thesis, at least in the beginning, will not be concerned with the urban at all, and instead with the cultural context through which digital urbanism became a sensible option in the first place.

Such approach aims to destabilize the questions that seem already self-evident, or how Nikolas Rose (1999:58 as cited in Huxley 2013:1538) put it so aptly, to "disturb that which forms the very ground-work of our present, to make the given once more strange, and to cause us to wonder how it came to appear so natural". As such, genealogical work is not necessarily aimed at stating that the given object of research, say digital urbanism, is 'bad'. In fact, as Foucault put it, it is not about denying but acknowledging the "reality of such phenomena" (Foucault 2001:171). This is then also its potential for critique, for that it rests on exposing the links that previously, for whatever reasons, have been obscured (Koopman 2013:92).

I will do so by pairing a genealogical approach tracing my question, with a discourse analysis of current policies by the German state that seeks to promote a particular digital urbanism in order to identify potential continuities. Importantly, I use the term discourse not to systematically describe the full scope of all the 'speech acts' that constitute digital urbanism. It is less ambitious and more focused on central policy papers of the German state that seek to promote digital urbanism. Additional sources are studies, surveys, so-called city rankings, and self-descriptions of some projects that illustrate 'typical' approaches in this regard. I would like to note, that both genealogy and discourse analysis are equally important to explore my central hypothesis:

> H: New information technologies not only propose a new set of solutions to naturally given urban problems but also shape the nature of these problems. That is, they helped to co-produce a discourse that privileges communicational (urban) problems.

Given that my discourse analysis is mostly concerned with the front stage of the current discourse (Bijker et al. 2011:124-125), the genealogy is to be understood as auxiliary in this regard, because in part it makes understandable how historically, information technologies enabled to think in certain terms, and by that, implicitly shaped problems to be solved. This is also grounded in central assumptions of feminist technoscience that this thesis draws from. Explicit links between human and non-human agency for example can be found in Katherine Hayles' work, where she argues that agency is distributed across a cognitive assemblage of different human and non-human actors (Hayles 2017:118), which deductively means that also problems of digital urbanism cannot solely be accounted to human intentions that chose their tools according to each given problem, but have to be understood in the context of technological infrastructures that framed social practices of problem-solving i.e. that posed particular problems to be solved in the first place. This brings me to my last central assumption: technologies are not neutral, and data is not simply there, i.e. data is never "raw", but always "cooked" (Gitelman & Jackson 2013:2). By that, the work sits somewhere between Critical Data Studies (Illiadis & Russo 2016), an Anthropology of Infrastructure (Bowker et al. 2009), and Science and Technology Studies. Importantly, one implication of problematizations is that they emerge in practice (Bacchi 2012:2). That is, in order to understand how technologies shape problems, or how people in practice possibly 'learn' to transpose their practical intuition to a given object (Boyer 2013:159), an ethnographic method would be needed. It is important to acknowledge, thus, that my hypothesis tends to be explorative, and the aim of this thesis is more to open up digital urbanism to think through a lens of problematization, possibly identifying sites where a closer ethnographic examination could make sense, and directions where urban research could go from here. Given that this approach has not been done with regard to digital urbanism yet, I am confident that even such non-ethnographic approach can be of help for future anthropological research.

3. Genealogy

In his recently published best-selling book *Homo Deus*, the popular historian Yuval Harari (2017:462) makes the point that algorithms at one point in the future possibly may know more about us than we do. In a way, this reading of algorithms reflects quite well a dominant popular story: there are non-human devices that already govern many aspects of human life, have the capacity to 'learn', and process amounts of data unprecedented for humans. What seems like a plausible consequence then, is that in some near future machines will 'know' more about us than we do.[2] This narrative implies that what essentially makes something (a computer) or someone (a human person) 'know' something are its calculative capacities to process data. As these capacities are so much higher in modern computers,

2 Today, this is known as the problem of 'Singularity'.

computers inevitably will know more than us at some point. Depending on one's standpoint, the trajectory outlined in Harari's book is then either embraced for its potential benefits or cautioned against. What both utopian and dystopian narratives have in common however, is that they both mobilize a 'cyborg discourse' assuming that the boundaries between humans and machines with regard to 'knowing' something will dissolve such that 'intelligent' infrastructures can be imagined. In this popular cyborg discourse, the foundation of knowledge for machines and humans is treated the same, or at least comparable namely as discrete units, often depicted as electric signals that constitute 'knowledge'. This has resulted in claims by popular figures of the AI community like Google Director of Engineering Ray Kurzweil or tech entrepreneur Elon Musk that in the future humans will be able to download knowledge or upload one's memories or self even (Kurzweil 2012, Kurzweil 2000, FAZ 2020). This is nothing Kurzweil or Musk came up with, rather their claims reverberate similar narratives that accompanied earlier AI and robotics research (Moravec 1988:109-110) or the cyberpunk movement, a group of science fiction writers that emerged in the 1980s. Despite being speculative, these predictions already have real consequences.[3] Recent developments in computer science have sparked enthusiasm about 'machine learning' and 'deep neuronal nets' and the increasing number of ways through which algorithmic knowledge production becomes experiential seem to have contributed to a stabilization of this cyborg discourse. Implicit is that 'knowledge' can be described apart from its corporeal dimension. To think of 'information' or 'knowledge' as a single unit as some kind of bodiless entity is nothing inevitable, or more 'natural' for that matter, but emerged only at the beginning of the 20th century as the product of certain practices which have co-developed with and within certain technological infrastructures and a specific geopolitical context (Geoghegan 2016:173). This is the nexus that I would like to outline as part of this genealogy.

To this end, I identify two developments (beyond the urban domain) crucial to understand: A) the reification of information, i.e. when information started to be conceptualized as a 'thing', and B) the reconfiguration of 'knowledge', i.e. the conflation of this notion of 'information' with what it means to 'know something' by rendering human minds information processors. I understand this as a necessary foundation to understand how 'intelligent' infrastructures, digital urbanism, and with it, a particular problematization of the city were able to emerge in the first place. Such history entails not only what specific people or theories 'really' said or meant but asks why some constructions of 'information' were deemed productive by other scientists to be picked up and others were not. That means, one also has to consider the material infrastructures and political context that co-produced specific practical (wartime) problems for which to be solved a particular 'information' was deemed adequate.

There surely is not *one* genealogy of information to be told and due to the confinements of this thesis, this genealogy is highly selective, confined to a Western discourse and hence,

3 The U.S. American Start-up Nectome for example offers its customers to conserve their brains after death. While not yet possible, the promise is then to scan the brain and upload it into a computer simulation at some point in the future (Regalado 2018).

by no means exhaustive.[4] I hope, however, that even this particular, simplified history can help to understand why digital urbanism emerged in the first place, and how information technologies might shape the very problematizations of contemporary urban phenomena that, in turn, circularly legitimize the application of these technologies.

3.1 Information reification

In this part I would like to first trace how the work on telegraphic transmission sparked an interest to construct a theoretical entity of 'information' that would help solving engineering problems. The resulting concept of 'information' was inextricably tied to this practical work. For reasons of scientific disinterestedness it was explicitly delineated from human 'intelligence' and thus, introduced the possibility to think of 'information' as a reified entity.

3.1.1 One root of information reification: Telegraphy

Before 'information' could emerge as a theoretical concept that was deemed interesting to research on, it had to become productive for certain practices, and by that, institutionalized (Nye 1990 as cited in Boyer 2013:156). Further, to look at 'information' as a binary system there had to be a material counterpart that enabled to think in such terms.
One example illustrating this entanglement of material infrastructure and knowledge production was the technology of telegraphy, which according to the science historian Bernard Geoghegan laid the ground for the contemporary understanding of 'information':

> "the technique of writing at a distance often through recourse to electrical signals - took the lead in delineating patterns and series that would eventually be called information" (Geoghegan 2016:175).

In this understanding, telegraphy was inscribed with a tendency to "turn all communications into standardized, quantifiable traces" (ibid.:176). As a consequence, not only 'information' detached from its bodily counterpart was introduced, also human agency was increasingly rendered obsolete for the content of 'information' such that the human was reduced to the role of an "instrument clerk", as a "Handbook of the telegraph" from 1862 suggests (Bond 1862 as cited in Geoghegan 2016:176). Thus, a telegrapher had to be necessarily knowledgeable in mathematics and had to have an excellent hand-writing, whereas "the ability to speak or understand the language being telegraphed" was rendered "non-essential" (ibid.).
Interestingly, this illustrates a point Harry Collins made in his book *Artificial Experts* (1990), where he writes that in order to 'digitalize' a task in the contemporary sense, that is to

4 See for example Boyer (2013:157ff.) for a tracing of digital thinking to mechanized computation, that is, tabulation machines that are said to have introduced digital, ergo binary, information processing on a larger scale to Western industrial nation states at the end of the 19th century, enabling the elicitation and control of populations (see also Beniger 1986). See also Black (2001) for how IBM, controlling most of the tabulation market, provided their technology to the German Nazi regime during the 1930s and WWII, and by that essentially helped to organize the Holocaust (Black 2001).

replace a human with a computer, the replacement is less a matter of comparing human with machine 'intelligence', because it is not their specific ways of 'thinking' that are in competition, but rather of the choices to render certain tasks in a way that prioritizes one mode over the other.[5] Put in infrastructural terms, one might say the domain of telegraphy was prepared for the substitution by a technological mechanism (Bowker et al. 2009:103). In this sense, what emerged during this time was a certain type of telegraphy. One that was not concerned with giving agency to the translator that could help interpret (the meaning of) a message if sent from a different context, rather, the task was willingly rendered machine-like and actively engaged "total indifference to the social, cultural, and geographic specificities of clients" (Geoghegan 2016:176). This is not to say that this was 'false'. In fact, telegraphy made experiential that computation 'works' in some form, making possible to transfer a message from point A to B so that even when telegraphy was surpassed by telephones in the 20th century, "the epistemic status of its techniques waxed" (Geoghegan 2016:177).

Hence, at the American Telegraph Company,[6] work on improving signal transmissions via telegraphs (and telephones) fueled the interest to define "that 'stuff' of communications" (Geoghegan 2016:178). Illustrating this, in 1928, the Bell Labs engineer Ralph Hartley published an essay in the *Bell System Technical Journal* where he suggested to replace the term "intelligence", which was commonly used by engineers when referring to transmission patterns, with the "less anthropocentric term" of "information" (ibid.). Hartley proposed that "human cognition should not feature in the definition of signals" (ibid.) to establish a "definitive quantitative measure of information" (Hartley 1928:538 as cited in ibid.) so that telegraphy no longer was a "medium for transmitting speech and meaning; speech and meaning became a medium for the production of telegraphic information" (Geoghegan 2016:178).

Put differently, telegraphy laid out a specific concept of 'information' as electrical signals and consequently, made it possible to think of 'information' as a discrete unit. The research revolving around 'information' however was not yet fully institutionalized nor was 'information' theorized, war helped to manifest these ideas into institutions.

3.1.2 From wartime problems to information theories

During WWII then, communication research became an issue of national security, so that also research in 'information' heavily accelerated. The militarization of communication research not only partially shaped the knowledge production by stating specific practical problems that were to be solved. Even if the research was not put to immediate military use, it also enabled an often underappreciated "massive institutional support" (Geoghegan

5 In a review of Collins' book Hubert Dreyfus made a similar point. While he slightly differed from Collins insofar that he held that a certain type of computer can duplicate a human expert where a certain domain, and type of knowledge can be theorized, (Dreyfus 1992:718), he acknowledges Collins' point arguing that "it might turn out that those domains for which we have a theory are just those domains of human activity in which we have disciplined ourselves to behave like robots" (ibid.).

6 From here on referred to as 'Bell Labs'.

2008:72) that would be responsible for building scientific networks and enabling interdisciplinary work with relatively large freedom as on how to solve war-related problems.
That is, all computer research during WWII in the U.S. was only possible due to direct funding from the War Department (Edwards 1996:44), entailing widespread interdisciplinary research efforts on topics like “cryptography, computing, radar, and fire control” (Geoghegan 2016:178). New institutions like the National Defense Research Committee (NDRC) and the Office of Scientific Research and Development (OSRD) were founded to organize and lead the research on topics deemed desirable for the military. Whether locating enemy submarine ships, predicting the trajectory of airplanes, or en-/decrypting telephone lines; many of the scientists that would later become known as important figures of information research were involved in solving these kinds of problems (Aspray 1985:118). Contracted under the NDRC, the mathematician and engineer Claude Shannon was able to conduct his military research at Bell Labs in 1941 on automatic antiaircraft weapon systems and cryptography after graduating from MIT (Verdú 1998:2058). His work entailed for example encrypting the telephone line used by Churchill and Roosevelt (Gleick 2011:4). Part of this research was published by Shannon in 1945 under the title “Communication Theory of Secrecy Systems”[7] which is considered to be the precursor of his information theory to be published three years later (Edwards 1996:200). In fact, Shannon himself suggested in an interview with the historian David Kahn that his work on cryptology and information theory “were so close together you couldn't separate them” (Kahn 1967:744). Similarly, in the UK, it was the British mathematician Alan Turing who, as part of his wartime work on decrypting the German encryption devices ‘Enigma’ and ‘Fish’, contributed to the invention of ‘Colossus’ in 1943, retrospectively the first “true electronic digital computer” (Edwards 1996:17).[8] And at the Radiation Laboratory (MIT), Norbert Wiener’s work on antiaircraft guns crucially informed his interest developing a new research program called cybernetics (Edwards 1996:180, Galison 1994:229f., Wiener 1956:265 in Mindell et al. 2003:68; see also section 3.2.1. in this thesis, p.15).
Importantly, the concerted efforts to work on similar practical war problems also created an “experience of community among scientists and engineers“ (Edwards 1996:47) to all of which communication research promised some resolution, spurring an increasing interest towards theorizing this ‘information’. As Geoghegan put it: “Experience and practice indicated commonalities, but the name or rule of these shared conditions escaped scientific definition. After World War II, *information* emerged as a keyword for defining that commonality” (ibid.:179, emphasis in original).
Consequently, the historian of science William Aspray (1985:117f.) writes that the “Scientific Conceptualization of Information” was the result of a movement that sought to “unify [its] diverse roots” laying in “physics, mathematical logic, electrical engineering,

7 Originally it was a classified report with the title “A Mathematical Theory of Cryptography” publicly available only after his “Mathematical Theory of Communication” in 1948.

8 Only 30 years prior in WWI however, the term ’computer’ still meant something else. During WWI, ‘computing’ described the work of (pre-)calculating artillery tables that was largely done by women employed to “compute the tables by hand using desktop calculators” (Edwards 1996:45). During World War II then, these tasks were gradually mechanized. Thus, increasingly ‘computing’ became a domain for, and associated with machines.

psychology, and biology" into a coherent scientific framework (Aspray 1985:118, see also Kline 2004). Accordingly, a "cohesive scientific community" (Aspray 1985:118) emerged, more or less personally acquainted and although coming from different disciplines, to each of them the concept of 'information' promised value to their respective research. Illustrating this, by 1948 at least seven information theories and principles circulated in British, U.S. American, and French journals, all "put forth in the space of a few months" (Verdú 1998:2058). Out of these accounts, Claude Shannon's information theory turned out to be the most influential one, or as the historian James Gleick put it, "it was a fulcrum around which the world began to turn" (Gleick 2011:4).[9]

It makes sense to look at Shannon's information concept, since his theory remains an important reference point for today's communication research. Shannon also pointed out that his work largely based on that of his colleagues at Bell Labs, among others the previously mentioned Ralph Hartley (Shannon 1948:379). Thus, it was not a theory falling from the sky, but represented a particular approach to 'information' prevalent among the "engineering culture" of Bell Labs or MIT during that time (Mindell 2002:135 as cited in Geoghegan 2008:75).

Like the engineers at Bell Labs were concerned with how to 'find' the original message sent and ensure a transmission despite constant noise (or encryption), for Shannon, the fundamental problem was „reproducing at one point either exactly or approximately a message selected at another point" (Shannon 1948:379). By that, Shannon was concerned only with the form of communication, not the content: "[T]he epistemic innovation of Shannon's information theory was to relieve communication of semantics" (Boyer 2013:159.), that is, an attempt to make 'information' quantifiable by detaching it from meaning (Hayles 2005[a]:34).[10] To this end, he defined 'information' as a probabilistic function similar to entropy in physics (Verdú 1998:2058, Golomb 2001:455).[11] The amount of 'information' thus, could be described by the number of **b**inary dig**its** (bits) necessary to

9 In fact, already in the early 1950s Shannon was popularized through several education media which helped for information research from being a "wartime science" to become "trendy topics of pop culture" (Geoghegan 2008:67) which is why today especially in the U.S. Shannon is sometimes referred to, as in his Wikipedia article, as the "father of information theory", or even "information age" (UCTV 2008). One has to see this in context: in an impending Cold War, communication research was considered increasingly important for the U.S. so that Shannon's "research into communication and computers symbolized the possibility of rationally managing new communications systems vital postwar security" (Geoghegan 2008:67). Maybe illustrating the politicization of information research due to its enmeshment with Cold War politics, in the Soviet Union under Stalin, information theory was seen as the epitome of an American ideological pseudo-science. As such, only the allegedly technical aspects of Shannon's theory of communication were translated. As a result, a chapter on Shannon's contemplations on the English language were removed, and even words like "information" changed into "data". It was an attempt to separate the technical aspects of the work from its anthropomorphic tendencies and perceived political implications (Mindell et al. 2003:66f.). When Stalin died, his anti-cybernetics campaign slowly lost its grip such that Russian scientists increasingly engaged with information theories as well (Mindell et al. 2003:67).

10 This was not a story without frictions. Uncomfortable with the notion of 'meaning-free' information, others like Heinz von Foerster said he would have preferred to call it "signal theory" because to him 'information' was inextricably tied to meaning (Gleick 2011:248).

11 In fact, mathematically both formulas nearly look the same (Mirowski & Nik-Khah 2017:46). For a more detailed account of the interrelationship of entropy and information, see Hayles (1999:100ff.) or Mirowski (2002:46) for more focus on cybernetics and entropy, and its impact on economics becoming a "cyborg science".

compute it. Although one bit was not the same as ‘information’, it became a proxy of describing potentially information-rich or -poor systems. As such, a bit effectively came to be known as the basic unit of ‘information’ (Golomb 2001:455). In Shannon’s understanding, language became understood as the sequence of formal symbols. This is not to say that Shannon’s intention was to promote a formalist epistemology. Rather, it would be “better to consider Shannon’s information theory (…) as an ideological transposition, that is, as an epistemic procedure that converts immediate practical intuitions into more general truth conditions” (Boyer 2013:159). That is, Shannon himself, being not concerned with ontological problems, explicitly stated that the semantic aspects of communication “are irrelevant to the *engineering* problem” (Shannon 1948:379, emphasis added), and it was for these practical problems to which this particular ‘information’ was helpful.

The analytic choice to separate the form and content gave means to translate, say, the recording of a voice, or moving pictures into binary numbers so that it (or rather, a representation of it) could be stored on a device, or sent through cables to be received with a telephone, television, or such. The historian of science Jonathan Sterne calls this process “compression”, that is, “the process that renders a mode of representation adequate to its infrastructures” (Sterne 2015:35). As such, it adequately captures the entanglement of engineering practice and the material infrastructure through which flows of electrical signals could be imagined as an informational entity. ‘Information’ was conceptualized, and the ground was set to view it as something that could be mathematically described and put in discrete serial units. And although ‘information’ described a particular approach to solve engineering problems, at least analytically, it became a ‘thing’.

To quickly recap, Shannon’s information theory was not successful because it was a ‘truer’ account of information, but because it was quantifiable (Hayles 2005[a]:34-35) and thus enabled the establishment of a relationship between the amount of information and its probability. This was particularly productive and valuable for engineering practices (Hayles 1990:52ff.) and with it, specific practical problems. In other words, research on ‘information’ did not come out of a vacuum of mere curiosity. It was the result of a specific combination of similar epistemological concerns, specific problems in wartime on which the vast majority of ‘information researchers’ worked on, techniques they shared, and technologies in which their practice was embedded. Through public funding infrastructures and institutions like Bell Labs and MIT communication research was increasingly institutionalized. Importantly, this is not to say that “militarization was [...] a false, but simply a *particular* process of knowledge production” (Edwards 1996:178, emphasis in original). The result was an ‘information’ that was explicitly delineated from ‘intelligence’ in order *not* to conflate it with psychological factors. ‘Information’ was reified, but this alone was not sufficient to think of human and machine intelligence in commensurable terms, let alone ‘intelligent’ cities.

3.2 Reconfiguration of ‚Knowledge‘

In the previous part, I attempted to show how during and after WWII a specific engineering concept of ‘information’ emerged. The elimination of semantics was a productive way to

deal with engineering problems concerned with transmitting signals through information infrastructures and allowed to think of ‘information’ as a discrete unit.
Now, I would like to show how this reified concept of information introduced the possibility to think of the ‘human nature’ in similar terms, and by that to situate human knowledge and computer information on the same scale, effectively enabling to speak of ‘intelligent’ machines. This was because during WWII practical problems of human-machine integration made it necessary to produce theories and models that would describe both machines and humans in commensurable terms (Edwards 1996:19). This line of research solidified after WWII in disciplines like cybernetics, cognitive psychology, and the field of Artificial Intelligence (AI), and informed biology, physics, social sciences, and economics, and the way they problematized their research objects. Further, ‘information’ became an increasingly popular concept to characterize Western societies.

3.2.1 From servomechanisms to cyborgs

In 1942, at a small interdisciplinary conference called the “Cerebral Inhibition Meeting” (CIM) led by the behaviorist psychologist Howard Lidell, mathematician Norbert Wiener, together with neurobiologist Arturo Rosenblueth and engineer Julian Bigelow presented their “theory of feedback control” (Edwards 1996:180), which was a “statistical theory based on incomplete information” (ibid.) as the direct result of their work on antiaircraft gunnery systems. Importantly, they found that it would not only apply to the weapon systems envisioned but potentially, human behavior as well. Given that weapon systems were still used by humans, “people and machines [were required] to be comprehended in similar terms” in order to “maximize the performance of both kinds of components” (Edwards 1996:147).
For automatic antiaircraft missiles then, human behavior had to be included in so-called servomechanism to “[reduce] the effects of human error” (Edwards 1996:180). As such it was the start of what Edwards retrospectively calls “cybernetic psychology” (ibid.:182), representing both “an extension and vindication of behaviorism” (ibid.), the dominant school of psychology at this time. Extension, because it presented “a uniform behavioristic analysis [that is] applicable to both machines and living organisms” (ibid.). Yet, the ‘new’ move was not to reject “purposes, goals, and will (as in behaviorist psychology)” (Edwards 1996:182) but “*expanding the category of ‘machines,’* via the concept of feedback, to include these notions” (ibid.). Put bluntly, feedback enabled to transform the analytic object (of behavior) into that of *one* human-machine system. As reflected in the CIM as well, the work on these technical problems brought psychologists together with information theorists, electrical engineers, and neurophysiologists (Edwards 1996:147).[12]

12 Such cooperation was not only confined to symposia or meetings. One emblematic example would be the paper “What the Frog's Eye Tells the Frog's Brain” (Lettvin et al. 1959) where mathematicians, biologists, and cognitive scientists worked together on experimenting with fibers of frogs’ optic nerves. One might say, cybernetics offered them a language to do so.

The new perspective on describing potentially both human and non-human behavior outlined at the CIM received considerable excitement.[13] Many participants agreed that a new research program should be established. After several attempts to institutionalize such approach,[14] in 1946, the neurophysiologist Warren McCulloch convinced the Macy Foundation to fund an interdisciplinary conference series, the Macy Conferences, which would become the watershed event of this new research program (Edwards 1996:189). This was two years prior to when Shannon released his information theory, and Wiener revealed the name of this envisioned research program: cybernetics (Wiener 1948). Although cybernetics "has proved difficult to define, even for its enthusiasts in the immediate postwar period" (Mirowski 2002:54), for the genealogical argument here, it is sufficient to understand it as a scientific approach essentially dealing with "problems of control and communication wherever they occurred" (Aspray 1985:124). As vacuous as this might sound, this open-endedness was intentional and is also illustrated by the first (Macy) meeting's title "Feedback Mechanisms and Circular Causal Systems in Biological and Social Systems". To break it down, it was not a program starting with a field but a principle that was assumed to be found in any entity to which system-like properties were ascribed.

While during WWII the interdisciplinary work on technical war problems of human-machine integration sparked an interest to describe human behavior with computational terms more generally, the Macy Conferences institutionalized this ambition: "Through the Macy discussions […], the discipline solidified around key concepts and was disseminated into American intellectual communities by Macy conferees, guests, and fellow travelers. Humans and machines had been equated for a long time, but it was largely through the Macy conferences that both were understood as information-processing systems" (Hayles 1994:441f.).[15] That is, from the beginning, information research was deeply linked to questions of cognition as its perspective on human nature heavily relied on the "computer as model, metaphor, and tool" (Edwards 1996:147).[16] Employing the computer metaphor enabled for information theory to be thought of not only in terms of engineering but as a

13 In fact, one of the participants, the anthropologist Margaret Mead would later recall that she broke a tooth during the conference but only realized it until the meetings were over (Mead 1968:1 as cited in Heims 1991:14-15).

14 In 1944, John von Neumann, Norbert Wiener, Warren McCulloch, Walter Pitts, and Howard Aiken set up the "Teleological Society", illustrating the increasing interest in machines and allegedly equivalent nervous systems, to study "communication engineering, the engineering of control devices, the mathematics of time series in statistics, and *the communication and control aspects of the nervous system*" (McCorduck 1979:66 as cited in Edwards 1996:188, emphasis added).

15 In fact, already in 1850, the physicist Hermann von Helmholtz adduced the telegraph wire as an analogy of human nerve fibers (Hoffmann 2003:136).

16 The behaviorist psychologist George Miller for example, who worked in 1944 at the military-funded Harvard Psycho-Acoustic Laboratory "on ways to jam enemy voice communication" (Edwards 1996:223) would integrate information theory into his behaviorist stimulus-response model in 1949; considered by some "the birth date of cognitive psychology" (Garner 1988:42 in Edwards 1996:225). And, the Mexican neurobiologist Warren McCulloch introduced his presentation at the psychological Hixon Symposium by outlining a "new [intellectual] revolution" that would "replace brains by machines" (McCulloch 1951:42 as cited in Edwards 1996:175).

key to describe mental processes of the human mind,[17] social systems, or really any complex biological phenomenon (Aspray 1985:124, Gleick 2011:258). As such, cybernetics as a “public philosophy” (Mirowski 2002:54) paved the way for describing not only the human mind but also social systems with computational terms. Shannon’s ‘information’, but even more so, Norbert Wiener’s and Warren Weaver’s popularization of it,[18] were invaluable for these efforts. One might say, ‘information’ turned out as a currency that made possible a commensurability of humans and computers in certain contexts (Edwards 1996:19).

In this view, both information theory and cybernetics emerged from a specific “epistemic ecology” (Boyer 2013:160) of computer scientists, social scientists, psychologists, and enabled via military research on a specific set of problems, that helped to “foster an environment in which the subsequent cyborg sciences could flourish” (Mirowski 2002:54). It allowed for a “language of intelligent machines” which Edwards calls the “cyborg discourse” (Edwards 1996:21).

The fact that the computer experienced such attention, in turn, was not because it was an inherently superior model for human cognition over others[19] but also because the computer and its techniques already were an integral part of the working environments of involved researchers.

As such, choosing computational metaphors was not necessarily a strategic choice, but given that for example “some of the Macy participants had spent so much time engaged in their specialized projects of digital computation”, it is possible, Boyer argues, “that they had simply come to apprehend the world through that practical lens” (Boyer 2013:162). In this vein, Paul Edwards paraphrases Sherry Turkle, saying the computer became an “object-to-think-with” (Turkle 2005[1984]:27, passim, as cited in Edwards 1996:160). Based on her

17 In fact, in 1944 Wiener challenged the chair of Harvard’s psychology department Edwin Boring to give him an example of a capacity of the human brain that he would not be able to reproduce with electronic devices. Two years later, Boring agreed with Wiener and proposed that the human organism, including the brain, is best imagined “as a machine or a robot” revealing to Edwards that “as early as the end of World War II, the computer metaphor had achieved widespread currency” (Edwards 1996:187-188).

18 Ronald Kline (2004:18-19) argues that Shannon’s information theory was heavily popularized by Norbert Wiener (1950), and Warren Weaver (Weaver 1949) who translated the very technical work by Shannon into a more broadly understandable version especially for social scientists. Importantly in Kline’s view, both of them encouraged a semantic interpretation of information theory. Weaver for example first situated Shannon’s information theory on what he called the technical level (A). Other levels were semantics (B), and pragmatics (C). This was followed however by the suggestion that a theory of (A) is, to some extent, also a theory of (B) and (C) (Weaver 1949:96,98 as cited in Kline 2004:18-19). Similarly, Kline argues, in his book “The Human Use of Human Beings”, Wiener first gave a non-semantic theory of information, then however equated the “amount of information” with the “amount of meaning” (Kline 2004:19). That was because Wiener, as opposed to Shannon saw information to be not positive, but negative entropy. Kline writes: “It appears that in viewing information as a measure of order rather than disorder as Shannon did, Wiener was inclined to use the term in a more everyday, semantic way to mean knowledge” (ibid.), in consequence, he “encouraged a semantic interpretation of information theory” (ibid.).

19 Although not unimportantly, according to the science historian Hunter Heyck, there were also conceptual overlaps between communication research and the dominant psychological paradigm of behaviorism that rendered such cooperation fruitful. First, the latter was used “seeing the body as a communication system” (Heyck 2015:85) (input-output vs. stimulus-response), and second, information theory “promised to bring higher mental functions, especially language, “within the ambit of experimental (rather than speculative) psychology” (ibid.:86).

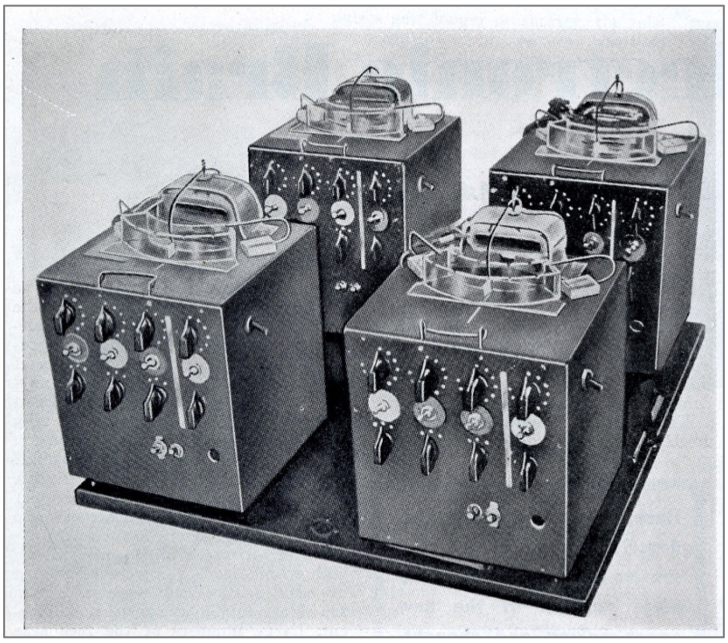

Figure 1: Ross Ashby's homeostat was not only a theory, but an actual machine through which theoretical ideas of 'feedback' became experiential. Image from Ashby (1954:94).

ethnographic research in the early 1980s when computers became increasingly affordable to the general public, Turkle observed that within cultural environments in which the computer constitutes some sort of practice, be it participating in computer clubs, playing computer games, tinkering with computer kits, or industrial engineering, the "computer brought many of [Turkle's interviewees] to talk about things they might otherwise not have discussed. It provided a descriptive language that gave them the means to do so" (Turkle 2005:27). Consequently, Turkle notes "discourse about computers [was] being used to think about free will and determinism, about consciousness and intelligence" (ibid.), even though she was not talking to philosophers, but "sophomores", "college freshmen", "five-year-olds", or "electronic hobbyists" (ibid.), diverse groups of people and practices whose common denominator was the computer.[20] It illustrates the practical dimension the computer metaphor entails. When Heinz von Foerster challenged the heavy use of computer-brain metaphors at the 6th Macy conference by putting forward a model based on quantum mechanics, consequently, this led to "confusion" (Edwards 1996:194) among the participating psychologists and neurophysiologists. This was because the model did not seem to be able to account for how nervous systems were thought of at this time. Thus, while most of the participants "welcomed the paradigm of servomechanisms and computers, machines they had all seen and worked with" they "did not quite know what to do" with his quantum model (Edwards 1996:194). As Fred Turner put it, cybernetic rhetoric alone did not suffice to popularize the computer metaphor for human behavior (or social systems) but had to be legitimized and experienced (!) through material artifacts as well, like Wiener's antiaircraft predictor or cyberneticist Ross Ashby's homeostat (Turner 2006:26; see also Fig. 1). That is, "[m]etaphors can be not merely linguistic but experiential and material as well. This is what makes metaphors such as the computer political entities" (Edwards 1996:30). Consequently, Foerster's proposition was not discussed again, also because it lacked this material counterpart so that the computer metaphor prevailed.

20 It also fits to Edwards' assertion that computers "resemble more closely things like rulers and blueprints, tools whose main function is to connect ideas and concepts to the material world. For the most part, computers are tools for *organizing* rather than performing physical work: tools for the mind" (Edwards 1996:28).

Condensed into a single model, the cyborg discourse was most visible in the imitation game that the British mathematician Alan Turing proposed in 1950, today also known as the Turing Test (Turing 1950). Although Turing was not an active member of the Macy Conferences, he was familiar with the works of Shannon, Wiener, and others, and himself heavily involved in military computer research. At the same time when Claude Shannon presented 'Theseus', a mechanical mouse that would learn how to navigate within a maze, Turing's thought experiment assumed that the computer, in theory, could exhibit 'intelligence', a term back then still largely reserved for the human domain.[21]
As such, it aptly reflects the 'cyborg discourse' that sprung from the ecologies of communication research in WWII. The game was set up as follows: take two rooms and three persons. Two persons, A (a man) and B (a woman) sit in one room, and person C in another. The only communication between A resp. B and C is written language. A and B are known to C only as X and Y. The goal for C is to determine which one of X and Y is the man (A), and which the woman (B). C does that by asking questions to A resp. B. The goal of A (man) is to deceive C, while B's (woman) goal is to help C. Now, if A would be a computer, could it win the game? The significance of the test continues to be an object of disputes.[22] For the argument here, let us emphasize that by suggesting that when the computer successfully deceives the interrogator in a setting where communication is only written, its intelligence would be proved, the game privileges the linguistic capacities of the computer and makes them "stand for the entire range of human thought and behavior" (Edwards 1996:159). Turing's implication that a "simulation satisfied some sort of criteria for the definition of that notoriously slippery concept 'intelligence' was a defining moment for the rise of the cyborg discipline of 'artificial intelligence'" as the science historian Philip Mirowski (2002:86) put it. More to the point, the setup of Turing's imitation game was inscribed with the notion that knowledge is bodiless, or put differently, by design the test could not account, for "voice, or (…) facial expressions, gestures, theatrical displays, laughter or any of the thousands of other ways of human communicate" (Edwards 1996:159). Maybe emblematic, in today's popular references of Turing's imitation game, the aspect of gender Turing's game is often ignored. In fact, as the historian Timothy Snyder points out, by assuming "C" to be genderless, Turing proposed some kind of bodiless entity of "pure mind", inscribing the very idea that ultimately the truth value of knowledge can be evaluated independently of its corporeal dimension (Snyder 2019). One might see this as a manifestation of the modern Western discourse privileging a distinct masculine culture of technology (Wajcman 1991:137ff.). Accordingly, the discourse of artificial intelligence and its ignorance of embodied forms of knowledge has been long in the center of feminist science studies' critique (Adam 1995:366-367). In addition, it might be that Turing shaped C in the image of the very computer he imagined as the perfect

21 In the 1930s Turing already formulated his idea of the Universal Turing Machine, a computer that in theory could simulate all mental states of the human brain, and by that would be indistinguishable from humans, possibly even having a mind (Edwards 1996:16). This is to say, Turing meant his test to be taken literally (Edwards 1996:159).

22 These discussions are often embedded in larger assumptions as to what degree the mind can be imagined as a computer, or as to whether machines can 'think'. For more a more thorough discussion of this topic, see for example Agre (1997) or Collins & Kusch (1998).

Turing machine.[23] In turn, the test not only privileged a particular 'intelligence' but with it, foregrounded a particular set of problems for which such 'intelligence' is best suited for.

3.2.2 AI: from hardware to software

Turing's test also represented a transition from cybernetics' ambition of "modelling brains in computer hardware" (Edwards 1996:239) to subsequent generations of AI research that "sought to mimic minds in software" (ibid.). I briefly mentioned Shannon's maze. Whereas he built 'Theseus' as an actual electromechanical device, Turing was concerned with how computers, in theory, could simulate mental states through programming; software was primary, the actual hardware secondary.[24] It helped for a shift away from embodied modes of 'knowing', such that it became increasingly common to assume something like disembodied intelligence.

This new approach was consolidated at the Darthmouth Workshop in 1956, sometimes considered the "birthplace of AI" (Edwards 1996:252). At the forefront of this new AI research was the Carnegie Mellon University with researchers like Herbert Simon and Alan Newell (Weizenbaum 2018:187). Privileging a view of human thinking as information processing, affected also how AI research referred to a 'problem'. This was demonstrated by Simon's and Newell's General Problem Solver (GPS), a heuristic target-means computer program that sought to model a purportedly universal human problem-solving mechanism. Simon and Newell assumed human intelligence to consist of information processing that transforms problems into formalizable steps. One might argue, looking at problem-solving through the GPS, they overly privileged certain modes of cognition, and with it, certain problematizations for which such thinking was best suited for. This makes the GPS not only a tool to solve problems, but one that also affects how a given problem should be approached, or what constitutes a problem in the first place (Weizenbaum 1978:238-239). As such, from the beginning, AI had and continues to have a strong inclination attempting to model human intelligence with the computer tools given, foregrounding those aspects of human intelligence that would not resist formal modeling techniques, and with it, a corresponding set of problems. In part, this is reflected by the predictions Simon and Newell brought forth: a computer would be able to beat a chess world champion, compose aesthetically valuable music, discover and prove an unknown mathematical theorem, and psychological theories would be essentially computer programs (Edwards 1996:255). What these examples have in common is that their domain and type of knowledge necessary, to a certain degree, can be theorized and thus made accessible to computational language. And while some of these predictions turned out to be true, they did not necessarily clarify whether machines and humans reside on the same scale of 'intelligence'. Thus, beyond their value of truth, what is important about these

23 In this light, Hayles makes the poignant comparison of Turing's test to a "magic trick" (Hayles 1999:xiv). It implies that the test is not necessarily able to exhibit 'intelligence', but acted more as a showcase of a particular understanding of bodiless knowledge. It foregrounded a notion of knowledge tailored to the possibilities of the computer and in turn, was transposed to human intelligence as well.

24 The technical term for this approach was "symbolic processing" (Edwards 1996:241).

predictions instead, is their “effect […] to shape how human being is understood *in the present”* (Hayles 2005:132) such that in 1988, it was possible for robotics research to assume the human ‘self’ resp. identity to be some sort of disembodied informational pattern that could be uploaded (Moravec 1988:109-110, Hayles 1999:xii).
At the beginning of this chapter, I have quoted Yuval Harari speaking of algorithms, not computers, assumed to know more than humans. Today, it is commonplace to assume programs or algorithms govern our lives and to ‘know’ more than we do (Bogost 2015), a view that AI research helped to consolidate.
To put things in perspective, it should be noted that what AI research solidified was not only the notion of disembodied information, but also a Bayesian view of knowledge that is so prevalent in today’s election poll forecasts, search machine algorithms, and for that matter, the variegated recommendation systems of Social Media platforms that to a large part shape the experiential basis of ‘artificial intelligence’ to which we as humans are exposed (Joque 2019). Thus, much of that we experience as AI in everyday technologies is grounded in probabilistic statistics that were used for specific war-related problems, and for which these calculational techniques seemed adequate. This was not because Bayesian statistics accounted for human knowledge in a ‘truer’ sense than other forms of statistical or non-statistical knowledge production. In fact, until WWII Bayesian statistics tended to be disregarded by leading statisticians as “virtually taboo” (McGrayne 2011:61). The pervasiveness of Bayesian induction as a means to produce future knowledge coincided with the rise of computer science itself. Here, Bayesian statistics proved valuable for predicting airplane trajectories, approximating submarine locations, and de-/encryption (McGrayne 2011:61f.). Grounded in engineering practices, it solidified a behavioral view of statistics, that is “for many Bayesians, the question is not whether it is permissible to say a claim is true; the point is whether it is profitable to *act* as if it were true” (Joque 2019:n.p.). The most notable example arguably being Google’s search engine: “There must have been dozens of times when a project started with naïve Bayes, because it was easy to do and we expected to replace it with something more sophisticated later, but in the end the *vast amount of data* meant that a more complex technique was not needed”, the Google research director Peter Norvig said to Sharon McGrayne in an interview (McGrayne 2011:244, emphasis added). I deem this important because when we talk about AI we often forget its grounding in statistical techniques. This implies a) a desubjectification of AI, or algorithms for that matter, by which I mean it is less an autonomous object that ‘acts’, but better understood as a technical object in the sense the French mechanologist Gilbert Simondon understood it, that is composed of three elements: (1) the technical elements (say, the (language of) code, its hardware, the integrated development environment) that compose the (2) technical individual (say, the actual algorithm), and the technical ensembles (3) which stand for the processes required to bring the elements into the form of the technical individual (Hayles 2012:88-89). Given that Simondon published mostly in the 1960s and 1970s, he did not primarily wrote about algorithms, but physical tools such as axes, hammers, or the like. However, especially the notion of the technical ensemble helps to destabilize the idea of algorithms as autonomous ‘tools’ that act on their own. Instead, it implies the creators of the tool (say, programmers), their techniques and

knowledge used, and with it the discursive context that made that knowledge available, to be part of the technical object as well (Iliadis 2013:18).
And b), it points toward the contingency of knowledge produced in such a way, emphasizing that the truth is not simply ‘out there’ to be found by a superior computer, rather the data is (purposefully) made sense of (Gitelman & Jackson 2013:3) in such a way that it is deemed ‘good enough’ for specific purposes.[25]

3.2.3 A bandwagon & new societies

As shown in the case of AI research, many of the cybernetic theories, techniques, and vocabulary continued to live in disciplines emerging from the cyborg discourse or were informed by it. At the same time, Ronald Kline argues, ‘information’ underwent what Thomas Gieryn has coined “boundary work” (Gieryn 1999 as cited in Kline 2004). This was represented by the disputes on what ‘information’ really meant, among information theorists and across disciplines alike (Kline 2004:16). Thus, early in 1951 at the Macy meetings, Shannon cautioned the Macy participants that his “information concept was not what they were imagining it was” (von Foerster et al. 1952:22 as cited in Mirowski & Nik-Khah 2017:47). The increasing enthusiasm with ‘information’ resulted in what he considered an inaccurate usage of the concept often suggesting a semantic interpretation so that in 1956, he wrote an editorial in the *IRE* (today *IEEE*) *Transactions on Information Theory* journal disapproving this tendency. Here, he depicted his information theory as a “bandwagon” warning that “it has perhaps been ballooned to an importance beyond its actual accomplishments“ (Shannon 1956:3).
This was because many non-engineering disciplines engaged with ‘information’ through their respective lenses.[26] As such, Shannon’s bandwagon refers to the real consequences the cyborg discourse unfolded over different scientific disciplines and for the way ‘knowledge’ was thought about and problematized.
Whether it was Bateson’s theory of “immanent mind” in anthropology (Bateson 1972),[27] the rise of systems theory in the social sciences that would increasingly problematize the

25 For an excellent example illustrating how the choice of tools affects the categorization of data, see the debate between Professor of English and Data Analytics Matthew Jockers and Professor of Digital Humanities Joanna Swafford. By applying a sentimental analysis, Jockers claimed to have found archetypical plot types across a dataset of over 50.000 books (Jockers 2015), whereas Swafford (2015) suggested that the categories Jockers identified were not necessarily natural plot shapes ‘out there’ but artifacts of the tools he used to smooth the data, implying that Jockers could have found different categories depending on how the data would have been worked with. A more thorough discussion of the debate can be found in Schmidt (2016). See also this *Vice* article for how these nuances are effectively blackboxed, and Jockers’ role in the process was abdicated to the computer, referring to his findings as follows: “There Are Only Six Basic Book Plots, According to Computers” (Richmond 2015).

26 As James Gleick writes about the Macy conferees: “Hard as Shannon tried to keep his listeners focused on his pure, meaning-free definition of information, this was a group that would not steer clear of semantic entanglements. They quickly grasped Shannon’s essential ideas, and they speculated far afield.“ (Gleick 2011:248)

27 See also Knorr (2011:53-55), Boyer (2013:160ff.) or Heyck (2015:6) for more examples of how anthropological research was informed by cybernetic rhetoric and its system approach.

communicational aspects of social systems (Knorr 2011, Heyck 2015),[28] the supersession of behaviorism by cognitivism in psychology, the increasing conceptualization of the Market as an information processor in economics (Mirowski & Nik-Khah 2017, Mirowski 2013:267), the reduction of human life resp. identity to the informational pattern of the human gene as the “book” of life (Kay 2000), or the fact that in biology genetic representations of cultural ideas could be increasingly imagined as reified ‘memes’ that would obey the laws of natural selection, (Dawkins 2016, Burman 2012:77), ‘information’ increasingly circulated under different meanings beyond the engineering domain through which disciplines, in part, reorganized their research objects. Hence, in the late 1970s, at least in the life sciences, it became increasingly possible to think of (cultural) knowledge as reified entities, that in principle can be isolated and manipulated. From this perspective, it does not seem so far-fetched that thoughts (and by that knowledge, understood as informational patterns) at one point in the future, also can be isolated, copied, uploaded, or send through information infrastructures. While skimming through these different domains is simplistic on its own, it can be said that through ‘information’, cybernetics and “subsequent iterations of systems theory, transposed thermodynamic, electric, and computational principles (…) into models of intelligence, language, behavior, society, even life” (Boyer 2013:162).

That is, although initially confined to academic circles, gradually, the role of ‘information’ as the basis for societies (and their progress) could be envisioned. Consequently, in the mid-1960s discourse of social sciences proclamations of a “new type of society based on the processing of information” (Kline 2006:519) emerged, suggesting a shift from industrial to service (Clarke 1940), to post-industrial (Bell 1973), to information society (e.g. Machlup 1962, Toffler 1970; 1980, Naisbitt 1984) or network society (van Dijk 2020, Castells 1996). Despite their diverging assessment of such development, both liberal and Marxist commentators agreed on such characterization of society (Tehranian 1990:60). In contrast, the Iranian-American Professor of Communication Majid Tehranian criticized the term itself given that historically all societies could be, in some sense, considered “information societies” by relying on a “system of signs, meanings, and communication” (Tehranian 1990:60f., see also Beniger 1986:vi). The fact that the term emerged now, was then more the product of some discursive formation that “misrepresents knowledge as a ‘factor of

28 In the German social sciences, such systems theory approach was popularized especially by the works of Niklas Luhmann (1984). This popularization was also grounded in what has been called the “organizational revolution” (Heyck 2015:5) between 1870 – 1920 “defined by the rise of large-scale organizations and bureaucratic hierarchies in business and government” in Western societies (ibid., see also Beniger 1986:13ff.). Given the rise of authoritarian regimes in the first half of the 20th century in which citizens of Western societies were ensnared by fascist regimes and their propaganda methods, Heyck notes, distrust in what was perceived a limited human cognition prevailed, whereas trust in organization and systems as means to generate rational decisions increased (Heyck 2012:100, Mirowski & Nik-Khah 2016:26, see also DeCesare 2012). The resulting growth of, especially state organizations and its corresponding military-industrial research complex helped social sciences until 1970 to foreground „system[s] defined and given structure by a set of processes, mechanisms, or relationships” as central objects of study (ibid.). The cybernetics’ promise to dissolve existing discipline barriers by providing a meta-theory that would explain universal principles (of control) applicable to social and natural systems alike proved highly attractive for governments and the corporate sector. In the 1960s, this manifested for example in the emergence of “management sciences” from which also the term “information technology” stems from (Kline 2006). Here, it “signified computer-based mathematical techniques designed to replace mid-level management” (Kline 2006:513-514).

production'" (Jessop 2008:2), through which 'information' tended to be conflated with the "commodification of information" (Tehranian 1990:60, see also Kenway et al. 2006:22). In Tehranian's view, the roots of this misperception go back to the fact that "theories of information society have (…) rapidly evolved from simple statistical observations – demonstrating a shift in occupations from agriculture to industry and services – to a neo-evolutionary theory of historical development" with one fundamental assumption being technological determinism (Tehranian 1990:59). This way, these narratives not only expose their narrow view of 'knowledge' as economically exploitable goods but also their heavy Western-centrism as the manufacturing sector did not really disappear. Rather, it shifted to the "new industrializing countries (the so-called NICS, including Brazil, Argentina, Mexico, South Korea, Taiwan, India, Singapore, Malaysia, and the Philippines)", while the U.S. became an exporter of "primarily banking, insurance, shipping, high technology and information services" (Tehranian 1990:62).

Throughout the 1990s, the connotation of the knowledge economy[29] increasingly circulated in supranational organizations such as the OECD, the European Union, World Trade Organization, and the World Bank that acted as "major players" in "disseminating the notion of a knowledge-based economy and society" (Kenway et al. 2006:20). So, if before the 1970s, cybernetics spawned "rich ways to talk about humans and information machines", Ronald Kline argues, it was replaced by an "impoverished discourse of information as commodified data, Big Data, and 'cyber' as an all-purpose, nearly meaningless adjective" (Kline 2016: 28:15-28:40).[30]

Today it is commonplace throughout Western policy institutions to problematize 'knowledge' as one driving factor for global economies. Although it seems sensible to speak of a knowledge-based society given that information technologies moderate much of our communication, it carries the same definitional impreciseness of 'knowledge' more often than not reduced to codified formal knowledge that 'information' represented and less so, tacit knowledge (Kenway et al. 2006:22). The former includes economic assets, either as physical goods, intellectual property, human capital (as the ultimate quantifiable knowledge, that is skills in which can be invested) or as (the result of) Bayesian induction as means to tie a particular kind of 'knowledge' to a material value (Joque 2019, McGrayne 2011).[31] At least in the context of these iterations of societies, the meanings of 'information' and 'knowledge' increasingly approximated.

Let us quickly recap. A specific engineering concept of 'information' emerged as part of engineering problems of working with the telegraphy infrastructure, explicitly delineated

29 That is, given that the meanings of 'information' and 'knowledge' have increasingly approximated, the notions of an 'information' or 'knowledge (-driven)' society or economy are often used interchangeably (Kenway et al. 2006:10).

30 This is also to say that cybernetics was not a homogenous group of like-minded people easily equating humans and machines. Also cyberneticists had concerns with the limitations an engineering notion of 'information' could bring. See for example Iliadis (2013) for how cybernetics turned out useful for early thinkers of posthumanism like Gilbert Simondon whose work Iliadis also regards as "an extension of these concerns" (ibid.:5).

31 For a more thorough overview of three modalities of information along which knowledge has been mapped and theoretically legitimized in modern orthodox, thus neoclassical, economics, see Mirowski & Nik-Khah (2017, ch. 8).

from ‘intelligence’ to not conflate it with human cognition. The work on wartime problems concerned with human-machine systems during WWII, however, required concepts that could account both for human and machine behavior, such that ‘information’ increasingly was thought of a force not only explaining machine, but also human behavior. ‘Information’ became increasingly contested and conflated with notions of human knowledge, such that an understanding of disembodied ‘knowledge’ solidified in narratives of artificial intelligence.

That is, ‘information’ turned out productive for specific wartime problems and enabled to organize scientific work of scientists across different disciplines, increasingly informing their respective disciplines. Subsequently, it began to be used to characterize (the future of) Western societies. This is the necessary foundation in which narratives of ‘intelligent’ cities are grounded. For information technologies, however, to be appreciated as pathways to future cities, they A) had to be experienced by a larger public as productive for individual purposes, and B) the city had to be imagined as a site to intervene on planetary problems. This will be outlined in the next part, only to then mirror the history with the current discourse of digital urbanism in Germany.

4. Interlude: Digital Utopianism & Smart Communities

With regard to urbanism, there is still the question of why the cyborg discourse also turned out productive for city planners today to think of cities as entities, whose future viability is governed by their knowledge production. The answer lays, I will argue, at least in part, how a certain counterculture in the U.S. came to appreciate the possibilities of digital (information) technologies as means to create “communities of consciousness” (Turner 2006:73-78). This was thought of as a more productive manner to induce political change beyond traditional methods such as protests. I will first outline the discursive shift that helped to imagine information technologies as viable means to achieve future communities. In the next part then, I will slowly lead over to the present by bringing the urban into the picture.

4.1 From communes to virtual communities, or: from military to liberating technologies

In the above-mentioned narratives of an upcoming society governed by ‘information’, especially Alvin Toffler (1970, 1980) and John Naisbitt (1984) tended to write enthusiastically about the democratizing prospects of new information technologies. They crucially helped to popularize the term ‘information society’ as a desirable scenario for the United States, writing best-selling books and quickly became adopted as “corporate futurologists” (Tehranian 1990:56-58, see also Kenway et al. 2006:12) writing about

"Megatrends" in 1982 that would map out the prospects ahead.[32] In contrast, until the 60s, the computer tended to be seen as a symbol for the military-industrial complex, culminating for example in the Free Speech Movement at the University of Berkeley in 1964 where students explicitly referred to the computer as a military technology that reduces humans to 'bits', integrating them into the "machine" of the university that would make of them valuable knowledge workers for the cold war, and not liberate them (Turner 2006:12, see also Golumbia 2009:204). While the motives of the Free Speech Movements cannot be reduced to protest against information technologies, it was one focus due to its link with cold war politics and the "military-industrial complex it served" (Turner 2006:12). To the protesters, the ban on political activities on the university's ground was a symptom of that. A year prior, the then-director Clark Kerr of Berkeley explicitly referred to Fritz Machlup's writings when ascribing a central role to the university driving the knowledge industry, and by that, national growth (Kerr 2001:66). This was not merely a rhetoric shift, but one with real consequences. Weizenbaum recalls that the concerns expressed by the students' protests more often than not were reduced to insufficient communication between the different parts of the university. Hence, officials responded to the protests by establishing 'hot wires', so that in turn the real political and ethical conflicts were effectively rendered a communication problem (Weizenbaum 2018:328). To Weizenbaum, it reflected the pervasiveness of how AI researchers like Newell and Simon tended to understand a 'problem' (ibid.).

As such, it seems surprising that only twenty years later, the computer became increasingly imagined as a tool for political transformation (Turner 2006:2-3). Tracing back these developments, Fred Turner identifies at least two countercultures in the 1960s in the U.S.: the New Left, and the New Communalists. The former embodied traditional modes of protest, such as staging of political struggle, protest, and inciting political change by new leaders, and parties, all of which the latter rejected. Whereas both the New Left and the New Communalists had a similar disdain for bureaucracy, big technology, and mass-culture, the New Communalists thought that to change the state of politics, one would have to build new "communities of consciousness" (Turner 2006:73f.). At the forefront of this counterculture, Turner identifies the *Whole Earth Catalogue* (WEC), a magazine published in 1968 by Stewart Brand to facilitate such social change. The WEC, as Turner puts it, functioned as a "network forum" for like-minded to organize and make themselves visible to each other (Turner 2006:72). The WEC consisted mostly of reviews (by its editors as well as recommendations by readers) of a wide range of products that were deemed valuable for such social change, e.g. Hewlett Packard's calculator (illustrating belief to overcome politics with technological means), body crafts (such as a native American's outfit as means to build and reshape one's identity), and most often, books (seen as tools to build consciousness and reaching a 'shared mind') (all examples taken from Turner 2013: 17:26 – 18:53min). The WEC didn't sell the items but acted more like a "pointing device" as Brand put it (ibid.: 19:00min). Accordingly, in his commencement speech at Stanford University in 2005, Apple co-founder Steve Jobs referred to the WEC as „one of the bibles

32 The urban was not central, but neither unimportant in these narratives. In his book "Future Shock", Toffler asserted that social change has accelerated for which he cited the increasing urbanization rate of 1970 to 1850 as evidence (Toffler 1970:22-23).

of my generation“ describing it as „sort of like Google in paperback form“ (Jobs 2005, 12:59 – 13:23min).

Based on the “notion that small-scale technologies could transform the individual consciousness and, with it, the nature of community” (Turner 2006:74), the New Communalists thought that a “shared mindset” would have to be built in these “communities of consciousness”, alluding to the roots of the New Communalists in the commune movement and media art collectives like the USCO[33] both communities which “depended on small-scale technologies to link them together” (Turner 2006:75) including psychedelic technologies such as LSD or peyote.

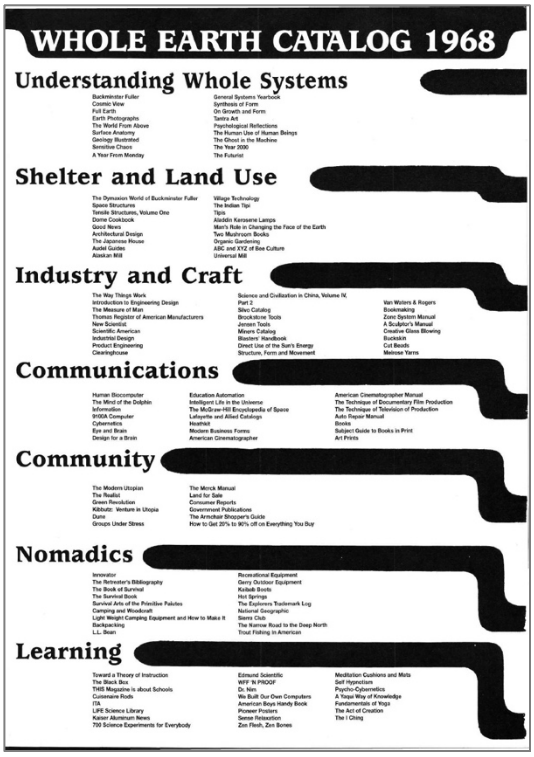

Figure 2: Contents of the first 1968 issue of the Whole Earth Catalogue. Image from WEC (1968:1)

Theoretically, this was grounded in what Brand identified as “two cybernetic frontiers” (1974) and of which he saw himself more aligned with what he called “organic cybernetics” as opposed to “machine cybernetics” (Brand 1974 as cited in Kline 2015:232).[34] This reading of cybernetics was inspired by Gregory Bateson’s attempt to reconcile cybernetics with his theory of “immanent mind” (Bateson 1971, 1972) stating that the human mind “resided in the flow of messages (information) through circular pathways between humans and their environment” (Kline 2015:230). Both Brand and Bateson believed that such organic cybernetics would help to tackle the environmental crisis of the 1970s (Turner 2006:124, Kline 2015:229). Put pointedly, changing one’s consciousness, would result in a changing environment.

If political change was envisioned not to be achieved with what was perceived as traditional forms of political protest, this was mirrored by the actual categories the WEC offered such that there was no explicit category of “politics” (see Fig. 2). Also recalling the feminist critique of the discursive disembodiment of information, the WEC could be seen, at least in part, as a testimony to that. Issues like gender, class, or race tended not to be central within the WEC, which is at least surprising given the rise of the Black Panther, American Indian,

33 In a way, the USCO reflected the ambition for shared minds in its name, which was an acronym for “Us Company” or “Company of us”.

34 This reading aligned with the critique of what Bateson and others like Heinz von Foerster, or Humberto Maturana identified as first order cybernetics (Kline 2015:232), where an engineer is assumed to be outside of a given system, analyzing and stabilizing it in a homeostatic way whereas second-order, or for that matter ‘organic’ cybernetics states that there is no privileged position to analyze and control a system (Kline 2015:197).

or Women's Liberation movements at this time. This was also due to the WEC's audience and network mostly composed of bodies well-educated, white, masculine, and entrepreneurial, which helped for the development of a "rhetoric of individual and small-group empowerment" (Turner 2006:97-102).

The books envisioned as means to transform one's mind were to a large part from information theorists such as cyberneticist Norbert Wiener, architect and writer Buckminster Fuller[35] or media theorist Marshall McLuhan, all of which tended to depict "technology as a tool for social transformation" (Turner 2006:52). As such, "information theory from the 1940s is the grounding for consciousness theory of the 1960s" (Turner 2013: 18:09min), or put differently, "information systems of the 1940s made it possible for the children of the 1960s to imagine a world linked by invisible forces" (Turner 2013: 18:17min). Drawing on universalist accounts of information, there seemed to be little room for problematizing (bodily) difference, even if to stage political struggle. One could argue the sole focus on 'minds' as the locus of politics mirrors the disregard for the corporeal dimension of information in the postwar period.

While none of the communes lasted longer than some years, the idea of shared communities remained and was reinforced in the mid-1980s when the Internet became a realistic possibility. Disillusioned, Brand came in touch with emerging cyberpunk and hacker cultures, for which a central claim was that 'information is power' as a documentary of "Cyberpunk" from 1990 suggests (Trench 1990: 17:28min). Both asserted that the world is best understood in terms of (information) technologies, and that these act as drivers for change or oppression, in part subverting traditional notions of politics. Brand networked these groups with former counterculturalists, such that computing technology increasingly began to be imagined as the medium "to pursue the New Communalist dream of social change" (Turner 2006:88). As Turner argues, both digital culture and counterculture shared a "dream of disembodiment" (Turner 2006:164). Hence, if for New Communalists LSD presented a "passage to an out-of-body experience, an opportunity to feel a psychic union with others in the crowd" (ibid.), for "cyberpunk authors, digital prostheses offered their users the opportunity to escape their bodies and enter cyberspace" (ibid.). Here, disembodiment was experienced as a productive way to empower oneself.

While initially, cyberpunk referred to a literary movement rooted in the New Wave Science Fiction literature in the 1960s and 70s,[36] the term was increasingly used to also describe hacking cultures for which the computer became a tool of political resistance. Through its popularization in movies, internet communities, or computer games, the term subsequently came to signify a genre of popular culture.[37] The cyberpunk's condensed cyborg discourse

35 Fuller was most famously known for his dome architecture used in the communes.

36 At the forefront, authors like Bruce Sterling or William Gibson. Even then, however, cyberpunk was not a closed stable category, so that authors like Philip K. Dick or James G. Ballard, although having published much earlier were regarded by cyberpunk authors as formative influences of the genre (Sterling 1988:x).

37 The theme is typically set in a near dystopian, often massively urbanized (!) future where totalitarian regimes (state or corporate) have established a technostructure that largely benefits political or corporate elites and oppresses those at the bottom of society (Knorr 2011:66). The book popularizing this genre was William Gibson's *Neuromancer* (Edwards 1996:346). It represented "subjectivity in a world where boundaries between human, machine, and computer have achieved a kind of unlimited flexibility in a totally recombinant world. Here no one and nothing living escapes entirely unaltered" (Edwards 1996:347). The story itself is often less

enabled the public to imagine the recombination of machines and humans, a hybridization of both machine and human thoughts. And despite the often dystopian settings, it stylized and thus stabilized the narrative of transferring information seamlessly between machine and human systems, rendering human identity an informational pattern, and promoted the idea of appropriating technologies from their oppressive context and repurpose them for social change (Turner 2006:162-163). Today, cyberpunk themes are not limited to a confined circle of sci-fi writers but have been normalized in Western popular culture.[38]

Not unimportantly, this was also because the computer changed its appearance and with it, part of its associations with the military complex. It was no longer human-sized machines tucked away in military labs, instead, new microprocessors enabled to build machines that would fit in the homes of an increasingly wider public allowing for these computers to be imagined as "personal" (Turner 2006:103-106). Also, a variety of new cyborg technologies such as pacemakers, protheses, or speech synthesizing software, made the recombination of human and machine components experiential (Edwards 1996:340, Knorr 2011:50) in a similar manner that the Internet, or not unimportantly, video games,[39] enabled to think of oneself as virtual personae that exist in the cyberspace as nothing else than malleable informational patterns.

Reflecting this increasing popularization in 1983, the cover of *Time* magazine showed a computer as "Machine of the Year"[40] (Time 1983). Two years later, former counterculturalists created the *Whole Earth 'Lectronic Link* (WELL) as means to "recreate the countercultural ideal of shared consciousness in a new 'virtual community'" (Turner 2006:142).[41] It was one of the first internet communities active until today and Brand's attempt to adopt the countercultural vision of the '60s to these new information technologies.

Importantly, the Whole Earth network's understanding of political transformation through technological means enabled them to see actors traditionally perceived as antagonists by the New Left, as potential partners for this transformation. Thus, by the 1990s the network would include "Defense Departments, U.S. Congress, global corporations such as Shell Oil, and makers of all sorts of digital equipment and software" (Turner 2006:5), and vice versa, many spokespersons of the Whole Earth network were invited to Congress, board rooms of companies, or the World Economic Forum in Davos. Maybe best illustrating the digital utopianism that these former counterculturalists now represented was the tech magazine *Wired*, co-founded by Brand in 1993 and exhibiting many writers affiliated with

important than the social and natural environment depicted heavily mediated by infrastructures of computation (Edwards 1996:346f.).

38 In popular media for example this was mediated, among others, through series and movies like *Star Trek: The Next Generation*, *Blade Runner* (Edwards 1996:339-346), or more recently *Matrix*, or *Avatar* to name just a few.

39 In fact, highly anticipated this year (2020) is a game that is literally called *Cyberpunk 2077*, where the player navigates in a massively urbanized environment, and the protagonist can enhance its body via implanting "cyberware". See for example also Golumbia (2009) for how real-time strategy games (RTS) represent a "computational view of history and progress" (ibid.:142), that is, they "demonstrate that human history is unified, progressive, and linear, and that in particular the *development of technology stands as the ultimate end of civilization*." (Golumbia 2009:139, emphasis added).

40 Typically, the category presents a 'Person of the Year'.

41 The term "virtual community" was coined by Whole Earth network member Howard Rheingold (1993).

the Whole Earth network.[42] Putting this in context, at this point “desktop computers had become common features of homes and offices nationwide” (Turner 2006:212).
If the WEC was the network forum for New Communalists in the 1960s, *Wired* turned out as one important network forum for cyberculture where “writers utilized the computational metaphors and universal rhetoric of cybernetics to depict new right politicians, telecommunications CEOs, information pundits, and members of GBN, the WELL, and other whole earth-connected organizations as a single, leading edge of countercultural revolution" (ibid.:209) one which would “set about to free America and the world from the rigid, oppressive corporate and government bureaucracies of the twentieth century” (ibid.:208). The mobilization of ‘virtual communities’ went along with “an extraordinary rise in networked forms of economic organization and in freelance patterns of employment” in the associated professional communities of the San Francisco Bay Area (Turner 2006:141). Thus, in the mid-1990s for many the success of this networked entrepreneurship of the Whole Earth Group seemed self-evident and “represented the transformative power of the ‘New Economy’” (ibid.:7).[43] Fittingly, the *Wired* cover of the July 1997 issue, showed a digital representation of the globe with a smiley face and a flower, once a cover for the WEC (and a reference to its countercultural roots of the 1960s), titled “The Long Boom. We’re facing 25 years of prosperity, freedom, and a better environment for the whole world. You got a problem with that?” (Wired 1997). The *Wired* executive director Kevin Kelly, a former associate of Stewart Brand, would bring together rightwing politicians like Newt Gingrich, technologists, and telecommunication executives in the magazine, heavily marketing for deregulating this ‘new’ economy. It is worth reading the passage from Turner’s book:

> “The builders of computers and telecommunications networks, suggested *Wired* - men like John Malone of TV cable behemoth TCI, Frank Biondi and Ed Horowitz of Viacom, and Bill Gates of Microsoft - were working to construct the high-tech infrastructure of a new and better world. So too were libertarian pundits and politicians. In the logic of *Wired*, **they were simply social, as opposed to technical, engineers.**” (Turner 2006:208, emphasis added)

These elites, information pundits and members of the various organizations connected to the Whole Earth network, Turner continues,

> “would do what the New Communalists had failed to accomplish: they would tear down hierarchies, undermine the sorts of corporations and governments that had spawned them, and, in the hierarchies’ place, create a peer-to-peer, collaborative society, interlinked by invisible currents of energy and information.” (Turner 2006:209).

For this particular “cyberculture” (Turner 2006:148) utilizing information technologies would drive social change through the private transformation of consciousnesses. As shown in

42 This includes writers for the *Whole Earth Review*, the magazine preceding *Wired*, like cyberpunk pioneers William Gibson or Bruce Sterling, but also *MIT Media Lab* co-founder Nicholas Negroponte, the latter who also initiated the *MIT Architecture Machine Group* of which the *Media Lab* emerged.

43 Reflecting this optimism throughout the mid-1990s, the stocks of internet-related companies were subjected to massive speculation resulting in what is today known as the Internet, or dot-com bubble that burst in the early 2000s (Turner 2006:214).

Fig. 3, similar to the WEC, *Wired* does not feature an explicit category of politics, but “business”, “gear”, “science”, or “ideas”, among others.

Figure 3: The navigation bar on the cyberculture magazine Wired’s website. Wired (n.d.), screenshot by author.

This culture of digital utopianism was prevalent among the professional business and engineering communities of California, prompting British political writers Richard Barbrook and Andy Cameron (1996) to call it, not without criticism, the “Californian Ideology”.[44] It was a mixture of “libertarian politics, countercultural aesthetics, and techno-utopians” (Turner 2006:209). As Turner argues, “by the end of the decade theirs would be the governing myth of the Internet, stock market, and great swaths of the new economy” (ibid.).

Whole Earth figures like Kevin Kelly, Silicon Valley journalist Esther Dyson, or John Perry Barlow, former lyricist of the band Grateful Dead and editor of a draft opposing censorship of the ‘cyberspace’ in 1996, were all convinced that the Internet would “dissolve bureaucracies of the marketplace by stripping away the material bodies of individuals and corporations” (Turner 2008:14). Whereas the imagination of the material environment as informational patterns, has its roots in the military-industrial complex, the language of “shared mindsets” and “virtual communities” enabled counterculturalists to imagine the same technologies in a new light. It is not coincidental that many of the most enthusiastic spokesmen (in fact, most are men), arguing today for the data sciences making scientific methodologies obsolete (Anderson 2008, Steadman 2013) had or have ties to these networks.[45]

The confluence of former countercultural and hacking cultures was reflected in 1994, when in an influential piece called “Cyberspace and the American Dream: A Magna Carta for the Knowledge Age” (Dyson et al. 1996) writers of the digital culture including Esther Dyson and Alvin Toffler invoked the ‘cyberspace’ to be part of an electronic “new frontier” (ibid.:228). ‘Cyberspace’ was a term coined by cyberpunk pioneer William Gibson in his 1982 short story *Burning Chrome* (Edwards 1996:347). The frontier rhetoric was used in U.S. history before (John F. Kennedy’s ‘new frontier’) and thus acted as a „contact language“ (Turner 2006:229) between “former hippies, young computer technologists, and government regulators” (ibid.). Quickly however, the Carta “came to serve a much narrower agenda” and equated individual with corporate freedom (ibid.).[46] In this vein, the Carta states that for the cyberspace to belong to the people, one would have to “massively [deregulate] the fast-growing telecommunications and computing industries” (Dyson et al.

44 Louis Rossetto for example, a former writer for *Wired* ascribed Barbrook with a “profound ignorance of economics” (Rossetto 1997)

45 One might mention that today’s popular formats like *TED Talks* also emerged from these epistemic ecologies and represent a similar cybercultural approach which Benjamin Bratton (2013:n.p.) has called “placebo politics”. That is, a fast solutionist understanding of political change primarily using (information) technologies as opposed to political protest. One extreme example is the *Kony2012* campaign which was promoted via *TED* (and Social Media) as well (ibid.).

46 Here, Turner refers to Richard K. Moore’s central argument in his more detailed analysis of the Magna Carta (Moore 1996).

1996:303). Accordingly, others, such as Langdon Winner had identified the growing cybercultural movements imbued with a philosophy of "Cyberlibertarianism" (Winner 1997:14), which he understands as a "collection of ideas that links ecstatic enthusiasm for electronically mediated forms of living with radical, right wing libertarian ideas about the proper definition of freedom, social life, economics, and politics in the years to come" (ibid.). That is, even though the category of 'politics' was mostly absent in cybercultural accounts, it was nevertheless a particular politics, foregrounding technological determinism (Winner 1997).[47]

To sum up, there has been a shift in the public discourse over the course of the late 1970s such that computers were now increasingly integrated into a narrative of digital utopianism and its prospects for societies (Kline 2015:235). This was very much different from the 1960s and 1970s where a simplistic narrative of "computers-out-of-control" dominated (Edwards 1996:327).[48] In the words of Paul Edwards:

> "Ubiquitous, easily operated computers were less frightening and less representative of government and corporate power. The technological shift from central mainframes to networks of desktop machines decentralized control over computer resources and diminished the iconographic link between computers and panoptic authority". (Edwards 1996:339-340)

In fact, as Digital Humanities professor David Golumbia notes, in more recent accounts such as Thomas Friedman's popular book *The World Is Flat* (2005) the cybercultural legacy is very much persistent. Here, Friedman referred to information technologies as "forces" that flatten social hierarchies, prominently placing the personal computer at the forefront of such liberation (Golumbia 2009:146).

With this in mind, in the next chapter, I will argue that this helped not only to imagine information technologies as means to achieve 'virtual communities' with which to achieve political transformation, but also stylized 'smart' approaches to urban development as desirable future scenarios. For that to happen, however, the city itself had to be imagined as a central locus of these transformative processes.

4.2 The city as a problem, and smart communities

So where was the city in all of this? In the immediate postwar era, when American cities showcased a variety of 'urban crises' such as overpopulation, crime, traffic congestion, poverty, and not unimportantly, a fear of potential nuclear attacks on cities, the very same experts that also organized large parts of military research, transposed their communication view to the urban. Seeing the city as a large-scale communication system, military planners and aerospace engineers suggested that their system analysis tools could be of help organizing city administrations. Many city mayors and the *Department of Housing*

47 For a more detailed account of how technologies embody certain 'cyberlibertarian' politics see for example Golumbia (2016). He argues that the cryptocurrency 'Bitcoin' is inscribed with cyberlibertarian values, through which fundamental terms of the political right are potentially 'learned' by Bitcoin users. In Golumbia's view, the decentral architecture of the Bitcoin technology suggests that government should not interfere with monetary politics or that central banks are 'bad'.

48 Mobilized for example through movies like Stanley Kubrick's *2001: A Space Odyssey* (ibid.).

and Urban Development (back then named differently) embraced what appeared as a more scientific approach to manage cities so that in 1966 some planners even proclaimed a "revolution" of the urban professions with "computers at the center of this transformation" (Light 2003:36-37) necessary "to cope with the new complexities of metropolitan planning" (Meier & Duke 1966:3).

This development was reinforced when at the end of the 1960s, urban riots escalated across American cities so that president Lyndon B. Johnson "recruited an army of 'defense intellectuals' – civilian scientists and social scientists from top universities, think tanks, and aerospace companies" (Light 2003:4) so that in consequence the urban crises became a matter of national security. Through it, much of the racial inequalities and discrimination that helped to spark much of the violence tended not to be problematized, instead it „helped to transform urban problems into strategic challenges to be met by defense intellectuals deploying techniques and technologies of command, control, communications, computers, intelligence, and reconnaissance." (Light 2003:5).

The 1960s and early 1970s marked the peak of this approach to city planning.[49] Universities established new departments like the MIT Urban Systems Laboratory, urban planning schools ran "courses with titles such as 'Systems Analysis and Urban Planning' (…), 'Cybernetics and Urban Analysis' (…) and 'Urban Gaming' (…) with lessons on quantifying 'inputs,' 'outputs,' and 'feedback.'" (Light 2003:51) and cities increasingly adopted these approaches as part of new agencies such as the *New York City Office of Management Science*, or *Los Angeles Community Bureau Analysis* (ibid.).

When it became increasingly clear that these system and simulation modeling techniques could not account for many urban problems (Light 2003:61-62), this form of 'urban cybernetics' became increasingly criticized, culminating in the acknowledgment of "wicked problems" of urban planning that could not easily be solved by large-scale models of the city (Rittel & Webber 1973, Lee 1973, see also Brewer 1973). When computers however became increasingly powerful and micro-processing technologies allowed to imagine decentralized computational networks, it seems, a cybernetically informed view of the urban was strengthened once more, such that "proposals for networked or computable cities began to appear as regular features in urban development plans from the 1980s onwards" (Gabrys 2014:30). This is also why some of the critics of the 1970s had actualized their critique (Lee 1994). In other words, if micro-processing technologies enabled the computer to be 'personal', and thus be imagined as tools for social liberation by former counterculturalists, similarly, decentralized sensors invoke digital urbanism to be socially empowering, and thus not merely a copy of older technocratic, centralized 'control-room' approaches to the urban. This alone was not sufficient, however. For digital urbanism to become as pervasive it is today, the city itself also had to be imagined as a central site to intervene in planetary problems in the first place. I understand this as the culmination of

49 It was this time, that also spawned model cities like the *Minnesota Experimental City*. A city planned from scratch most notably by the cartoonist, urban planner, and technocrat Athelstan Spilhaus who envisioned to build it "like a machine (…) planned for an optimum population size" (Spilhaus 1967:1129). For him, pollution and rising populations required new technologist, ergo scientific solutions to urban living. Buckminster Fuller was also part of the advisory board, suggesting his typical geodesic dome architecture that would have literally transformed (parts of) the city into a closed system (ibid.:1138).

two developments: the increasing scientificity of computational climate models (1), and the consolidation of this view in supranational policy documents as an urban SDG (2).
Although not specifically concerned with the urban, in his book *A Vast Machine* Paul Edwards asserts that over the course of the second half of the 20th century, computational climate models became increasingly regarded as 'scientific' policy tools. Starting in the late 1960s with the controversy regarding the environmental impact of supersonic flights, "a series of new global atmospheric issues, including ozone depletion and acid rain (mid 1970s), 'nuclear winter' (early 1980s), and global warming (late 1980s)" (Edwards 2010:358) provided crises "that made climate change a focus of international concern" (ibid.). One important aspect was that starting from the 1970s, computer simulations and forecasts became increasingly elaborate and spoke to a mode of policy-making concerned with managing the future. These crises enabled to imagine human activity as affecting the atmosphere "not only locally and regionally – as 'pollution,' the typical frame for environmental issues of the 1960s – but on a planetary scale." (ibid.). In 1992, this was acknowledged also by supranational institutions like the UN as part of the *UN Framework Convention on Climate Change* (ibid.). In turn, the climate models enabled the identification of cities as the central hubs of energy consumption, and thus, carbon emissions. In turn, climate change as a planetary phenomenon could be problematized in confined spatial units, that are cities. Paired with what was perceived as increasing urbanization processes on the global scale, the city was increasingly imagined as a central site to mitigate climate change, manifest in the most recent *New Urban Agenda*. It is the product of concerted efforts "to secure one of the UN's new sustainable development goals (SDGs) […] as an *urban focused goal*." (Barnett & Bridge 2017:1195, emphasis added). This urban SDG then was to "[m]ake cities and human settlements inclusive, safe, resilient and sustainable" (UN General Assembly 2014:10 as cited in Barnett & Bridge 2017:1195). This development helped for a shift from environmental concerns with regard to the "sanitary city" (Melosi 2008[2000]) to a larger paradigm of the "sustainable city" embedded in a global system (Pincetl 2010:45). This was done also, as Barnett & Bridge argue, by linking "three distinct claims about contemporary urbanization processes […] into a coherent narrative of *cause, potential* and *action*" (Barnett & Bridge 2017:1196, see also Barnett & Parnell 2016):

> "The first is an empirically led claim about the ways in which the problems to be addressed by the SDGs are concentrated more and more in urban areas. The second is a more conceptually oriented claim concerning the degree to which the dynamism of cities, as economic and social clusters of activity and innovation, is an opportunity that must be harnessed to achieve the SDGs. And the third is a claim about cities as political entities capable of acting as drivers of the SDG agenda" (Barnett & Bridge 2017:1196).

This tripartite argument has helped to foreground cities not only as primary drivers but also as central sites of climate change mitigation. Barnett & Parnell (2016) argue that this view has been reinforced on the one hand, by an aspiring "new science of cities" (Batty 2013) that, "informed by complexity theory but also enabled by data-driven forms of statistical modelling and visualization" (Barnett & Parnell 2016:93) conceptualizes cities "in terms of interactions, flows, relations and networks" (ibid.). Such focus on the complexity of cities went along with an increasing focus on resilience in urban social science (ibid.) as a "new art of governing complexity" (Krivý 2018:18). On the other hand, a 'new economic geography' has helped to imagine the city not only as a central site to climate change mitigation but also highlighted the "central role of cities in driving economic development processes" (Barnett & Parnell 2016:93), taken up in 2009 by the World Bank Report "Reshaping Economic Geography" (World Bank 2009 as cited in Barnett & Parnell 2016:93). Given that since the mid-1990s 'knowledge' increasingly is considered the driving force for these economic processes (Kenway et al. 2006, see also OECD 1996), first attempts of smart urbanism were explicitly conceptualized along these lines, circulating under the label of the "smart community" (Bradley & Gurman 2005:603, see also Lindskog 2004:2-3). Reading one definition of a 'smart community' brought forth by a panel commissioned by the Canadian Government, we can find parallels to how the New Communalists imagined communities of 'shared consciousness' as the nucleus of political transformation through technologist means:

> "a community, ranging from a neighborhood to a nation-wide community of common or **shared interests**, whose members, organizations, and governing institutions are working in partnership to **use information and communication technologies to transform their circumstances** in significant ways'." (Report of the Panel on Smart Communities 1998:n.p. as cited in Bradley & Gurman 2005:604, emphasis added).

A whitepaper on the future of cities published by *The California Institute for Smart Communities* makes this link more explicit, understanding smart communities as "cyberplaces" to be the physical manifestation of "cyberspace" (Eger 2003:5-6).
Also, just like cybercultural assumptions were closely linked to a 'new economy',[50] smart communities perpetuated this connection:

> "Communities which had suffered the most from deindustrialization, as well as those in which the telecommunications industry was already significant, such as Silicon Valley in California, started looking at the potential of ICT as a tool for URBAN [sic!] renewal and enhanced economic growth." (Bradley & Gurman 2005:603).

Fittingly, in 1997 the San Diego State University published the "Smart Communities Guidebook", a guideline for communities to explicitly reposition themselves in times of the "Knowledge Economy" to "transform life and work in their region in significant and positive ways" (Eger 1997 as cited in Lindskog 2004:1).
In this line, today's digital urbanism can be seen as a response to the "twin challenges of climate change and the knowledge economy" (Perry et al. 2013, see also Angelidou 2015). Arguably, this increased the diversity of problems associated with the urban so that it became commonplace to "assert the need for a cross-sectoral policy focus on cities in future development policy agendas" (Barnett & Bridge 2017:1196), which was most prominently taken up in 2007 by the *Leipzig Charta*, that acts as a European framework for the integrated sustainable European City and is a common reference to German city development until today (BMUB 2007).[51]
The next chapter will now examine how digital urbanism is mobilized in the German discourse.

50 Which at this point was just a different way of alluding to the increasing role given to 'knowledge' and networked modes of entrepreneurship for the economy.

51 Currently, a successor is in the works (NSP n.d.).

5. Discourse of digital urbanism in Germany

The current discourse on digital urbanism largely builds on the previously outlined arguments and acknowledges cities as central drivers of and locus to intervene on planetary challenges, first and foremost through the use of information technologies. In this chapter, I would like to trace how this narrative also shaped the emergence of smart city approaches in Germany. Finally, I will zoom into more concrete projects to discuss whether one real consequence of the discourse outlined so far, could be that in digital urbanism urban problems are increasingly understood as informational, or for that matter, communicational.

5.1 Sustainability & Innovation: the road to Germany's Smart City Charta

In Germany, the first Smart City approaches can be identified from 2012, although only five years ago the topic was increasingly adopted as part of national and local strategies (Soike & Libbe 2018:9). While urban sustainability is often the raison d'être of the Smart City, earliest efforts of digital urbanism did not (need to) foreground this aspect. The T-City in Friedrichshafen for example was a joint project of the city of Friedrichshafen and Deutsche Telekom AG in 2008 aiming for two goals: enhancing the life quality of citizens, and economic advantages for the city with regard to attracting capital ("Standortvorteile") by using state of the art ICT technologies (Deutsche Telekom n.d.). Urban sustainability as a means to global climate protection became dominant in the discourse of urban planning only more recently in Germany. This can be traced through the *Hightech Strategie* (HTS) of the German government, of which the first issue was published in 2006 by the *Federal Ministry of Education and Research* (BMBF). It acted as a research strategy foregrounding the need to position Germany as an innovative R&E location (BMBF 2006:7). The first issue outlined technological fields in which 'innovation' was to be spurred, explicitly stating that in a "wettbewerbsorientierte Wissensgesellschaft" (ibid.:3) Germany cannot win the competition for lowest labor costs, but the competition for ideas ("Ideen") in order to lead Germany to the top of the most important future markets ("um unser Land an die Weltspitze der wichtigsten Zukunftsmärkte zu führen", (ibid.:3)). It is targeted to spend 3% of the GDP on research to reach the beforementioned goals. Knowledge production is envisioned as a vital part of Germany's wealth and economic growth. In this view, knowledge, just like in the typical proclamations of an 'information society' or 'knowledge economy', is conflated with commodified information, be they technological prototypes, or intellectual property. Valuable knowledge thus is that which can be translated into marketable commodities, and for that to happen a more intimate connection of science ("Wissenschaft") and business ("Wirtschaft") is needed (ibid.:11ff.).[52]

52 These strategies are often accompanied by expert groups consisting of figures from science and business (and sometimes civic society) that consult the government on its implementation. In the case of the *Hightech*

The strategy lays out a particular understanding of scientific knowledge production, and in the same vein, technological development as its main purpose to compete on a global market that is increasingly concerned with ‘knowledge’. Since 2006, the strategy has been actualized several times. In 2010, the strategy was no longer structured by the technological fields ought to spark innovation (e.g. “Informationstechnologie”, “Fahrzeugtechnologie”, ”Umwelttechnologien”; BMBF 2006:4) but now classified into areas where innovations are seen as most necessary (“Klima/Energie”, “Gesundheit/Ernährung”, “Mobilität”, “Sicherheit”, “Kommunikation”, BMBF 2010:12). By that, it also integrated a formerly separate *Hightech-Strategie zum Klimaschutz* from 2007 (BMBF 2007) and with it, explicit future projects such as the carbon-neutral, and energy-efficient city (ibid.:6)[53] which continues to be an important reference for current efforts in digital urbanism. It is to be appreciated thus, that the reorganization of cities as carbon neutral entities, was first taken up by a strategy that tends to be technologically solutionist[54] and as such, is understood not only in terms of reducing carbon emissions but (also) at least initially, more so with regard to economic growth within in a “Wissensgesellschaft” (BMBF 2006:3).

Appreciating technologist solutions as means to integrate both climate protection, and economic growth, over the following years such a particular vision has solidified in several programs and working groups most notably in the so-called *IMA Stadt*. It was established by the governmental committee on sustainable development[55] in 2015 as an inter-ministerial working group to produce a framework through which sustainable city development envisioned in the several supranational guidelines (such as the *New Urban Agenda*, or *Leipzig Charta*) is to be achieved (IMA Stadt 2017:4-5). As such, it was awarded as a “Leuchtturmprojekt” by the most recent *Deutsche Nachhaltigkeitsstrategie* (Bundesregierung 2018:22).

Based on the *IMA Stadt*, the science policy paper *Strategische Forschungs- und Innovationsagenda* (FINA) adopts and translates part of the technologist view outlined in the HTS more specifically to the city by making demands to research, and formulating what science ought to do to help achieve urban sustainable development (BMBF 2015:3).

At the same time, the *Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety* (BMUB) commissioned the *Dialogplattform Smart Cities*, a series of workshops from 2016 – 2017 with selected participants[56] out of which in 2017 the *Smart City Charta* emerged (BMUB & BBSR 2017). It consolidates the preceding efforts to digital urbanism, acts as a normative guideline to digital urbanism for municipalities and cities, and is understood as an explicit response to the committee on sustainable development that also spawned the *IMA Stadt* (BMUB & BBSR 2017:9).

Strategie it is stated that the expert group consists of “Vertretern der Wirtschaft und der Wissenschaft“ (BMBF 2006:3). Upon closer look, the group reveals a slight imbalance, consisting of ten tech business executives, and three directors of research facilities (ibid.:103).

53 In the German original: „CO_2-neutrale, energieeffiziente und klimaangepasste Stadt”.

54 The term is borrowed from Evgeny Morozov (2013).

55 My translation. Original “Staatssekretärsausschuss Nachhaltige Entwicklung” (IMA Stadt 2017:2)

56 State ministries: 13, federal/municipalities: 26, public and private associations/organizations from civic society, science or business: 27. In the self-understanding of the Charta, this reflects that the Charta is not a top-down master plan, but one that emerged from the concerted efforts of (representatives of the) cities themselves (BMUB & BBSR 2017:9).

5.2 Integrating the different dimensions of sustainability

Thus, the Smart City Charta understands successful urban digitalization[57] to consolidate at least two central foci: integrative city development (1), and the sustainable city (2). Drawing on the diverse set of problems that cities are increasingly faced with, sustainability is conceptualized along three lines: economic, social, and ecological (BMUB & BBSR 2017:10).[58]

Economic sustainability points toward "new" business models, and renders digitalization a mode that enhances the competitiveness of local economies (BBSR & BMUB 2017:56).[59] In this sense, the 'digital transformation' also implies a repositioning of urban economies according to a global knowledge (based) economy similar to the first 'smart communities'.

Social sustainability is kept a bit more vaguely. It is sometimes understood as (1) a mode of conducting digital urbanism, that is establishing formats where citizens can deliver input and might co-produce specific outputs such as prototypes (e.g. future workshops, hackathons, FabLabs, LivingLabs, citizen sciences), (2) a mode of consulting citizens as part of establishing a digital or smart strategy, where a framework is developed with the help of different forms of 'participation' (future strategies), (3) an effect that is purported to benefit citizens' life quality. This is arguably the vaguest point since 'life quality' comes close to be an empty signifier given the lack of taxonomy as to what constitutes 'good' life. Accordingly, when the Charta envisions putting the "Bedarfe der Menschen in den Mittelpunkt" (BMUB & BBSR 2017:9), just like the sometimes slippery term of the 'common good', in practice this can be interpreted in different, potentially contradictive ways.

Ecological Sustainability is reflected most clearly in one guiding principle ("Leitbild") of the carbon-neutral city. However, aside from the general acknowledgment that cities are the central sites to mitigate climate change, and ought to pursue measures that promise resource efficiency (ibid.), there are no milestones or clear objectives apart from overarching national goals to become carbon-free by the end of 2050 (BMUB 2016).

The ambition to pursue "Integrierte Stadtentwicklung" (BMUB 2007) then, signifies a city development not to be confined to only one particular segment of the city, but which through cross-sectoral approaches (BMUB 2007:2) at best integrates the different dimensions of sustainability.[60] This privileges city programs that claim to be cross-sectoral. To this end, 'digitalization' is mobilized within the discourse as a „Schnittstellentechnologie“ (BMBF 2015:9) that can be harnessed to achieve a sustainable city. Consequently, digital

57 In the German discourse, digital or smart urbanism is discussed under the larger term of "Digitalisierung" or "Digitale Transformation". Although the English language offers a slightly more nuanced view of the term, either as 'digitization' or 'digitalization', I will follow my material from the German context, where such distinction is not made. Hence, throughout this chapter I will always use the term 'digitalization' or 'digital transformation'.

58 Thus, the Smart City envisioned here has to be "lebenswert", "partizipativ und inklusiv", and "offen" (social), climate neutral and resource-efficient (ecological), and "wettbewerbsfähig" (en. 'competitive') and "innovativ" (economic) (BMUB & BBSR 2017:10).

59 The original quote is: „Die Digitalisierung bietet Möglichkeiten für die Stärkung lokaler Ökonomien. Mit neuen Informations- und Produktionstechnologien können neue Unternehmen und Geschäftsformen entstehen oder die existierende Wirtschaft wettbewerbsfähiger und effizienter werden.“ (BBSR & BMUB 2017:56).

60 In theory, this means that, say, ecological sustainability should not be in conflict with social or economic sustainability and vice versa.

urbanism is invoked as a form of city development that potentially integrates the different lines of sustainability (BMUB & BBSR 2017:11).[61]

5.3 Inevitability & Digitalization as a form

The argument that digitalization is of help for achieving urban sustainability is further legitimized by constructing digitalization both as an inevitable development which has to be steered, and a technique that can be used according to one's desires invoking digitalization as a specific form of knowledge production adequate to tackle future urban challenges.

5.3.1 Construction of Inevitability

Throughout the state's efforts in digital urbanism, the inevitability of the digital transformation of cities is enacted through phrases that set up the self-evidence of digitalization as the subject of a larger transformation of society:

> "Digitalisierung ist inzwischen in vielen Lebensbereichen Realität geworden" (BMUB & BBSR 2017:10)
>
> "Die Digitalisierung wird viele Bereiche von Verwaltung, Wirtschaft und Stadtgesellschaft weiter verändern" (ibid.)
>
> „Die Digitalisierung wirkt sich auf alle Lebensbereiche aus und verändert die Struktur unserer Städte und Gemeinden" (BMI n.d.:n.p.)
>
> „Die Digitalisierung verändert auch die Stadtpolitik, indem sie neue Formen der urbanen Wissensproduktion und der Beteiligung schafft. Sie verändert das Verhältnis von Stadtverwaltungen und Bürgerschaft." (BMUB & BBSR 2017:n.p.[62])
>
> „Die Digitalisierung schreitet voran und die Kommunen in Deutschland müssen mithalten." (BMI 2019:n.p.)

Framed by repeated notions of a 'digital age' (BMUB & BBSR 2017:4,5,44,74,81; BMBF 2015:3), the Charta helps to imagine digitalization as some sort of evolutionary, natural progress in a similar fashion information pundits like John Naisbitt (1984) proclaimed that computational technologies have put in motion a number of "Megatrends" all of which are associated with 'information' increasingly governing (Western) societies with almost exclusively optimistic implications.[63] Additionally, in a contribution to the Charta, the former

61 "Digitale Transformation – den Wandel der Städte hin zu Smart Cities – nachhaltig gestalten bedeutet, mit den Mitteln der Digitalisierung die Ziele einer nachhaltigen europäischen Stadt zu verfolgen." (BMUB & BBSR 2017:10). See also: „Die Digitalisierung (…) soll sowohl im sozialen, ökologischen wie auch ökonomischen Sinne nachhaltigen Zielen dienen und darf diesen nicht entgegenwirken. Kommunen sollen die Digitalisierung dazu nutzen, ihre Entwicklung sozial verträglich, gerecht, energie- und ressourceneffizient zu gestalten." (ibid.:11)

62 This quote was taken from the first preface of the Charta which is not paginated.

63 As such, he saw a desirable decrease of "dependence on hierarchical structures in favor of informal networks" (Naisbitt 1984:xxii-xxiii) and even claimed, "that the framework of representative democracy has become

state secretary of the *Federal Ministry for the Environment, Nature Conservation and Nuclear Safety* situates digitalization on the same scale as climate change, or demographic change illustrating its alleged ubiquity:

> „Denn die Digitalisierung betrifft wie der demografische Wandel, die Globalisierung und der Klimawandel weltweit viele Bereiche der Stadtentwicklung: Ihre Potenziale sollen für gesellschaftlichen Wohlstand, für mehr Lebensqualität und zur Verbesserung des Umweltzustandes genutzt werden." (BMUB & BBSR 2017:80)

By conflating qualitatively very different processes, this subtle comparison invokes a certain urgency since climate change and demographic change are processes that have undeniable consequences if left unaltered (e.g. an inhabitable planet resp. increasing dysfunctionality of the German social security system). This is not uncommon, in fact, Halpern et al. (2017:108) have identified a "language of crisis" that has typically accompanied the "vision of smartness" in the past. Such view is then transposed to the city, the center of these planetary changes, allowing for the Charta to start from the assumption that also a digital transformation of cities is inevitable and in fact, like climate change, may be problematic if left unaltered (BMUB & BBSR 2017:5).[64]

It seems only pragmatic then, that the main focus is put on how to 'sustainably' manage this digital transformation as the Charta's title suggests.[65] In this vein, digital transformation not only describes an inevitable global process, but signifies a technique, or toolbox that can be appropriated according to one's values comparable to the New Communalists' ambition to repurpose information technologies for social liberation. Consequently, the Charta presents several "worst" and "best" case scenarios (BMUB & BBSR 2017:52-55,60-63,68-71,76-79). By that, it draws on a common story of technologies as neutral tools shaped by their users' intentions. Consequently, there is general agreement in the policy documents, that digitalization not only poses challenges but also offers "Chancen auf dem Weg zur nachhaltigen Entwicklung" (BMUB & BBSR 2017:8, see also BMBF 2015:19, passim) and should be used accordingly (BMUB & BBSR 2017:11).

As repeatedly stated throughout the Charta, such digital transformation shall put the human into its center. In this sense, the Charta likes to understand itself as a more social, citizen-centered approach to the smart city as opposed to a mere technocratic or corporate

obsolete in an era of instantaneously shared information" (ibid.:xxii) suggesting that representative democracy was merely a problem of lack of information. This reverberates debates on the "knowledge problem" during and before WWII which in Naisbitt's view is implicitly solved by information technologies. It is worth mentioning that the book was ranked in the best-seller list for two years, and the present reissue from 1984 (originally published 1982) starts with eleven (!) pages of positive reviews (e.g. by Alvin Toffler) about the book. It can be said that he popularized the term 'megatrend' for a business-oriented form of future research. That is, today the term is still used in a way to make global transformation processes intelligible in a language of markets such that future markets can be identified, and controlled. In Germany, see for example the consultancy "Zukunftsinstitut" heavily using the term "megatrend" to the end of identifying future markets (Zukunftsinstitut 2020).

64 A popular assertion is that Germany cannot keep pace with its global competitors. This is also illustrated by several fictitious 'worst case' scenarios (BMUB & BBSR 2017:76ff.). Often this is invoked in two ways: either by being dependent on large companies, or countries where certain legal protections are not given.

65 The full title is "Smart City Charta. Digitale Transformation in den Kommunen nachhaltig gestalten" (BMUB & BBSR 2017)

approach to city development.[66] This view is reflected in the urban literature as well, where it has been argued that if the “smart city 1.0” was the corporate version of digital urbanism (advertised through international model cities like Songdo or Masdar City) that has failed to address social problems, the “smart city 2.0” aims to correct this trajectory by centering social problems, or sustainability (Trencher 2019).[67]

This aligns with the Charta repeatedly problematizing the so-called Digital Divide (BMUB & BBSR 2017:72), which is the unequal distribution of skills necessary to make use of digital technologies, i.e. digital literacy. Hence, the Digital Divide does not disqualify the Smart City, or digital urbanism, per se. It is understood as a challenge whose detrimental effects on social inequality can be mitigated. In other words, not the digital technologies are the problem, but the skills required to benefit from them. This has real consequences. In this view, social difference manifests in digital milieus such as “Digitale VorreiterInnen” (en. digital forerunners), or “Digital Abseitsstehende” (in en. analogous to ‘digital outsiders’) (Initiative D21 2020:35, passim).[68] Urbanist and writer Maroš Krivý (2018) attributes this tendency also to a shortcoming of the criticisms of the Smart City that in consequence, have turned out to be of an *auxiliary* nature. That is, they tend to problematize the incompatibility of the Smart City with the “informal character of the urban” (Krivý 2018:10; for the critique see for example Sassen 2013, Greenfield 2013), the Smart City as a corporate project that promotes entrepreneurial urbanism (Hollands 2008, Söderström et al. 2014, Kitchin 2014) or its tendency to reproduce, even amplify, social inequalities (Hollands 2008); however in all accounts, Krivý argues, it is suggested that such tendency can be corrected by suggesting a more citizen-centered approach, or a “human capital” view (Hollands 2008:315). He continues that these suggestions have been “enthusiastically welcomed by SC proponents” (Krivý 2018:14) since it tends to reinforce an informational view of the city, in turn legitimizing the trajectory of solving urban problems employing information technologies.[69]

The concrete benefit of this approach to be expected however tends to be kept vacuous. It is not clearly explicated what precisely is the beneficial aspect of digital urbanism, instead

66 As such, it states role models to be Copenhagen, Barcelona, Amsterdam among others, (and say, not King Abdullah Economic City) which are understood in the Charta as a more “social” approach to the smart city (BMUB & BBSR 2017:5,18)

67 In fact, the Charta contains an article written by *Demos Helsinki*, an initiative that represents exactly this view, and explicitly refers to the Smart City 2.0 (BMUB & BBSR 2017:43). Others have made similar arguments calling for a “smart urbanism” that centers the social supposedly lacking in the “smart city” (Hajer 2014:13).

68 The D21 Digital-Index is an important annual survey in this regard. It was commissioned by the *Federal Ministry for Economic Affairs and Energy* as a public-private-partnership in 1999 (together with the former director of IBM) to tackle the digital divide, featuring several big companies as partners such as Facebook, Huawei, Allianz, KPMG, Bertelsmann, Microsoft and more (Initiative D21 2020, for the PPP see Menzel-von der Mark 2020). The categories are based on market research methodologies that render milieus according to the usage intensity of digital tools, and the confidence with which these tools are used, i.e. their capacities.

69 In this vein, Sassen argues for an open-source urbanism “connecting all these diverse actors with their specific forms of knowledge to open-access networks, or wikis, that circulate these bits of information.” (Sassen 2013:n.p.).

it hinges on a more general language of connectivity[70] that is used in order to promote the prospects of such networking:

> „Die Experten der NPZ schlagen vor (…) Informations- und Kommunikationstechnologien (IKT) in städtischen Systemen auszubauen und weiterzuentwickeln. **Schnittstellentechnologien und -plattformen sind essenzielle Treiber (Enabler) für neue Lösungen, Betreibermodelle und Anwendungsfelder**“ (BMBF 2015:16, emphasis added)

Given the fact that according to the *Deutsche Institut für Urbanismus* smart city projects haven't been comprehensively evaluated yet (Soike & Libbe 2018:9), I argue that this is possible because the discourse on digital urbanism is imbued with optimistic cybercultural assumptions about the prospects of information technologies to transform cities, and with it, herald a 'new' relation between citizens and their urban environment. Consequently, the social may benefit through enhanced responsivity or co-production of digital tools, the economic through 'new' business models, or cooperation between different stakeholders, or a more efficient management of institutions, and the ecological by increasing resource efficiency.

5.3.2 Digitalization as a form

The idea is that digitalization is a neutral process with inherent qualities that can be harnessed for making cities more sustainable, integrating the economic, social, and ecological. To a certain degree, it mirrors how early information theorists concentrated on the form, rather than the content of 'information' as the underlying mode of computation and stylized the prospects of such form as socially transformative. Accordingly, the state activities in digital urbanism represent a foregrounding of digitalization as a form of knowledge production with its most staggering characteristic to 'network' („Die mit der Digitalisierung einhergehende Vernetzung von Infrastrukturen…" BMUB & BBSR 2017:13), or 'connect' formerly separated entities often invoking the notion of untapped hidden potentials, to be future viable (BMBF 2015:3).
This notion of connectivity runs like a common thread through all of the policy documents, if not most of the discourse more generally. As such, it also extrapolates to other domains, so that even when there is no explicit reference to the digital, the Charta repeatedly suggests that networking constitutes one vital component of achieving Germany's 'Zukunftsstadt' (BMUB & BBSR 2017:16-18). Importantly, due to digitalization perceived as a cross-over technology, such mode is not confined to one sphere of the city but always imagined across manifold areas, as this scheme taken from the DIV-Report might illustrate:[71]

70 In fact, the beforementioned (see p. 43n63) Zukunftsinstitut situates digitalization as part of an even larger "megatrend" of "connectivity" (Zukunftsinstitut 2020). This is not to stand as evidence, but more as another manifestation of the discourse in which a link between the digital and this characteristic form is established.

71 The DIV (Deutschland Intelligent Vernetzt) report is published annually as part of the *Digitalgipfel*, an annual congress since 2006 initiated by the *Federal Ministry for Economic Affairs and Energy* promoting the digital transformation of Germany.

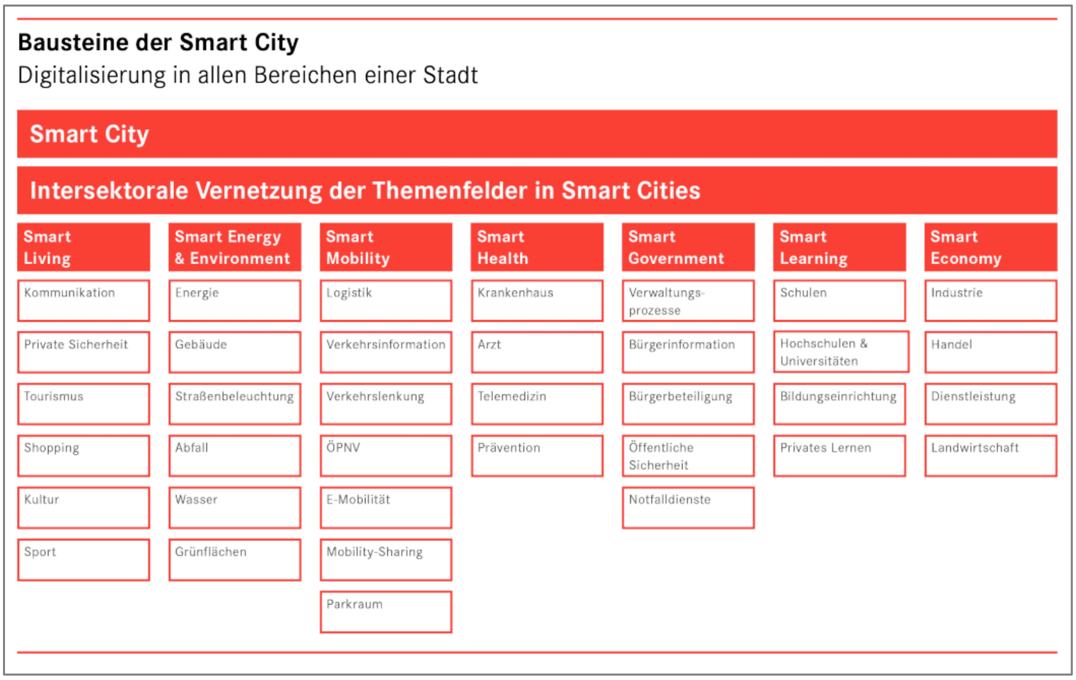

Figure 4: The DIV identifies the areas of the city that can be digitally transformed and networked, Image from DIV (2015:n.p.)

This enables the Charta to suggest more generally that a new cooperation of stakeholders (BMUB & BBSR 2017:17,65,95; BMBF 2015:3,7,19; IMA Stadt 2017:14,17,40) is necessary for a future city development implying that existing forms of cooperation are unfit for future challenges of cities exactly because of their non-connectedness, resulting in an inferior capacity to take meaningful action. Urban innovations thus require, the experts of the FINA suggest:

> „neue Rahmenbedingungen zu analysieren und zu erproben, um die institutionelle Zusammenarbeit zwischen kommunalen, privatwirtschaftlichen, wissenschaftlichen, politischen und zivilgesellschaftlichen Akteuren zu verbessern." (BMBF 2015:19)

Going one step further, this means that science ought to promote networking technologies:

> „Die Forschung soll die technologischen, ökologischen und sozioökonomischen Bedingungen für eine erfolgreiche Transformation bestehender Infrastrukturen untersuchen und vernetzte Lösungsmöglichkeiten aufzeigen." (BMBF 2015:8)

That is, science is coopted to produce solutions in accordance with the networking principle whose effectiveness seem to be self-evident. While such cooptation of science has its own tension,[72] the self-evident language is only insufficiently understood as mere rhetoric. Thus, what is needed to unfold this potential is a correlate that is receptive to such mode of knowledge production.

72 It carefully reminds us of Boden & Epstein's intriguing observation that political claims of "evidence-based policies" in practice tend to be better described as "policy-based evidence" (Boden & Epstein 2006:226).

5.4 From complexity to necessity, or: preparing the city for the digital

To this end, the policy documents signal increasing complexity as characteristic for the current state of the world, that for to be managed also requires 'new' modes of urban management. It does so by foregrounding either the complexity of cities as systems (BMBF 2015:9,16) or that of planetary (thus, also urban) challenges (ibid.:18). By that, parallels to the postwar period of urban cybernetics are visible in which it was common to promote system analysis techniques for city planning "to solve the complex urban problems which exist, today" (Optner 1960 as cited in Light 2003:48).

In the present discourse, this is typically accompanied by descriptions of increasing global urbanization processes that act as a multiplier to this complexity. As such, it follows a line of argumentation that can be found especially in the 'new urban science' that from its initial concern with a "computable city" foregrounds the increasing complexity of "social structure and behavior" (Batty 1997:157), and thus of understanding and planning cities (ibid.:159), that is "characteristic of the information society" (ibid.:164). In the eyes of urban geographer Brandon Gleeson, the recognition of increasing global urbanization processes as a signifier of an "urban age" also led to an inclination towards what he identifies as "urban physics" (Gleeson 2013:1846) by which he refers to the influx of engineering expertise within the field of urbanism promoting a more positivistic understanding of the city.[73] This branch of urbanism has adopted the language of complexity to promote digital urbanism as an adequate, even necessary response to manage future cities. Importantly though, despite the methodological criticism the urban age thesis was objected to (Satterthwaite 2010, Brenner & Schmid 2014), the assertion that "for the first time in human history, more than half the world's population now lives within cities (…) has become the most quoted, but therefore also among the most banal, formulations in contemporary urban studies" (Brenner & Schmid 2015:155-156). Effectively, it helped to homogenize the quantitatively, and qualitatively different urbanization patterns and obscure that most of the urban growth accounted for in the UN reports has happened and continues to do so in the Global South and, in fact, not the Western cities where smart technologies purportedly are required to tame urbanization growth. Nevertheless, the references to planetary urbanization growths seem to be the current default mode to legitimize also state practices of digital urbanism (Bundesregierung n.d.).

I am not arguing that a complexity view prevailed and then information technologies were chosen to manage it. More, both reinforced themselves, also since complexity thinking can be said to have emerged from a close relationship of information research and physics.

73 One junction point for Gleeson is for example when in 2010, the physicists Luis Bettencourt and Geoffrey West (2010) published an article in the *Nature* journal presenting "A unified theory of urban living". Here, the authors proclaim that in order to "combat the multiple threats facing humanity, a 'grand unified theory of sustainability' with cities and urbanization at its core must be developed' (Bettencourt & West 2010:912). What is needed is "an integrated, quantitative, predictive, science-based understanding of the dynamics, growth and organization of cities' (ibid.). The consequences for city planning can only be surmised if such view hinges on the insight that "[s]urprisingly, size is the major determinant of most characteristics of a city; history, geography and design have secondary roles" (ibid.).

That is, the „metaphoric joining of entropy and information" in the mid 20th century enabled to view complexity, not as a lack of order, but rich in information that could be tapped with information technologies (Hayles 1990:51).

Recalling that resilience and complexity often go hand in hand (Krivý 2018:18), in the state documents one can find a dominant concern with resilience and a corresponding systems-view of the city (BMBF 2015:8).[74] In fact, it is suggested that the lack of such systems thinking so far has hampered innovation:

> „Infrastrukturen als Teil der Daseinsvorsorge sollen für die Zukunftsstadt im System gedacht werden. Die Systemgrenzen heutiger Infrastrukturen hinsichtlich Versorgung und Betrieb oder Anbietern und Dienstleistern sind massive Innovationshürden für innovative Infrastrukturen in der Zukunftsstadt" (BMBF 2015:16)

It seems to be suggested that for cities to successfully transform into future cities they have to incorporate the 'networking' capabilities of information technologies that are set up throughout the policy documents. In other words, networking is not only understood descriptively, but normatively:

> „An der Schnittstelle bestehender Infrastrukturen und Stadtsysteme (wie z. B. Sicherheit/Schutz, Konsum/Lebensmittel, Information/Kommunikation und Beleuchtung/öffentlicher Raum) sind zunehmend digitale und technische Lösungen erforderlich. **Erst sie ermöglichen eine optimale Vernetzung**." (BMBF 2015:9, emphasis added)

Only consequently, if the lack of networking is constantly problematized, the FINA establishes a link between the lack of 'knowledge' (or of an appropriate networking thereof), here understood as 'data', and restraints that hitherto have hampered urban climate protection measures:

> „Grundlage für die Entwicklung unserer Städte zur CO2-neutralen, energie- und ressourceneffizienten sowie klimaangepassten Zukunftsstadt ist eine sichere Datenbasis. […] Die bessere Vermittlung neuen und vorhandenen Wissens soll die bestehende Zurückhaltung beim Handeln verringern." (BMBF 2015:9)

If data was indeed the limiting factor to politically meaningful urban climate mitigation actions, then at least the Charta does not explicate what 'knowledge' or 'data' could counter this. Instead, if anything, these truisms seem to suggest that current modes of knowledge production are insufficient to tackle the complex challenges that future cities purportedly face (BMBF 2015:13,18).[75]

Broken down, this language captures large parts of the discourse on digital urbanism. While it seems plausible to embrace a 'better' interlocking of 'knowledge', it is not clear how

74 „Resilienz ist eines der zentralen Systemmerkmale einer nachhaltigen Stadtentwicklung und betrifft Landschaft, Siedlung, Wirtschaft, Gesellschaft und Infrastruktur gleichermaßen." (BMBF 2015:8)

75 To Krivý it reveals parallels to a language of transition prevalent in second-order cybernetics (Krivý 2018:18). He writes, that "If second-order cybernetics grounded its sweeping claims in vague truisms ('humanity as a whole is today in a transition period' (Prigogine and Stengers 1984:19)), these truisms in turn legitimized sweeping imperatives how entities, themselves only vaguely defined, must change and adapt ('there is a need for new relations between man and nature and between man and man' (312))." (Krivý 2018:18) For the argument here, it is sufficient to understand this as a cybernetic reference. A condensed overview of the different currents of cybernetics however can be taken from Hayles (1994).

precisely digital technologies can add to that, particularly due to the lack of differentiation as to what kind of knowledge is expected to be needed. That is, even if ‘knowledge’ tends to refer to data, i.e. formal rather than tacit knowledge, “just getting more data on the problem is not necessarily going to help” (Bowker 2013:171), and assuming so obscures not only the relevance of the quality and politics of data but also renders other problematizations less meaningful in this regard.
Nevertheless, the Charta envisions such ‘new’ architecture of knowledge production central to act on future challenges, partly overemphasizing the informational grounding of these challenges, and by that, obscuring alternative approaches which we would not necessarily account for as informational, say carbon limits or bans in car production or elsewhere. Nevertheless, it effectively leaves a present city that yet has to be transformed.
To this end, in the discourse a link is established between the degree of urban digitalization and the future viability of cities, that is the capacity to deal with future challenges. In recent years, this link has been increasingly mobilized in rankings, studies, and surveys, where cities are weighted against each other in terms of their current status quo of digitalization. Given the lack of a taxonomy of ‘smartness’, the rankings typically vary in their indicators which is why the same cities often occupy very different positions in these rankings.[76] Throughout these rankings and studies, we find a similar structure as outlined above: Global crises and increasing urbanization are likely to pose increasingly complex future challenges to cities for which current modes of urban management are inadequate, requiring ‘new’ forms of knowledge production that digital information technologies embody, as seen exemplary in the following two rankings:

76 See for example Berlin ranking 10th place in the Haselhorst’s *Smart City Ranking Digitales Deutschland 2019* (Haselhorst Associates 2019), 4th place in bitkom’s *Smart City Index 2019* (Bitkom 2019), and 14th place in Fraunhofer’s *Morgenstadt Index* (Radecki et al. 2019).

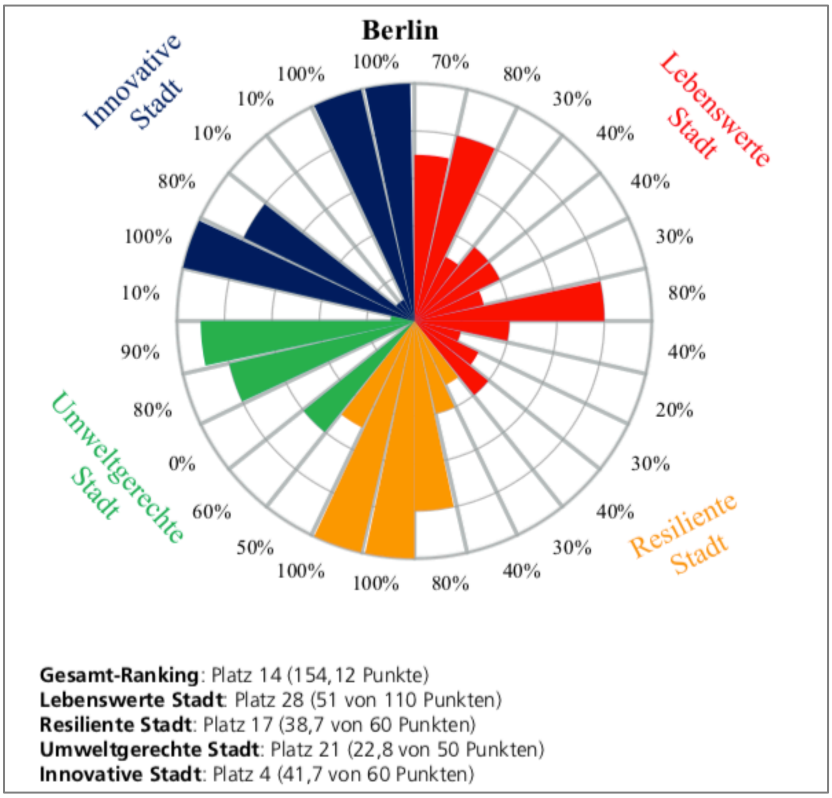

Figure 5: Morgenstadt Index, Fraunhofer IAO, Image from Radecki et al. (2019:17)

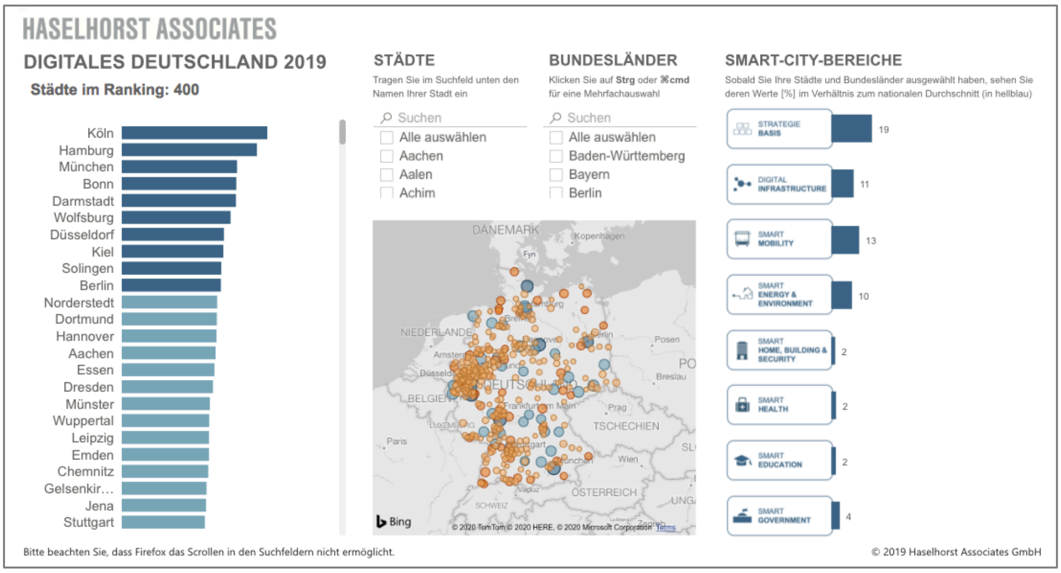

Figure 6: The Smart-City-Ranking allows to identify the areas of the city that yet have to become 'smart', Haselhorst Associates (2019), screenshot by author.

These rankings might also function to establish a commensurability of cities such that cities may compare themselves and possibly imitate, according to the respective ranking, 'successful' cities. Similarly, studies that capture a given state of digitalization reinforce the necessity to digitalize, mostly by identifying the lack of digitalization. Typically, in these studies, the ongoing digital efforts in certain areas of the city are identified and lauded to then expose the lack of digitalization in other spheres. Importantly, collaboration[77] between ICT companies, engineering sciences, and the state are very common in this regard making it hard to criticize any smart approach as merely corporate (Bitkom 2019, Radecki et al. 2019, Initiative Stadt.Land.Digital 2020, DIV 2018, Deutsche Telekom AG 2017).[78]

We might understand these rankings and studies also as curations of specific (and not other) facts, and thus problems, attempting to enact a specific, desirable form of digital urbanism (Law 2009). Whether they succeed in performing these enactments is a different question. Nevertheless, these rankings, surveys, or studies help to solidify a systems-view of the city through which complexity is reduced to clear measurable indicators, even if for example the *Morgenstadt Index* does not explicitly label such approach as 'smart'.

In line with anthropologist Shannon Mattern, I would argue that a specific view of the city is shared across the different communities of practice engaging in digital urbanism. I would differentiate however that such a view is not simply that of a computer (Mattern 2017), but more a conceptualization of the city as a communication system, prompted by systems thinking. Given that systems thinking in the very beginnings of computer research enabled collaboration between distinct disciplines of psychology, physics, and communication engineering (among others) by providing a "rhetoric and conceptual framework with which […] to coordinate the work as a whole" (Turner 2006:24), the present material might suggest that systems thinking occupies a similar role in the current discourse of digital urbanism, at least concerning future visions of the city. I am not suggesting that these communities of practice are all agreeing on future trajectories of the smart city. It is more subtle. Given the role material technologies historically had in co-producing the cyborg discourse and its metaphors to be used to think about the world, one could argue that what is shared across these communities is a particular way of seeing the city that seems to be inscribed into the technologies that are in the center of these narratives. This means, the city as a system for example is grounded in computational metaphors and inscribed into sensor kits, digital urban platforms, or rankings that embody attempts to view the city as a

77 Either when state ministries commissions studies conducted by business actors, or, maybe more importantly, reflected in the expert groups that are chosen to accompany initiatives that seek to promote digital urbanism. One example would be the expert group on "Smart Cities/Smart Regions" that contributed to the DIV-Report (part of the national initiative "Deutschland Intelligent Vernetzt") where more than half of the experts were business associates, whereas the rest represented a more engineering approach to science (DIV 2018:138).

78 One can say however, that especially Bitkom, the association of digital companies in Germany, displays a more aggressive marketing strategy. One example is the attempt to promote 'intelligent' mobility through surveys. Here, participants are asked "Which of these possibilities would you support in your city?" and one answer is "Intelligent traffic control to avoid congestion". The fact that a causal connection between the rather abstract concept of 'intelligent' traffic control and reduction of congestion is already established may facilitate approval. In Social Media then, the findings are reframed as citizens 'wishing' for intelligent traffic control (Digitale Stadt 2017). While certainly there is a need for democratic consensus with regard to digitalization, these surveys can also fulfill functions beyond merely capturing an allegedly 'objective' state of citizens' preferences given that "methods practices" can also be performative and "help to enact the world that they describe" (Law 2009:249). Thus, the question is why citizen consultation is practiced so heavily in this regard, while those who oppose digital urbanism are sometimes labeled as 'pessimists' or lacking the skills to benefit of the technologies.

complex system. This enables, not more and not less, collaboration among communities who previously would possibly have not engaged together in this form, not out of disdain, but more out of lack of these technologies acting as what Star & Griesemer call “boundary objects” (Star & Griesemer 1989).[79] At the risk of appearing redundant, importantly, this systems view is not merely a rhetorical device but has real consequences for the way urban problems are framed. Once digitalization is understood as an urban phenomenon, it enables to draw from expertise that hitherto would maybe have been absent. Consequently, urban problems can be reorganized in accordance with what is considered the ‘right’ expertise, approaches, and tools. This could be understood by what Geoffrey Bowker has called “legitimacy exchange” (Bowker 1993:116). That is, scientific claims that in isolation could be labeled as outlandish, “could gain rhetorical legitimacy by pointing to support from another field” (ibid.). Take for example the, in the discourse of digital urbanism, surprisingly common proposition to install ‘smart’ garbage cans as means to increase energy efficiency of urban waste management.[80] It is at least up for debate whether this technology in itself, would be acknowledged as a serious attempt to solve urban sustainability if not accompanied by a narrative of an ‘intelligent’ city. Hence, embedded in a systems-view of the city, they can be legitimized as but only elements of a larger, ‘holistic’ mode of mapping sustainability along the whole array of the urban as a system of systems, and which to make sustainable requires tinkering with (and optimizing) many different parts of it, rather than forwarding only one solution. In other words, the smart garbage can then no longer hinges only on niche claims by scientific workers, or for that matter, companies, but can be backed up by scientific claims of experts such as computer scientists or environmental technicians that view these projects not in regard with the historicity of urban problems, but through their respective practical lens. Through it, a smart garbage can is rather one technical possibility, that even if not necessarily the only best option, can stand for one legitimate element of a networked infrastructure to achieve sustainability.

The discourse thus enables for these legitimacy exchanges, and in turn, reorganizes the terms under which urban problems, at least in part, can be discussed. This brings me to my hypothesis that digital urbanism not only offers ‘new’ solutions to given problems, but also shapes the way these are solved, or put more pointedly, *reconfigures* the nature of urban problems to make them solvable by specific information technologies.

5.5 Zooming in: Privileging communicational problems?

To the end of achieving the previously outlined transformation of cities, in recent years Germany has initiated several funding initiatives such as *Modellprojekte Smart Cities* (BMI 2019) or the *Wettbewerb Zukunftsstadt* (BMBF n.d.) that aim for municipalities to become digital as envisioned in the Charta. At the same time, one notable effect is the occasional establishment of a “Chief Information/Innovation Office” (Dortmund), or “Chief Digital

79 One has to be cautious however with such assertions since for that an ethnographic approach to the actual communities of practice would be required.

80 See for example in Karlsruhe (Hofheinz 2018) or Heidelberg (Rhein-Neckar-Zeitung 2018)

Officers" (Düsseldorf, Darmstadt, Kaiserslautern, Essen) which typically ought to drive and consolidate the dispersed digitalization efforts of city administrations into a coherent strategy.[81]

So far, I have presented a more general overview of how the discourse on digital urbanism is structured and how it mobilizes a certain digital urbanism as a desirable form of the future city. Crucially, although meant as a normative guideline to the smart city, the documents are often very vague in their claims apart from general phrases that state the self-evidence of networking technologies as a better, future viable mode of urban management implying that the resulting knowledge will render future challenges amenable to cities' agency.

In my view, firstly, this reflects the very discourse on digitalization pointing towards the cybercultural legacy of smart urbanism allowing for calls to 'network' or 'intelligent infrastructures' appear as obvious choices for future cities despite the conceptual fuzziness and the lack of actual empirical data more profoundly backing up these claims. However, secondly, the vagueness also allows for the inclusion of very different communities of practice (or stakeholders) that can come together each with their own understanding of the prospects of networking. Taken together, the discourse of digital urbanism enables to mobilize an informational view of the city which might have helped to privilege forms of knowledge production that envision a seamless transmission of 'information' (and by that, 'knowledge') flows as a vital element of the future city. I understand this problematization of the city typical for the current digital urbanism and it is this view that prepares cities to view the nature of urban problems as informational. Importantly, however, this does not happen in a straightforward, deterministic way, but should be understood as a tendency.

In order to illustrate this, and to get a better understanding of what the Charta sees as desirable digital urbanism, let us look at one project that is deemed best-practice in the Charta.

To this end, I chose the "ViWoWolfsburg2030+" project that is not only commended in the Charta but also awarded as a "Zukunftsstadt" project as part of the funding initiative *Wettbewerb Zukunftsstadt*. The project suits for closer examination for several reasons: a) it was in part accompanied by the Technical University Berlin (hence, not a company), b) it envisioned to include citizens, c) it is one of the few smart city projects that also tackles housing, d) it is relatively well documented (Stadt Wolfsburg 2020) so that it allows to roughly compare the initial problematization by citizens, with the final outcome. Nevertheless, this analysis hinges on desktop research and should be treated as such. That is, the project might fulfill functions beyond my sight, or put differently, like the Smart City Charta, I was only exposed to the "front stage" of policymaking (Bijker et al. 2011:124). Also, I want to emphasize that my aim is not to systematically evaluate the project itself, I am using the project as a, in its structure, typical manifestation of the current discourse in order to highlight a specific trajectory within digital urbanism that I deem underrepresented. That is, a side-effect of the current discourse on digital urbanism is a tendency to reframe urban problems increasingly as communicational, ergo informational problems, not necessarily because this is 'objectively' the best way to tackle urban problems, but more

81 These positions are occupied mostly by computer scientists (in German "Informatiker"), or in one case, by a former public relations consultant. For the sources, see Stadt Dortmund (n.d.), Digitalstadt Darmstadt (2017), Stadt Düsseldorf (2019), KL.digital (n.d.), Stadt Essen (2018).

because urban problems are ‘compressed’ to the very technologies and their infrastructures that co-produced the discourse in the first place (Sterne 2015).

The project “ViWoWolfsburg2030+” (“Visionen zum Wohnen in Wolfsburg 2030+: digital und vernetzt in die Zukunft”) was conducted between 2015 – 2018 and was structured in two phases: development of a future vision in cooperation with citizens, development of a concept of action. This included several smaller projects across predetermined topic areas of “Wohnvielfalt”, “Mobilität”, and “Klima”. In 2018 then, the output of the project was to be implemented.[82] What I am interested in is how the workshop enabled to follow up on certain ideas and made impossible other ways to address future challenges.

First of all, the project draws on the very legitimation structure outlined above: Digitalization is set up as a global process and the complex system of the city is said to be affected by these challenges in an unprecedented way.[83]

The project is framed as a citizen-centered project concerned with the question of how people imagine living in Wolfsburg in the future. The aim was to include citizens as “Gestalter der Stadt” (Stadt Wolfsburg 2018:3) however emphasizing that the final project proposals need to have a “Digitalbezug” (ibid.:5), i.e. “smarte Innovationen” that can be tested in the city (ibid.).[84] It was structured such that in a first future workshop, interested citizens, adults, and children, would communicate their needs and wishes concerning the topic areas living, mobility, and neighborhood quality among others (Stadt Wolfsburg 2015). The next phase consisted of a study project by the Technical University Berlin that conducted 37 interviews with citizens to identify their needs (“Bedarfsbefragung”). Both in the workshops and the survey, one primary concern for citizens was the lack of affordable housing (Evers et al. 2017:17, Stadt Wolfsburg 2015:7-8). In the second “Bürgerworkshop” then, the initially collected visions and concerns of citizens collected in the first workshop and the survey were condensed into a more general cluster that envisions an increase of the housing supply’s diversity, and the establishment of innovative finance models[85] („Schaffen von vielfältigen und flexiblen Wohnungsangeboten und -konzepten sowie Etablierung innovativer Finanzierungsmodelle“, Stadt Wolfsburg 2017:4). This second workshop was based on the method of urban design thinking, a method whose origins the authors previously situate in product development (Evers et al. 2015:10). Importantly, it is structured such that ideas gathered in the beginning, can be translated into potential prototypes, i.e. technological solutions, and disseminated through a corresponding business model (Stadt Wolfsburg 2017:6, Evers et al. 2015:10). Over the course of the

82 For my argument, however, the two phases are sufficient, also since the implementation is still pending.

83 “Das komplexe System Stadt ist an unzähligen Schnittstellen von diesen Entwicklungen berührt. Städte sehen sich der Herausforderung gegenübergestellt, ihre Prozesse und Strukturen anzupassen und weiterzuentwickeln“ (Stadt Wolfsburg 2018:3).

84 This mode of urban experimentation is actually a typical element of smart urbanism, which deserves closer scrutiny on its own. I am aware of these developments, given the confinements of this thesis, however, and since this form of urban experimentation typically only emerges once a testable solution is already outlined, I left this phenomenon aside. For closer scrutiny of the increasing emergence of “urban laboratories”, and its origin in the Chicago School of urbanism, see Karvonen et al. (2014) and Karvonen & van Heur (2014). For a more detailed account of how the Chicago School mobilized the city (of Chicago) as a “truth-spot” that allows for scientific examination, see Gieryn (2006).

85 Typically, this means autonomous and not publicly funded.

workshop, the participants created two potential project approaches to the beforementioned cluster of living: one that aimed for institutional and legal reforms to either accelerate the building process of new houses, enable different finance models such as “Mietwohnkauf, Crowdfunding, Baugruppen” (Stadt Wolfsburg 2017:19), or the provision of parcels. The other project approach envisioned a digital platform through which flats or houses could be offered to swap, people in search for a place could connect with like-minded to join efforts,[86] or simply find information on “innovative Finanzierungsmodelle” for homeownership (en. “innovative financing”, ibid.:20). In a documentation of the workshop, the former project was disqualified due to its lack of connection to the possibilities of digital urbanism (“der digitale oder smarte Bezug ist nicht gegeben”, Stadt Wolfsburg 2017:19), whereas the latter platform project seemed to be in alignment with the expectations.
In the following two expert workshops,[87] the institutional approach was not further discussed, whereas the platform idea was added to a list of now three project ideas: 1) the mentioned digital swapping platform, 2) a cluster living project[88] which is envisioned to address mainly two problems: a) how to provide need-based (“bedarfsgerecht”, Stadt Wolfsburg 2017[a]:2) living spaces, and b) how to improve neighborhoods, which were identified to hinge on a support structure that could be provided by digital platforms facilitating contact among neighborhood inhabitants. We see that in this second project, the initial problem of affordable housing seems to have shifted to a broader problem of need-based housing. Here, the modular character of cluster living is rendered an adequate response.
A third project was the establishment of a so-called “Quartiersplattform”, where inhabitants’ needs would be collected digitally without further specifying how this ought to function in practice (ibid.). In fact, this is acknowledged in the documentation of the second expert workshop, stating that the platform alone was too broad in its focus (“zu schwammig”, Stadt Wolfsburg 2017[b]:2). However, this did not disqualify the project completely, and thus it was envisioned to complement the cluster-living project, also because the cluster project was imposed to improve the neighborhood.
The swapping-platform eventually was discarded, not due to its problematization, but since a similar platform is said to exist already, and the target group benefiting from it might be too small. Consequently, the final approach integrated the cluster living with an infrastructure envisioned to network the inhabitants of the neighborhood, entailing an “öffentliche Mobilitätsstation mit unterschiedlichen Mobilitäts- und Sharing-Angeboten“ (Stadt Wolfsburg 2018:10) which is intended to be used also for “Nachbarschaftshilfe” (ibid.), and a “Digitale Haustafel” (ibid.:9) through which „nachbarschaftliche Bedarfe und Angebote“ can be communicated (ibid.:10). Such networking is also envisioned to reduce anonymity which is seen to be detrimental to the health of a neighborhood (“Vernetzung im

86 The mentioned example is that people in search of a place connect in order to e.g. buy houses via the concept of “Baugruppen” (ibid.:20).

87 Unfortunately, there is no documentation of who, resp. what kind of expertise participated here. It is implied though, that one role of the experts was to assess the projects with regard to possible business models (Stadt Wolfsburg 2017[a]:2)

88 Cluster living describes a model of housing where inhabitants have their private (access to) living spaces plus the possibility to use shared spaces such as a communal kitchen, living room, leisure spaces, or the like.

Quartier fördern und somit Anonymität reduzieren“, ibid.) obscuring the potential benefits of anonymity in public space, especially for “women and for others whose bodies are marked in terms of difference” (Tonkiss 2003:301). At the same time, such reliance on the self-evidence of networking is very much typical for many smart city projects that are commended by the state’s Charta or its funding programs.

There are some points to bear in mind here: while envisioned as an open-ended discussion about the future of Wolfsburg, the workshop was actually tightly framed by its pursuit to find a testable prototype relevant to digital urbanism. This was not so much because of companies pushing their products, but due to the funding criteria on producing a digital project that in the eyes of the Smart City Charta could act as a template for other cities, and in this case, also by the method used that was seen as an appropriate way to include citizens as “Gestalter”. In fact, more generally within digital urbanism participatory formats are increasingly popular and tend to escape closer scrutiny such that “living labs”, “hackathons” or future workshops are seen as an unproblematic and adequate response to include the citizenry (BBSR & BMUB 2017:15). In more critical accounts, it has been argued that with it, these formats carry a shift from “participation in decision-making” to “participation in innovation-making” (Delvenne & Macq 2020:245) emphasizing “productivist” rather than “civic values” (ibid.). Technologically inclined Smart City advocates like Anthony Townsend thus tend to render these developments a win-win situation rather than potentially problematic, stating that “putting the needs of citizens first isn’t only a more just way to build cities. It is also a way to craft better technology, and do so faster and more frugally” (Townsend 2013:282). In contrast, I would like to understand this project also as an attempt to incorporate citizens as “collaborateurs and endorsers of the smart city“ (Datta 2018:9) framing participation “within an instrumental rather than normative or political frame” (Cardullo & Kitchin 2019[a]:10).[89] Fittingly, the Charta repeatedly states that digital, or smart city strategies, also function to increase the acceptancy by the public (BMUB & BBSR 2017:4,39,45,50,51,55,74), which is also why for example participation events occasionally take the appearance of entertaining showcasing events where people can experience the respective technologies first hand.[90] Correspondingly, the closing event of Wolfsburg’s Zukunftsstadt project offered „Angebote zum Mitmachen und Ausprobieren, wie [einen] Alterssimulationsanzug, VR-Brillen, Energiebikes zum Antreiben einer Carrerabahn, [ein] Energieeffizienzhaus, Informationen zu Smart Home und das Leben im Alter unterstützenden Produkten“ (Stadt Wolfsburg 2020:n.p.). To put it pointedly, participatory formats can also be imagined as a way to nudge citizens into what is considered the right direction.[91]

89 In a different piece, the authors (Cardullo & Kitchin 2019:820) ascribe this tendency also to the very funding structure on which most smart city projects hinge: “Any engagement that occurs after funding, even if designed to be citizen-centric, has then to meet pre-determined milestones and fulfil the deliverables of the contract, meaning citizens have limited scope to reframe the initiative around their concerns and desires.”

90 In particular, strategies are not only promoted by civil society but companies as well. That is, the association of the internet economy in Germany “eco” suggests that coherent strategies are needed in order to keep pace with competitors on the smart city market, which is assessed to be the one of the fastest-growing economic sectors in the upcoming years. In these accounts, strategies seem to be valuable because they render future uncertainties amenable to present (business) planning (eco 2017).

91 For that matter, see also the publication issued by the BBSR on “nudging” in the digital city (Jakubowski 2018).

Framed by the larger discourse on digital urbanism outlined so far, Urban Design Thinking helped to stabilize the view that an urban problem is best tackled with technologist means so that consequently the one project approach that attempted to tackle affordable housing with institutional means was discarded. Instead, a hybrid project prevailed that addressed a perceived inflexibility of the housing market to provide need-based housings, such that cluster living was imagined as an appropriate response. In itself not necessarily a digital project, it was complemented by a not fully-articulated idea of a mobility platform, and a digital house board ("Digitale Haustafel").

This is why one could understand the project as a site which enabled the proposed urban problems, to be translated into communicational problems: what citizens initially identified as a central topic was the affordability of housing. Over the course of these different project approaches however, the focus on how to tackle affordability seems to have shifted from what could have been an institutional approach but due to the lack of jurisdiction and no explicit "Digitalbezug", an attempt was made to tackle affordability within the confinements of the workshops. In this sense, one might conceptualize these as what STS scholars and sociologists Adele Clarke & Joan Fujimura have called a "situation" (Clarke & Fujimura 1992:5). That is, all of the heterogeneous elements that co-construct scientific work and with it „the 'rightness' of the tools for the jobs", including "*workplaces (…), scientists (…); other workers (…); theories, models, and other representational entities (…); research materials, instruments, technologies, skills and techniques, and work organization (…); sponsorship and its organization (…); regulatory groups (…); and both desired and unintended audiences and consumers of the work"* (ibid., emphasis in original).

Although they referred to scientific work, it can help us to at least understand that the workshop did not merely act upon the wishes of citizens but the elements that composed it (e.g. the methods applied, funding criteria that evaluate the project's quality, involved personnel or experts, the material arrangements of the workshop, or the valued expertise) pre-structured or outlined a path as to what can be considered the 'right' choice of a tool to address the given problem. At the same time, this 'situation' only makes sense within a discourse of digital urbanism that places digital technologies and their mode of knowledge production as essential tools to tackle future urban challenges, and thus frames it as 'sayable', to put it in Foucauldian terms.

I would however caution to conclude that digital urbanism simply creates communicational problems. That is not the case, but we can say that within the project a certain problematization was privileged over alternative approaches, although it did not determine it. Affordability then was imposed on the cluster housing project, and while cluster living as a form of living together does not necessarily determine cheaper rents,[92] it is also not necessarily an informational solution. However, it reverberated the perceived potential of

92 A recent study on cluster living issued by the *Federal Institute for Research on Building, Urban Affairs and Spatial Development* could suggest that if cluster houses are more affordable, it is not necessarily only because of the cluster idea but also since in practice these projects tend to be realized by building cooperatives (Pyrtula et al. 2020:12). What could illustrate this, is a private, so-called linked living project in Berlin which would account for the criteria of cluster living but due to its target group of temporary inhabitants, even the smallest available ready-furnished apartment size of approx. 20m^2 requires a rent of over 700€ (Linked Living n.d.).

digital urbanism to integrate different segments of the city such that it was accompanied by a networking infrastructure that ought to address, somehow, social cohesion. By that, it takes up a point that was mentioned less prominently by citizens, however, I argue, it was foregrounded due to its compatibility with the larger discourse of digital urbanism that was expected in the workshop. Thus, a link between a networked neighborhood and a strengthening of the community ("Stärkung der Gemeinschaft", Stadt Wolfsburg 2018:10) was established, such that increasing the information flows across the neighborhood is envisioned to make the neighborhood 'better'. One has to acknowledge though that this is not necessarily a universal feature of digital urbanism but has to be seen in context with historically grown urban practices. That is, in Germany, such inclination towards politics of social cohesion has a longer tradition, especially against what is perceived as disadvantaged neighborhoods. It is for example inscribed into development programs such as "Soziale Stadt" initiated in 1999 (BMI n.d.[a]). If in these programs, (disadvantaged) neighborhoods are problematized with regard to their lack of community or social cohesion, and digital urbanism promises to increase community by enhancing the information flows within a (system of the) neighborhood, both seem compatible. It is not explicated, however, in what sense a digital house board can contribute to the fulfillment of citizens' needs except for the assumption that connectivity somehow raises the potential for these needs to be fulfilled. As such, it stabilizes reductionist accounts of politics of social cohesion through networking rather than taking serious the ambiguity and complexity involved in such approaches that can be subsumed under the more broad label of 'neighborhood effects' (Nieszery 2014). By that, it implicitly problematizes the lack of information as a hindrance in this regard so far, rather than, say, the social mobility of neighborhood inhabitants and potential constraints affecting the capacity to choose a given neighborhood in the first place. This can mean that digital urbanism is not only successful or productive because of its cybercultural legacy, but also because it complements existing urban politics of community. This is however also what makes these approaches resilient to critique since (urban politics of) community, also due to its fuzzy definition, often is "unvirtuous to reject" (Tonkiss 2003:298).

That is not to say though, that communicational problems are 'bad'. The real problem arises when older, possibly more effective problematizations are replaced or pushed into the background by it. My methodology only allows me to state that the discourse of digital urbanism manifests in such a way that it seems to facilitate viewing the nature of urban problems as informational and to strengthen networking approaches. I wanted to illustrate this by showing a project that tackled a classic problem of affordability that many would classify rather than a communicational one, as a social or economic problem.[93] There are however other smart approaches to city development where such dynamic might be even more visible, especially in the manifold claims to smart mobility. Here, sustainability is increasingly rendered a network problem, thus foregrounding e.g. smart traffic control that

93 Even though, framing it as such brings its own epistemological difficulties depending on how the 'social' or the 'economic' is understood. A reading of Mirowski & Nik-Khah (2016) suggests that an economical problem for example can be understood as an informational problem by large parts of Western orthodox modern economics. Correspondingly, the social is easily also communicational if understood through a lens of systems theory.

establishes a traffic system of seamless information transmission in order to manage traffic more efficiently. In fact, such a view is astonishingly close to how the cybernetician Wiener talked about the city in a piece for *LIFE* magazine in 1950 where he rendered the city "primarily a communications center, serving the same purpose as a nerve center in the body". Thus, "traffic jams in streets and subways" were an indication that information transmission of the city could be improved (Wiener et al. 1950:85).

Other approaches might involve 'shared' mobility[94] whose potential contribution to more sustainable mobility has been already called into question. A recent study by the *Öko-Institut* and the *Institute for Social-Ecological Research* (ISOE) over the course of four years found that car-sharing services did not contribute to a decline of carbon emissions and in fact even have slightly increased the number of cars on the streets (Hülsmann et al. 2018).[95] Despite this evidence, shared services (which for that matter might be better described as renting services) continue to be a popular form of digital urbanism. Correspondingly, though for different reasons, the Smart City has been labeled repeatedly as an ideological, rather than a merely pragmatic, or even "evidence-based"[96] (BMUB & BBSR 2017:12) project (Tompson 2017:213, Grossi & Pianezzi 2017:79, Hollands 2008:312, Cardullo & Kitchin 2019). Whether 'ideology' really is the best concept to grasp digital urbanism is beyond the scope of this thesis, requiring a more precise conceptualization of the term. If anything, however, it points to what I think is captured adequately by understanding digital technologies as political, rather than neutral.

Imagining the city through a lens of digital urbanism allows compressing urban problems to the very infrastructure of information technologies that are said to be in the center of an inevitable digital transformation of cities. Paired with a more general claim often left implicit, namely that networking, as a side effect, also empowers citizens makes these claims resilient to critique. Orit Halpern pointed to this fact, stating that "feedback as a democratic virtue makes a critical stance difficult" (Halpern 2014:243). Thus, when the city of Amsterdam (which is mentioned in the Charta as well as a commendable smart city, BMUB & BBSR 2017:5,20) promoted a "Smart Meter" project in which interested participants would be given sensors with which to measure the air quality on their own, it foregrounds the informational aspect of the problem 'bad air quality', stating that a decentralized sensor network might empower citizens to meaningfully move in on transgressed limit values. While such an assumption cannot be negated completely, it promotes a specific form of citizenship that views "data as the power of speech" (Zandbergen & Uitermark 2020:1739). Moreover, cybercultural assumptions (on the prospects of digitalization as means to empower people) might allow ignoring the fact that Amsterdam already has a relatively

94 Although beyond the confines of this thesis, it is noteworthy how the current discourse allows for car rental services to be labelled as a 'shared' service although car rental has existed before the emergence of digital urbanism and tended not to go under the label of 'sharing' but simply 'renting'. It seems that these 'new' services' decentralized infrastructure of cars and its direct access via digital tools somehow makes it 'sayable' to label it as a 'shared' service.

95 The study was conducted between 2013 and 2017 in the German city of Ulm.

96 My translation. Original quote: "Ziel ist es, evidenzbasierte Politik und Demokratie zu stärken und Entfremdung, Populismus und Polarisierung durch neue Technologien entgegenzuwirken." (BMUB & BBSR 2017:12).

compartmentalized measuring infrastructure,[97] and the fact that exceeding limits of air quality tend not to be only an informational problem, but more often a political one, involving the negotiation (of facts) and consolidation of different stakeholder's interests which effectively cannot be reduced to information, but also implies social hierarchies, and by that power, in the widest sense. As such, if we look again at the Wolfsburg project, we can understand the future workshops also as attempts to depoliticize urban problems which urban geographer Alberto Vanolo has characterized as "Smartmentality" (Vanolo 2014). Consequently, the initially identified central problem of affordable housing became stripped of its political conflict potential by favoring an approach that posed the problem as one to be solved with technical means, instead of say, problematizing the lack of social housing or discussing urban land rent.[98] As such, there is a tension between the project's predetermination to find testable, digital solutions and the promise to provide a space in which citizens could openly imagine how to live in their city in the future ("Wie wollen wir in Zukunft in unserer Stadt leben?" Stadt Wolfsburg 2018:3).

6. Summary & Outlook

Now what does this leave us with? Rather than stating whether the city 'really' only is a communication system, or condemning digital information technologies per se, I attempted to foreground the potentially unintended (or undesired) consequences that arise from the implementation of these tools *as if* the city first and foremost constitutes a communicational problem, sometimes despite the lack of evidence.

I hope I could show that in the German context this is possible due to the discursive formations that a) overemphasize the prospects of a specific form of knowledge production for societies' progress that ICT technologies embody, and b) the reconceptualization of the city as a complex system that is rendered the central site to solve planetary challenges and by that, requires 'new' modes to manage urban complexity. In turn, urban challenges can be posed amenable to the very mode of 'thinking' that ICT technologies constitute, one side-effect being a tendency to produce communicational problems.

The context necessary for digital urbanism to appear as a sensible mode to intervene on the city and thus, to place 'knowledge' as constitutive for future cities, however, reaches back to the early 20th century when engineering work on telegraphy infrastructures enabled first to theorize 'information' and to view it then as an autonomous 'thing'. The work on

97 Fittingly, the project manager of a computer training program for the elderly and people inexperienced with computers, who is interviewed as part of a documentary of the project boils down his thoughts on the project as follows: "Personally, I have my doubts about this excessive computerization. It's a solution looking for a problem. We have already developed some great instruments to measure air quality. 'Let's distribute them, so people can use them.' But who's asking for that?" (Zandbergen & Blom 2015)

98 See for example Haila (2015:5-6) where she argues that separating land and house value enabled the city-state of Singapore to own 90% of urban land, while at the same time more than 80% of the resident population live in public housing, 90,1% even are homeowners. This is not to say that such alternatives would be less ideological. In fact, as recent expropriation debates in Berlin suggest, such approaches are quickly labeled as 'socialist' not least due to the history of a politically divided Berlin. This makes it even more intriguing that smart urbanism is spared of these accusations, and instead understood as a more systematic, scientific approach, based on objective knowledge that is data, to be gathered by the digital infrastructure.

specific problems of human-machine integration in WWII then allowed to think of both in commensurable terms. Computer information, and human knowledge increasingly converged such that humans were seen as information processors, albeit inferior than computers. In turn, not only information but also ‘intelligence’ came to be understood as something that is no longer confined to the human domain, but, stripped of its corporeal dimension, could be exhibited by machines, or for that matter, infrastructures as well such that non-human devices began to ‘know’ (1). Further, the computer increasingly became discursively ‘personalized’, co-produced via assumptions of a specific counterculture and the materiality of actual computers that fit into the homes of an increasingly larger public such that they could be imagined, and experienced as tools for individual empowerment (2). Utopian narratives about potential recombination of humans and machines, often to ‘upgrade’ the former, and about future societies governed by information, helped to give these technologies a larger meaning with regard to managing the uncertain challenges of planetary futures. In this light, when the city increasingly became imagined as the nexus to these planetary challenges, ‘intelligent’ or ‘smart’ cities were one manifestation of an already continuous cyborg discourse. As such, they were the consequence of transposing enthusiastic views of societies governed by ‘information’ to what is considered the next relevant unit of social organization which over the second half of the 20^{th} century was ascribed to cities.

Drawing on the concept of “problematization” allowed me to identify that what the current digital urbanism primarily seeks to solve are problems of communication, that is the seamless transmission of ‘information’ between the different parts of the city. This tendency cannot easily be reduced to clearly articulated, or assumed intentions or ‘interests’ of specific actors that decided to conceptualize the city in these terms. And while neither material technologies simply determine such view, they helped to co-produce a discursive context through which the city can be reduced to a communicational system allowing for long-lasting urban problems to appear *as if* they could be addressed via communicational solutions that these technologies offer.

The consequence is an inclination of digital urbanism to compress a given urban problem to the modes of ‘knowing’ ICT technologies are inscribed with, in turn, implicitly reformulating the problem as one that is communicational.

I attempted to illustrate this by examining a workshop project ‘typical’ for the present discourse, that was recommended by the German government. Here, the workshop’s structure to find a ‘digital solution’ helped to reimagine the problem of affordable housing such that a cluster living project prevailed that did not necessarily tackle the affordability aspect, but instead one of a perceived ‘inflexibility’ of the housing market that at the same time was able to integrate an informational solution (digital neighborhood platform, digital houseboard) to a problem that was stated less prominently by citizens: neighborhood community. Although additional research is needed here, on the basis of its genealogical roots, it seems that information technologies indeed shape practices of problematization. One important implication of such tendency seems to be the depoliticization of potentially confrontational topics. That is, whether the Free Speech Movement’s ethical concerns were reduced to communicational problems by the University of Berkeley, the Whole Earth network thought of categories like race, gender, or class as negligible in favor of harmonious information networks, urban cybernetics that treated racially induced urban crises as if they could be addressed with information technologies, or a project in Wolfsburg through which a politically loaded question of affordable housing became a problem to be solved via technological prototypes that manage information; what all projects effectively shared, to different degrees, is an inclination to reconfigure social problems in terms of information. With it, issues that require political negotiation were effectively depoliticized, or put differently, politicized such that it could be solved technically, making older social categories appear as less relevant in order to address them.

For this, I deliberately put focus on historical developments that have less to do with the city directly. Through it, I think, I was able to acknowledge that digital urbanism is not only the employment of information technologies, but also a way to conceptually reorganize cities as communicational systems such that these in turn can be imagined to benefit of information technologies. I hope I could show that because of this, it can be fruitful to look at digital urbanism not only as an urban phenomenon, but one that rests on larger historical trajectories through which, since WWII, trust in computational means of managing the social increased whereas human cognition (and for that matter, planning) was considered an inferior mode of information processing. To put it pointedly, digital urbanism was not merely the result of 'new' technologies but also of an epistemological urban hinterland, so to say, that enables to make the city appear to be receptive for a 'digital transformation'. The difference to earlier modes of computational urbanism is that a decentralized architecture of digital urbanism seems to allow for today's digital urbanism to be considered socially empowering rather than resembling a top-down approach.

This thesis however also exhibits some shortcomings. In retrospect, the broad focus of this thesis, and the various areas it touches upon made it harder for me to concretize my arguments, given the already relatively broad formulation of my question resp. hypothesis. Instead of providing definitive answers, it opened further questions on the way. At worst, this affects the readability and the lack of preciseness of my arguments, at best, it suited the explorative character of this thesis, allowing for different perspectives on the topic and opening potential connections for future research.

Additionally, the genealogy and discourse analysis could have been integrated better. The fact they appear to stand apart was also because parts of the genealogy were written before the discourse analysis. In a back and forth between my material and the genealogy I attempted to smooth out the initial differences, such that it helps to make for a coherent story. For future research I would like to pay more attention to this.

And while I think that this thesis succeeded in showing that material technologies cannot easily be separated from the problems they attempt to solve, it leaves many questions unanswered. Due to its narrow confinements to the front stage of policy making, the discourse analysis was not suited to really examine the actual practices through which citizens, policy makers, data scientists, or other experts, potentially 'learn' to understand the urban as an informational phenomenon, in the Wolfsburg project, but also beyond that. That is, my material suggests that much of the problematization occurs not only when citizens and experts engaged in the workshops, but already when experts and policy makers define funding programs that constrain the range of potential solutions to a problem. Given that much of these practices rest on what counts as 'good' knowledge, it makes for an ideal research object for STS, or an anthropology of knowledge. It is this nexus for which I would like to roughly outline three perspectives that could be of value for a future urban anthropology.

Firstly, we saw for example that digital urbanism was not only promoted by companies, but also by the state, and ‘experts’ from different scientific disciplines that see the digitalization of cities, for different reasons, as desirable. For this reason, it could be productive to look at the expertise that is drawn upon in order to legitimize digital urbanism. Here, the variegated funding programs or initiatives and their expert groups suggest that rather than clear-cut corporate or state practices of digital urbanism, it seems, there is a convergence of epistemological concerns of both state, and corporate actors with regard to what digital urbanism ought to achieve. That is, if both understand technological development to be the driver for economic growth, or national wealth, we may arrive at different conclusions rather than labeling the Smart City (as one enactment of digital urbanism) a corporate project. Additionally, science actors and bottom-up movements calling for ‘open data’ are still relatively underresearched with regard to their role in promoting an informational view of the city. How do these groups draw on what kind of expertise, such that informational solutions like ‘networking’ or ‘hacking’ appear as productive ways to ‘scientifically’ improve the city resp. to enforce political demands? Questions such as these could be comprehended by an urban anthropology through the concept of “ecologies of expertise” (Beck 2012), and ask how expertise is “done” such that it is considered by others as “constituting expertness”? (ibid.:2). While Beck outlines a much more comprehensive research program, one specific element could be to examine *how*, *what kind* of technologies, or for that matter, what ‘data’, are used in order to display, or ‘learn’ expertness (ibid.)? We already saw that for example city rankings can also act as promoting a particular systems view of the city: how relevant are these technologies for expertise of digital urbanism? We saw that within workshops, citizens are allowed to work on urban problems, but at the same time are constrained by its problematization, that is, its focus on finding particular (digital) solutions to these problems. Although I touched upon some of these questions, my approach was more suited to carve out the general trajectory that enabled such thinking. Ethnographic research in turn, could focus much more detailed on the actual interplay of technologies and expertise in these different knowledge practices, of which these workshops are then but one manifestation.

Frictions between narrative and reality can serve as a point of departure. That is, why does the state call for informational solutions in some domains (of the city), but not in others? In Berlin for example there is a law (‘Mietendeckel’) that allows raising the rent only so much in relation to rents previously paid by former inhabitants of the apartment. In order to act against potentially illegal rent increases however, citizens need to have access to this information. There was not one project however that promoted to establish, say, a digitally accessible archive of former rents which if desired, could make the law more effective to enforce for citizens. This is only one example, but the question is, what kind of data is considered ‘worthy’ of being open and which not, or put differently, why are some urban problems rendered informational while others are not? Drawing on an approach of “ecologies of expertise” could contribute to understanding these issues.

Secondly, given that urban sciences are not absent from narratives of digital urbanism, such approach could also help for critically reflecting on urban research itself. That is, depending on how urban scholars employ technologies to understand the city, different problems might be foregrounded. This implies a potential rise of engineering disciplines that engage in the urban (1), but also, more generally, the discrepancy between topics that are addressed by urban scholars and that of urban managers (2). In a review of urban literature and survey of 50 global cities for example, da Cruz et al. (2019) found that whereas urban scholars identified “participation” as the most pressing urban issue, for more than 50% of the cities (and thus, most frequently mentioned) the biggest challenge was “insufficient public budgets” (ibid.:4). Whereas such approach deals more with how the city is problematized by different communities of practice (a), one could also ask how in turn cities shape practices of scientific knowledge production as part of an “urban history of science” (b) (Dierig et al. 2003).

Finally, a different approach could ethnographically deal with potential consequences of a digital urbanism that hinges on the idea of disembodied information. How are citizens and their bodies made legible and what other modes of ‘reading’ the population are potentially replaced by these techniques? Put differently, can we identify an increasing reliance on “measurable types” (Cheney-Lippold 2017:10) in city planning? And if so, what are the consequences of stripping away bodies in favor of allegedly more ‘objective’ categories of social behavior produced by traces of digital data? And once these behavioral categories are linked to race, gender, or class, can they potentially even reinforce essentialist understandings of human life? That is, already in the Internet statistical recommendation techniques create racial stereotypes, or “cybertypes” (Nakamura 2002), that for example confront people that have “black-sounding names” with racist advertisements (Sweeney 2013). This is particularly relevant for studies of urban surveillance of which we already know that the inscribed techniques of facial recognition often learn to see non-white bodies as a greater threat than white ones, raising important questions about the alleged neutrality of data (Browne 2012). How can we make sense of this with regard to narratives that promote the future city as one being governed by information? The concern in policy documents with the ‘Digital Divide’ suggests that ‘social difference’ already manifests under different terms such as ‘digital outsider’ or ‘digital forerunners’. It remains to be seen how relevant these categories will be for future city planning, and if indeed they replace older social categories, and with what consequences. For this matter, urban anthropology can draw valuable insights from Critical Data Studies (Iliadis & Russo 2016).

In any case, I hope my thesis was able to open a different perspective for digital urbanism and its criticism, and with it, could show some potential roads an urban anthropology could go from here. It should be noted that this thesis was written in the midst of a global pandemic through which digitalization efforts were increasingly pushed as means to remain a status quo. While my analysis was concerned with material before the pandemic, it is not unlikely that also digital urbanism will gain more prominence, possibly even additionally legitimized under terms of urban health and resilience. That makes it even more necessary to really understand the epistemological consequences of engaging in the city with primarily communicational tools, and the interrelationship of ICT infrastructures and practices of problematization. I think, urban anthropology can very much contribute to a better understanding of this.

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