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Affective Infrastructure

Towards the Naturalization of the Digital

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Abstract: Following Mark Weiser's vision from 1991 that the digital of the 21st century weaves itself "into the fabric of everyday life" until it is "indistinguishable from it," we are today facing an evolution of the digital toward its naturalization. In this context, the miniaturization of technology plays an important role, but even more so the increasingly natural access to the digital, which brings the digital closer to emotions, affects and intuitions. The term "naturalization" ambiguously refers on the one hand to the digital as a technology that becomes (second) nature, and on the other hand to the naturalization (citizenship) of us in the digital sphere. The paper analyzes from a philosophical perspective the increasing naturalness of the digital as an affective infrastructure as well as the phenomenological consequences for us.

Keywords: Ubiquitous Computing; tacit knowledge; naturalization; digital; smartphone; automatization

1. The 1990s' vision of ubiquitous computing

1 One of the leading research centers in the design of the digital was Xerox Parc in Palo Alto, California (Smith and Alexander 1988). Xerox Parc, a research center of the Xerox Group, was involved in the 1970s with developments such as Ethernet network technology, the improvement of graphical user interface, and laser printers (cf. Gaboury 2021). Xerox Parc's Computer Science Division was remarkably adept at hiring employees not only from ARPA Networks, which had invented the internet, but also from Douglas Engelbart's Augmentation Research Center (Rheingold 1994). Engelbart was one of the early computer pioneers who had developed the idea of graphical user interfaces at the Massachusetts Institute of Technology in the 1960s as well as the computer mouse. According to the sociologist and computer science writer Howard Rheingold, Xerox Parc's philosophy in the 1970s was devoted to Engelbart's vision of "Augmenting Human Intellect" following his idea that computers are amplifiers of the human intelligence (Engelbart 1963).

2 Xerox Parc in the 1990s was a different research environment as Rheingold reported:

3 > "In the fall of 1993, I returned to Xerox PARC for another chance to go back to the future. Where was Xerox? On the road to reinventing itself for the third time. New, young faces populate the halls today. Video windows and audio communications are built into workstations. Desktop screens have evolved into wall-sized screens, clipboard-size screens, and pocket-size 'tabs.' The place is still an intellectual wonderland. Again I feel like I've dropped in on an outpost from the future. It's not just the latest gadgetry. Something's happening. [...] The first person at PARC I talked to this time around was Mark Weiser. […] Weiser wants computers to disappear into the background. When computers become invisible to users, the most important side of human-computer symbiosis (to humans) has a better chance to emerge. How to make them invisible? Make them ubiquitous. 'Ubicomp' Weiser calls it." Rheingold (1994, page 92).

4 Ubiquitous computing means computing is available anytime and anywhere. However, Weiser's vision of "ubicomp" goes deeper, much deeper, directly into the basic anthropological conditions—so my hypothesis—of the human being.

5 This vision was best outlined by Weiser in a 1991-paper in *American Scientific* entitled "The Computer of the 21st Century" in which he prognosed: "The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it." (Weiser 1991, page 94). These

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sentences are remarkable for two reasons. First, because they have been written at a time when computers were still very clumsy devices and user interfaces were still under development. Second, because, as he made clear, "such a disappearance is a fundamental consequence not of technology, but of human psychology." (Weiser 1991, page 94). Weiser referred to the omnipresence of the symbolic sphere that constantly surrounds us in everyday life in the form of books, newspapers, advertisements, traffic signs, pictures, signs and much more (cf. Alpsancar 2012). The symbolic sphere has become natural for us, and the electronic sphere of information technology should also become natural for us in this regard. In order to explain the nature of "naturalness" he had in mind, Weiser referred to Michael Polanyi's *Tacit dimension* (Polanyi 1966), Hans-Georg Gadamer's concept of the horizon (Gadamer 1960), and Martin Heidegger's ready-to-hand (Heidegger 1927) as the psychological process of ceasing to be aware of it. "All [Heidegger, Polanyi, etc.] say, in essence, that only when things disappear in this way are we freed to use them without thinking and so to focus beyond them on new goal. [… This is the] idea of integrating computers seamlessly into the world." (Weiser 1991, page 94).

6 In particular, Polanyi's conception is of interest, because he provides an epistemic theory. Polanyi defines implicity as a functional relation between two terms of tacit knowing. A nearer or proximal term (e.g., driving behaviour) evoked by a distant or distal term (e.g., traffic sign). "We may say, in general, that we are aware of the proximal term of an act of tacit knowing in the appearance of its distal term; we are aware that *from* which we are attending *to* another thing in the *appearance* of the thing. We may call this the *phenomenal structure* of tacit knowing." (Polanyi 1966, page 11). This "from-to" knowing is based on prior learning and practice. "This is so also when we use a tool. We are attending to the meaning of its impact on our hand in terms of its effect on the things to which we are applying it. We may call this the *semantic aspect* of tacit knowing. All meaning tends to be displaced away from ourselves." (Polanyi 1966, page 13).

7 It is this kind of process Weiser had in mind when transferring Polanyi's concept from the symbolic sphere to information technology. When technology becomes indistinguishable from everyday life, we should no longer be aware of it while using it. This is the aim of ubiquitous computing. However, the reference to the symbolic sphere is only an analogy. In the sphere of information technology, the semantic aspect of tacit knowing is changing.

2. Towards the naturalization of the digital

8 Before analyzing this decisive shift in tacit knowing in the realm of digital technology, today's technological situation needs to be analyzed. The major difference to Weiser's vision is that the actual computer of the 21st century is not a personal computer, but a smartphone. The smartphone is more than a miniaturized, interconnected computer, Weiser had in mind. It is a purely individualized device in the pockets of five billion people. While the 1990s saw the triumph of the personal computer flooding offices and households, the computer of the 21st century is a ubiquitous mobile device—the perfect proof that Weiser's vision of "ubicomp" computing has become true; but different than he thought, because a smartphone is less a telecommunication machine, but a multi-sensible device of mobile sensing. Mobile sensing is the use of mobile devices to collect data from the environment in order to record a variety of human activities and uncover frequently occurring correlations. Smartphones have dozens of sensors, each of which is only a few millimeters in size. In addition to the microphone and various cameras, there are infrared cameras and illuminators, dot projectors, ambient light and proximity sensors and loudspeakers. This allows voice, face and environment recognition as well as localization without any problems. There are acceleration sensors, magnetometers, barometers, sonars or heart rate monitors, proximity sensors that switch off the screen lighting and the touch function as soon as the device is held to the head. There are light sensors that detect the ambient brightness. But these two sensors alone, the proximity sensor and the light sensor, can do much more: they make bodily functions measurable. This has opened up the new and mass data-driven research field of human activity recognition (HAR), for instance, of recognizing walking patterns measured by the accelerometer (Straczkiewicz et al. 2021).

9 While in Weiser's technological sphere communication and information were crucial, in today's technological sphere, sensing and statistically averaged responses have become decisive. This is a different forming of technology's lifeworld indistinguishability with some major consequences for us. The most fundamental one is the

changing of the semantic aspect of tacit knowing with a tendency towards levelling. Smartphones evoke communication and information expectations and behaviours by us when calling friends, checking feeds, posting news. They work perfectly as tools for social media in the realm of the symbolic sphere of humans, but in fact they have a hidden intrinsic live of only machine-readable sensing, signalling, and analyzing data. The latter is the real nature of the digital, not the symbolic (human-readable) sphere. Thus, when using a smartphone, we refer to the semantic aspects of a symbolic communication and information tool, while its real nature is covered. Therefore, "the meaning of its impact on our hand in terms of its effect on the things to which we are applying it" is no longer present for us (Polanyi 1966, page 13). Such a separation of mankind from its tools is new. It is the result of the transition from implicity, which still requires a certain amount of learning, awareness, knowledge, to a natural given. But this digital naturalness is a specific one. First, its givenness is an active, responsive, adaptive, informed one. It envelops and lulls us. Second, it operates below human phenomenological thresholds, whether of perception, consciousness or meaning. The main characteristics of the digital is its subliminal quality which has become the main precondition of its lifeworld indistinguishability. Or in other words: Today's digital indistinguishability is of subliminal nature, not of symbolic nature Weiser has dreamt of.

10 This subliminal nature is a processual one of (machine-readable) data processing moving into the exaFLOPS range, i.e. a quintillion operations per second. "Real time" has long since ceased to be tailored to people, but enables computers to do "incredible" things for us such as predicting, rating, nudging. Humans are simply far too slow to become aware of the algorithms' busy activities in the background while calling friends, checking feeds, posting news. Moreover, we can phenomenologically not make sense of data. Thus, the "subface" of the digital remains hidden: "The algorithmic thing comes as a visible [or usable] appearance for us. At the same time, it comes as a computable appearance to the program." (Nake 2008, page 105). The computer of the 21st century is designed for rapid sensing, fast data processing, and statistically averaging analyses and responses. It generates an expanding universe of zettabytes of data. Furthermore, its subliminal data processuality is active, responsive, adaptive, and informed. Functioning as a tool for communication and information is just a nice gimmick; a reward for humans. However, when 24-frames-a-second marks the boundary between an image and a film, one can imagine that the phenomenological consequences of the digital naturalness are fundamental to our anthropological conditions (see section 4).

11 The increasing naturalness of the digital, on the one hand, requires the indispensable naturalization of us as individuals in one of the two digital nations—iOS and Android, respectively. Modern life is hardly imaginable without such a citizenship. However, this citizenship has its price paid in personal data. On the other hand, digital naturalness involves the process of naturalization as a psychological process of fading it out and delegating even the semantic aspect of tacit knowing to machines. Thus, the digital is becoming a second nature for our shared lifeworld—"Mitwelt" in Helmuth Plessner's terminology (Plessner 2019).

3. Affective indexicality of digital naturalness

12 The crucial question is: What happens when the semantic aspects of tacit knowing in using tools are taken over by the tools? An important part of Polanyi's conception of implicity is the phenomenal structure of tacit knowing—a "from-to" relation. A distal term (e.g., traffic sign) evokes a proximal term (e.g., driving behaviour). A stop sign automatically makes us stop the car without giving it much thought; only, and only, because we have actively learned it beforehand. These epistemic automatisms are the result of procedural learning for generating embodied knowledge by transforming an explicit relation into a from-to trigger relation.[1] Such "from-to" trigger relation involves aspects of awareness and recognition, but also an epistemic automatism from representational to procedural knowing. Automatism means bypassing due to a trained routine of assigning.

13 Triggers can be interpreted as indices. Indices are signs pointing to some element in the context in which they occur (e.g., smoke pointing to fire). Triggers, in Polanyi's sense, can be understood as indexicals with a specific "from-to" indexicality: a distal term pointing to some element, not in the context in which it occurs like

1. Interestingly, the current debate on enactivism refers to Gilbert Ryle's differentiation of "knowing how" and "knowing that" (Ryle 1949), i.e. practical (procedural) and representational (propositional) knowing, but do rarely refer to Polanyi's sophisticated conception of implicity (Hutto 2005; Gallagher 2017).

smoke, but pointing to a proximal term in us. In other words: Parts of our symbolic sphere function indexically in that moment we have embodied its indexical meaning by training to cease to be aware of it. Obviously, it was this characteristic assignment function of the symbolic sphere which Weiser had in mind for ubiquitous computing. Such triggers are not natural ones, but solely symbolic ones. We have introduced them over the course of centuries and with them all kinds of literacy. One can say that a "from-to" trigger relation reduces Charles Sanders Peirce's triadic relation of a sign, its object, and its interpretant into a binary relation in which the sign's object and interpretant fall into one (Peirce 1998). Furthermore, it bypasses the conscious assigning of representational to procedural knowing. Epistemic shortcuts are of tremendous significance, because they enable a faster response due to their immediacy. Without such shortcuts we could not survive, but too much epistemic shortcuts transform us into automats—a behaviouristic dream, but a philosophical nightmare replacing refection by reflex.

14 However, the digital naturalness makes the behaviouristic dream of conditioning us with triggers come true. The central lever for this is the replacement of the semantic aspects of tacit knowing by affect. Affect is a boundary concept involving on the one side the experience of feeling or emotion, on the other side the immediacy of (bodily) reactions and reflexes (Angerer 2017). Affect exhibits some similarities to tacit knowing, but without the epistemic references of the latter. However, affects can trigger representational or procedural knowledge, e.g. a smell that evokes a feeling that triggers a memory or a behaviour. My hypothesis is that the characteristic assignment function of epistemic shortcuts of the symbolic sphere, Weiser had in mind, is currently replaced in the digital sphere by a new characteristic assignment function of affective shortcuts. The precondition for this is the subliminal nature of the digital in form of mass data retrieved by mobile sensing.

15 Affective shortcuts and epistemic shortcuts share their built-in immediacy. However, this immediacy is subliminal in its effect in order to react more quickly. Affects, in other words, accelerate our responses. Affective shortcuts exploit this built-in immediacy of "from-to" trigger relations, but they work differently than epistemic shortcuts. First affective shortcuts require personal data (mobile sensing), pro-active algorithms, and a subliminal infrastructure of referencing (mass data averaged responses). Second, the pro-active algorithms bypass the epistemic preconditions of leaning and then ceasing to be aware of it. Third, affective shortcuts intermingle personal and averaged knowing. Thus, affective indexicality of digital naturalness is a strategy of humans to cope with the expanding universe of zettabytes of data, but it is also the major strategy of data capitalism by exploiting human slowness.

16 If the semantic aspects of tacit knowing in using tools are taken over and changed by digital tools, the relation between man and machine is changing. Such tools detach from mankind and become independent by introducing new forms of automatisms, e.g. affective assignment functions, AI-based machine rationality and action, etc. However, automatisms petrify knowledge and behaviour, fix history to the present, and eliminate future and alterity. In brief: Automatisms are not contingent. But contingency is an anthropological characterization of man. In fact, according to Helmuth Plessner's philosophical anthropology, humans differ from plants and animals in their eccentric standpoint. This standpoint enables self-reflection and normative orders instead of reflexes and affects, and contingency in the form of notions of alterity—the latter as 'utopian standpoint' in the wording of Plessner (2019). The utopian standpoint allowed mankind to develop technology, culture, and art. Eccentricity inevitably requires conceptual differences, possible futures, and reflections. However, if eccentricity is eliminated by epistemic and affective shortcuts and other kind of machine-based automatisms, man becomes centric—immersed in the here and now of digital naturalness (Gramelsberger 2022). This absorbing immersion has spread out with five billion smartphones—sometimes referred to as digital toxicity. It turns eccentricity partly into centricity. But centricity was Plessner's characterization for animals, but not for humans.

4. Philosophical analysis of naturalization and naturalness

17 Naturalness in the sense of ceasing to be aware of it and automatisms or reflexes are

18 > "counter-concept[s] to that 'self-understanding' which, for Husserl, is the actual task of phenomenological philosophy. [...] The life-world is [...] the inexhaustible supply of the unquestionably existing, the familiar and, precisely in this familiarity, the unknown. Everything that is real in the life-world plays into life, is used and consumed, sought and fled, but it remains concealed in its contingency, i.e. not perceived as also-being-different." Blumenberg (1981, page 26).[2]

19 In regard to Edmund Husserl's definition of the life-world, the computer of the 21st century was successful in indistinguishably integrating computing and the digital into life-world. Although, Weiser didn't refer to Husserl, Heidegger's concept of ready-to-hand is rooted in Husserl's life-world conception. But, different than Heidegger, Husserl saw the task of phenomenological analysis to reveal the self-evident nature of the life-world. Hans Blumenberg later applied phenomenological analysis to technological society.

20 Thus, following Husserl's and Blumenberg's account, a critical perspective on the digital can be achieved through a phenomenological analysis that reveals the self-evident nature of the digitality of the living world; i.e., precisely that self-evidence that was the goal of the computer of the 21st century. The term "digitality" refers to the properties introduced by the digital into our shared live-world. And one of the main characteristics of digitality is that it is increasingly turning the live-world of technological society into an affective infrastructure; a characteristic that is completely alien to reality before the digital transition from communication and information to perception and statistically mediated responses. An affective infrastructure gains naturalness through its affective indexicality; through the built-in immediacy of "from-to" trigger relations based on affective shortcuts. However, if the assignment functions of the digital, with which we are addressed as individuals, is changing into affective shortcuts, the task of phenomenological analysis is to unveil the consequences for us as individuals embedded in this new form of digitality. Such an analysis is carried out by many philosophers at the moment for various aspects of digitality (an overview is provided in Gramelsberger (2023)). In case of the above outlined anthropological consequences, the naturalization of the digital goes along with a conception of individuality which doesn't involve much subjectivity—subjectivity in the traditional philosophical, Kantian sense. Although this traditional conception of subjectivity is still the basis of our political, juridical and epistemic freedom of action and personal identity as members of democratic states, this is not the case in the digital sphere. Not because someone is withholding it from us, but because the formal nature of digitality does not allow for it.

21 It is no coincidence that the epitome of digitality is a mobile and multi-sensible sensing device. Digitality resolves everything into measurement data and formal procedures. For instance, a circle on the screen is not a circle, it is a formal procedure for generation pixels equidistant to a center point in a coordinate system. A human subject is not a human subject, but a collection of personal, mainly bodily data. Smartphone sensors can only grasp physical changes of objects and physical media, i.e. humans as bodies. Personal symbolic data are either typed in by us or retrieved from natural language processing. As most of our personal data nowadays is bodily data, we do not have access to most of our data. But we know that these data are processed and transformed into something else. According to the economist Shoshana Zuboff, "human experience as free raw material for translation into behavioural data are declared as a proprietary behavioural surplus, fed into advanced manufacturing processes known as 'machine intelligence', and fabricated into prediction products that anticipate what you will do now, soon, and later." (Zuboff 2018, page 4). Sources of this behavioural surplus are measurable behavioural patterns, activities in the digital sphere, and even emotions based on measurable bodily reactions. Most of these sources are either raw material of involuntary body states—bodily states we are not aware of, or patterns we are not aware of. This is another aspect of the subliminal nature of the affective digital. From these data, the individuality of each smartphone user is reconstructed, intercompared with other

2. Quote translated by deepL.

users, and averaged. This averaged data is then sold back to us, creating a new form of partially averaged and externalized individuality.

22 However, more decisive is the behavioural turn introduced by the affective infrastructure of the computer of the 21st century. While communication is an intrinsic human matter—just like emotions—behaviours are observable from the outside. Thus, from perspective of the digital, emotions are behavioural patterns resulting from changes of bodily states like skin resistance, temperature, heart rate, voice frequency, etc. as well as gestures and facial expressions (Gramelsberger 2020). Affective computing (Picard 1997), emerging in the late 1990s, claimed that "the convenience of a new affective computing technology can lead to new self-understanding [...]. Objective data related to emotion is more believable than verbal reports about feelings. Shared affective data can improve communication between people and lead to better understanding and sometimes to beneficial changes in behavior." (R. W. Picard 2015, page 12). Affective computing was made possible by the algorithm-based interpretation of individual measurements for the automated attribution of emotions using psychological models and classifications (Calvo et al. 2015). It externalized the internality of emotions into behavioural patterns.

23 It can be argued that the computer of the 21st century is now finally able to mimic the affective nature of human social interaction. This is true, but these capabilities are on the one hand controlled and exploited by the benefits of companies. On the other hand, cultural development emerged from the struggle with and partly overcome of the affective nature of mankind—referred to as eccentricity by Plessner. The more affective the digital infrastructure and thus our live-world becomes, the more affective our actions and reaction become. Perhaps echo chambers, conspiracy theories, mood manipulation, fake news, etc. are a consequence of increasingly unleashed affectivity as the new normal.

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