Phenomenology and Mind

20 | 2021
Digital Identities, Digital Ways of Living: Philosophical Analyses

Persuasive technologies and self-awareness: a discussion of screen-time management applications

Lorenzo Olivieri

OpenEdition Journals

Electronic version
URL: https://journals.openedition.org/phenomenology/411
ISSN: 2239-4028

Publisher
Rosenberg & Sellier

Printed version
Date of publication: 1 June 2021
Number of pages: 52-60
ISSN: 2280-7853

Electronic reference
Lorenzo Olivieri, "Persuasive technologies and self-awareness: a discussion of screen-time management applications", *Phenomenology and Mind* [Online], 20 | 2021, Online since 01 May 2022, connection on 30 August 2022. URL: http://journals.openedition.org/phenomenology/411

LORENZO OLIVIERI
University of Bologna
lorenzo.olivieri3@unibo.it

PERSUASIVE TECHNOLOGIES AND SELF-AWARENESS: A DISCUSSION OF SCREEN-TIME MANAGEMENT APPLICATIONS[1]

abstract

Persuasive technologies are interactive systems designed to change and shape users' behaviours towards specific goals. By discussing the case of screen-time management applications, this paper explores how persuasive systems transform self-awareness and the self's cognitive architecture. Drawing on the notion of tectonoetic awareness, I will illustrate how artefacts enable the transition from the temporal bounded experience characterizing first-person perspective (noetic awareness) to the ability of reflecting on oneself from a third person and temporally extended perspective (autonoetic awareness). I will argue that persuasive systems make possible new modalities of self-recognition and self-projection while they simultaneously affect the sense of agency by interfering with users' actions and intentions.

keywords

persuasive technologies, tectonoetic awareness, material agency, self-recognition, sense of agency

1 I am grateful to Marta Caravà for her feedback, and to Margoth González Woge, Ciano Aydin and Michael Nagenborg for their comments and suggestions to an extended version of this paper. I wish to thank two anonymous reviewers for their helpful comments.

Phenomenology and Mind, n. 20 - 2021, pp. 52-60
DOI: https://doi.org/10.17454/pam-2005
https://www.rosenbergesellier.it/eng/journals/phenomenology-and-mind

ISSN 2280-7853 (print) - ISSN 2239-4028 (on line)

1. Introduction

Persuasive technologies are interactive systems designed to change and shape users' behaviours towards specific goals. The variety of cognitive and psychological stimuli and feedback enabled by digital technologies offers new means for guiding human choices and promises to improve or radically transform previous modalities of persuasion (Fogg, 2003). Persuasive systems invite users to behave in supposedly morally good or healthy ways; they perform autonomous actions and they adopt emotionally or intellectually engaging persuasive strategies in order to constrain and nudge users' actions. Due to this deliberate interference with human agency, persuasive technologies have received, over the last years, considerable attention from a moral perspective as they challenge the traditional understanding of freedom, autonomy and responsibility (Brey, 2005; Guthrie, 2013; Nagenborg, 2014; Spahn, 2012; Verbeek, 2006). However, the goal of this paper is to show that the effects of persuasive systems on human life are not limited to their possible unethical consequences or to the ways they might modify, and potentially inhibit, the ability for moral reasoning. I will suggest that persuasive technologies might re-model the self's cognitive system and thus lead to new modalities of experience and perception of the self. The notion of *tectonoetic awareness* (Malafouris, 2008a), articulated upon the relation between *noetic awareness* and *autonoetic awareness*, will allow us to stress the twofold implications of persuasive technologies on the human self. First, these technologies modify the self's sense of agency, through cues and feedback interfering with users' actions and designed to steer them towards certain behavioural patterns; second, persuasive technologies aim to make users more aware of their past and current actions and to shape a "future self" who is liberated from "harmful" behaviours.

The paper contributes to the debate about the implications of digital technologies on the human self and cognition (Clowes, 2015; Clowes, 2018; Heersmink, 2016; Smart, 2017; Smart, 2018). However, none of these works explicitly address persuasive technologies. Clowes (2018) describes how some persuasive systems - like *Fitbit* or *Stay Focusd* - have the potential for self-shaping and for constructing "new forms of self-regulation practices", but his discussion is overall more concerned with the enhancing effects of Internet technologies on human agency rather than with persuasive technologies and self-awareness.

2. Persuasive technologies: the case of screen-time management applications

The label "persuasive technology" refers to an heterogenous set of computing technologies (applications, websites, videogames, smart and virtual environments, wearable devices) which are applied to a likewise heterogenous set of target domains and behaviours (health care, education, environmental sustainability, e-commerce, social networks). Due to the vastness of the field, I will discuss a specific subset of persuasive systems, namely self-imposed persuasive technologies designed for helping and motivating people to adopt beneficial behaviours and to avoid harmful ones. This choice cuts out persuasive systems imposed by third parties without the explicit consent of the users, such as social networks, and it cuts out persuasive systems imposed by third parties (governments, institutions, companies) to steer the behaviours of citizens, students or employees toward supposedly good behaviours. Self-imposed persuasive technologies are less problematic from an ethical perspective, at least *prima facie*, because they presuppose users' deliberate decision to deploy them and hence they seem to better preserve freedom of choice.

To understand the functioning of a self-imposed persuasive technology, consider applications like *Rescue Time, Freedom* or Apple's S*creen Time,* which are designed to both manage the time spent on laptops or smartphones and to support people to remain focused on their work-related activities. In addition to these general goals, these systems aim to mitigate Internet addiction (Montag *et al.*, 2015) and the so-called checking habits (Oulasvirta *et al.,* 2012), namely those relatively short but repeated sessions in which emails, social network updates or news headlines are revisited. Checking habits threaten and hinder the achievement of a permanent and deep level of attention and concentration (state of flow), and they have negative effects both on work productivity and on personal life (Duke & Montag, 2017). To support the development of healthier digital habits, persuasive technologies for screen-time management enable users to set up a time limit for websites and apps or to completely block them; they provide users with historical data showing the time spent on productive or entertainment activities, and they allow to create customized schedules of internet usage. Despite small differences, the logic underlying the functioning of these systems is the same and evokes those of other self-imposed persuasive technologies, such as persuasive mirrors (Nakajima & Lehdonvirta, 2011; Nakajima *et al.*, 2008)[1]. A lifestyle tracking component collects information on user behaviour by automatically tracking and recording screen-time activities. Feedback information is then presented to the users in order to persuade them to come back to working activities or to not get distracted. Alerts or notifications pop up on the screen blaming the users for not being working or, on the contrary, praising them for having reached a pre-established goal. The feedback might also have a more disruptive modality, for instance by completely blocking the possibility to access a website once the time limit is achieved or during a "focus time" session. Besides these immediate types of feedback, screen-time management applications also provide users with accumulated feedback, usually through reports, graphs and charts showing the amount of time spent daily, weekly, or monthly in leisure or work-related activities or through a resume of the "challenges" won or lost. Screen-time management applications are thus interactive and individualized systems which transform how people make decisions about their digital behaviour. The use of these systems amounts to a delegation of decision-making processes, to an "outsourcing

1 The goal of persuasive mirrors is to support behaviour change by providing users with personalized visual feedback that reflects the progress toward a beneficial lifestyle. Like a traditional mirror reflects a person's physical appearance, a persuasive mirror reflects back to the person her alignment to the desired target behaviours in order to increase awareness about her choices and actions. Persuasive mirrors can alter the reflected image either through augmented reality or by displaying virtual scenarios, and can extract and process diverse sources of users' data. See Verbeek (2009) for a discussion of the ethical implications of persuasive mirrors.

of conscientiousness" (Guthrie, 2013). As Guthrie (2013) notes, a controversial aspect of persuasive systems is that the actions elicited by them "may carry the form but not always the power of the virtues of thoughtfulness or order" (p. 328). On the other hand, these technologies can be treated as a form of "potential agentive enhancement" which do not only help to comply to our own policies, but also offer new possibilities for self-reflection (Clowes, 2018). These views are inspired by diverse interpretations (and concerns) of the effects of persuasive technologies on human thinking and action. However, the more fundamental problem underlying these different viewpoints concerns the role played by artefacts in shaping not only human agency and cognition but also in transforming the experience of oneself. The next section will thus be dedicated to outlining, through the notion of *tectonoetic awareness* (Malafouris, 2008a), how the material agency of artefacts re-models the self's cognitive system and brings forth new possibilities for perceiving and reflecting upon oneself.

3. Tectonoetic awareness: artefacts and the extended self

Malafouris (2008a; 2008b) grounds the concept of tectonoetic awareness on the distinction between two levels of awareness: *noetic awareness* and *autonoetic awareness*. Noetic awareness refers to "the basic sense of oneself as acting in and on the environment at a time, according to one's first-person perspective" (Malafouris, 2008b, p. 407). Autonoetic awareness refers to the ability of reflecting upon oneself from a third person perspective; it introduces a temporal dimension in the perception of the self, namely the process of self-recollection (the mental reinstatement of past events and experiences) and self-projection (the ability of thinking, imagining and planning about the future) (Malafouris 2008a; 2008b). As Malafouris acknowledges, the notions of noetic and autonoetic awareness were originally introduced by Tulving (2002), for whom the former "was used to describe the conscious state that accompanies thinking about (knowing) the world", while the latter "was used to describe the experiential 'flavor' of remembering, or recollection" (p. 4). However, Malafouris's use of these two concepts shares stronger affinities with the concepts of *minimal self* and *narrative self* (Gallagher, 2000). More specifically, noetic awareness corresponds to the minimal self, namely the consciousness of oneself as an immediate subject of experience, un-extended in time and characterized by the first-personal givenness of experiential phenomena (Gallagher, 2000; Zahavi 2007). It includes the sense of ownership (the sense that is my body which is undergoing an experience) and the sense of agency (the sense that I am the initiator or source of action). On the other hand, autonoetic awareness shares important features with the narrative self, a more or less coherent self (or self-image) that is evolving and extended in time to include memories of the past and intentions toward the future and which is understood in the light of one's own self-interpretation (Gallagher, 2000; Gallagher & Zahavi, 2012)[2]. Malafouris's thesis is that the passage from noetic to autonoetic awareness is made possible, both ontogenetically and phylogenetically, by the use of and interaction with artefacts. Artefacts enable humans to extend into their material surroundings and simultaneously to detach themselves from the temporal and spatial contingencies of first-person experience. Objects, in other words, liberate the self from the here and now of ordinary experience and allow the minimal self to be anchored into its social surroundings (Malafouris 2008a; 2008b). Tectonoetic awareness has thus to be understood as "a scaffolding process of ongoing

2 I am aware that the two notions - autonoetic awareness and narrative self - are not identical. First of all, unlike autonoetic awareness, the narrative self is not necessarily conscious or reflective. Also, whereas the narrative self is mostly conceived in terms of narrative structures and personality (including the endorsement of values and beliefs), Malafouris's autonoetic awareness stresses the embodied and ecological dimensions of the self. However, in the context of this paper what I think is relevant is that they both insist on the diachronic nature of selfhood, on its persistency over time and on the awareness of such temporal structure.

structural coupling that grounds in action and integrates the noetic and autonoetic aspects of selfhood" (Malafouris, 2008a, p. 1998). Different objects illustrate this process: beads for self-decoration (Malafouris, 2008b), a Mycenean golden ring (Malafouris, 2008a), the sword of Myceanean warriors (Malafouris, 2008c). Individually and culturally invested with memories and events associated to their use and ownership, these objects helped humans "to move across the scales of time and to construct bridges between temporal phenomena that operate at different experiential level" (Malafouris, 2013, p. 247). In this way, objects embody a "dynamic cognitive biography" which redefines the boundaries of biological memory and that brings forth a new kind of autonoetic awareness, making possible explicit self-recognition through objectification (Malafouris, 2008a, p. 1999).
It is worth noting that any modality of interaction with tools and objects might enable the transition to autonoetic awareness. Tool use and manufacture played, before body decoration, a decisive role in the development of human self-awareness (Jeffares, 2010). However, what is crucial is that different forms of autonoetic awareness emerge as an effect of the specific epistemic qualities of the material mediums: beads, being permanently attached to the body, made possible the emergence of forms of self-knowledge and self-recognition that cannot result from the interaction with and production of stone tools (Malafouris, 2008b). Things impose their own agency on human cognition and modify the self's cognitive architecture in virtue of their material properties. The notion of tectonoetic awareness is thus grounded upon a process of reciprocal causation: the self extends into its environments and emerges through objects which enable novel and specific forms of cognition and self-recognition; in turn, the material agency of objects re-organizes and re-models the self's cognitive system. What needs to be analysed in the next section is how this process of reciprocal causation between objects and the self applies in the case of screen-time management applications: how do they shape users' first-person experience, and their sense of agency? What are the modalities of self-knowledge and self-recognition emerging from using them?

4. Self-awareness and persuasive technologies

Two preliminary considerations are needed in order to properly analyse the type of self-awareness brought forth by screen-time management applications. First, there is a substantial qualitative leap between the archaic artefacts discussed by Malafouris and current digital technologies (Aydin *et al.*, 2019). Digital technologies are, in fact, increasingly defined by interactivity – which allow them to interfere with, and even to anticipate, human actions – and by their hidden functioning – which allow them to operate without requiring attention. The alerts and notifications as well as the self-tracking features of screen-time management applications capture precisely these two properties of digital technologies. Second, what is at the stake in the case of persuasive technologies for screen-time management is not the transition from the noetic to the autonoetic awareness as discussed by Malafouris, who, as a cognitive archaeologist, is mainly interested in the phylogenetic trajectory of human cognitive development. In fact, the decision of adopting a self-imposed persuasive technology already presupposes a narrative self who is conscious of its past behaviours and who willingly undergoes a persuasive process in order to shape a "future self". However, the notion of tectonoetic awareness and the distinction between noetic and autoneotic awareness are crucial because, as I shall show below, persuasive technologies modulate and affect the relation between those two levels of awareness.
Having made these considerations, I suggest treating the immediate feedback and the accumulated feedback of screen-time management applications as the specific epistemic qualities of these systems. To begin with, by tracking and recording users' activities, these technologies are part of that E-memory revolution (Clowes 2013; 2015) that has considerably enhanced the possibility to access information about oneself, since E-memory technologies

can potentially record everyday activities on a scale and with a fidelity and completeness previously unknown. The data about smartphone or laptop activities shown on graphs give access to qualitatively and quantitatively new information about users' actions compared to the information which can be remembered by the brain. As digital repositories of our behaviours, screen-time management applications can consolidate and digitalize moments of our past that we did not remember and, also, those that we do not want to remember. The accumulated feedback provides users with a diachronic representation of their screen-time activities, enabling new ways for perceiving themselves as temporally extended subjects. In this respect, screen-time management applications strengthen and enhance the ability of self-recollection because they allow users to remember, with unprecedented degrees of accuracy, their past actions. Moreover, they offer new possibilities for self-projection because, by being confronted with the amount of time spent on productive or entertainment activities, users can reflect upon the consequences of their behaviours, and thus they can adjust their digital habits in order to reach their future goals.

While accumulated feedback affects autonoetic awareness, the alerts and notifications popping up on users' screen interfere with the noetic dimension of the self, especially the sense of agency. The sense of agency is a phenomenologically ambiguous concept characterized by different elements (Gallagher, 2013). The immediate feedback of screen-time managements systems does not involve the pre-reflective aspect of agency connected to motor control, but rather "a more reflective sense of intention, involving attention directed toward the project or task that we are engaged in, or toward the means and/or end that we aim for" (Gallagher, 2013, p. 12). When I wish to stop working and create an online chess match, but the screen-time management system blocks the website and prevents me from accessing it, my sense of agency is significantly compromised. The persuasive system interferes with my intention of playing chess and re-directs myself toward my work-related activities. Similarly, when the system notifies me that I have reached the daily limit of usage and invites me to put the phone down, it triggers thoughts and reactions which influences my behaviour. Importantly, these immediate feedbacks deeply affect the motivational and agential character of cognition (Walsh, 2017). As Walsh notes, there are crucial phenomenological differences between cognitive processes supported by artefacts and those limited to the skin-and-skull boundaries. Such differences have to do with how relevant information becomes phenomenally conscious and with the role of intellectual virtues such as understanding and self-reliance. In the case of screen-time management applications, there is a difference between *understanding* that I should stop browsing the web and merely *knowing* it because a notification told me so.

Putting all this together, screen-time management applications make possible the emergence of a highly personalized form of autonoetic awareness, one in which new modalities of self-recognition and self-projection are possible. At the same time, however, they deeply affect and modify the noetic aspect of self-awareness, by interfering with people's intentions, preventing them from behaving in certain ways and redirecting their patterns of action. My conclusion applies not only to screen-time management applications, but it can also be extended to other self-imposed persuasive technologies relying on the same feedback logic. Moreover, focusing on the noetic and autonoetic levels of awareness enables the assessment of alternative design approaches to persuasive technologies, such as mindless computing (Adams *et al.*, 2015) and reflective computing (Munson, 2012).

The idea of mindless computing is to design systems that do not rely on users' motivation and ability but rather aim at influencing users' behaviour in subliminal, subconscious ways. Whereas most of the persuasive technologies depend on conscious awareness and imply reliance on motivation and capacity of self-control, mindless computing aims to operate below the threshold of conscious awareness, in order to automatically trigger the desired behaviours

while relieving the users from the burden of motivation and reflection (Adams *et al.*, 2015). The triggers deployed in mindless computing, in fact, produce immediate and automatic responses which affect users' behaviour without being noticed or perceived by them. A user of mindless computing device is thus aware that it is her body which is acting in a certain way, but she does not control the source of that action. The noetic self is thus deprived of the sense of agency and it is left only with the sense of self-ownership, while the absence of any forms of accumulated feedback and the subconscious modality of persuasion do not allow for the emergence of new forms of self-recognition.
On the other hand, reflective computing (Munson, 2012) has a radically different goal and it shares strong affinities with the boosting approach (Hertwig & Till Grüne-Yanoff, 2017). The aim is to provide users with relevant data about their behaviours, but without having the system prescribing what to do, inviting to action or setting specific goals. The design of these systems thus does not include any persuasive feedback mechanism, but rather it merely reveals data to the user in order to make them reflect. In this case, due to the lack of any type of immediate feedback interfering with human action, the effects of the persuasive system on noetic awareness are very weak, whereas the persuasive process is directed to strengthen autonoetic awareness, to make it thicker, by giving users' the possibilities to learn about their past behaviours but without the introduction of interactive persuasive elements.

5. Conclusion

In this paper I argued that persuasive technologies have a double effect on self-awareness. First, they strengthen and thicken autonoetic awareness: new possibilities of self-recognition and self-projection emerge due to the possibility to access data about one's own screen activities. Second, persuasive technologies erode and weaken noetic awareness by interfering with the self's sense of agency. The notifications and cues (or blockage) to actions appearing on the screen redirect our intentions and shape our actions. Lastly, I suggested that focusing on these two levels of awareness allows us to analyse the design and functioning of other approaches to persuasive technologies and their effects on the self's cognitive system.
Before concluding, I wish to suggest that the notion of tectonoetic awareness might represent a precious analytical entry point for discussing digital technologies because it stresses the dynamic and developmental dimension of the human mind. Far from being a static feature of human cognition, self-awareness is constantly re-shaped and restructured by material culture. As shown by the case I discussed, the relation with digital devices has become particularly redundant. On the one hand, phones, websites and social networks ask for attention through their visual or acoustic signals, they afford fast access to a vast array of informational rewards and they are purposefully designed to make people spend increasingly more time with them. On the other hand, digital systems can become persuasive agents which record and store significant portions of people's lives and to which self-control is delegated in order to reach goals and desires. These apparently opposite tendencies are however mediated by the same material support, or, in Gibsonian terms, by the same surface. For this reason, framing the discussion about the consequences of digital systems in terms of enhancement or diminution might reiterate an essentialist understanding of the human self and mind, and it might prevent us from conceiving of them as historically situated contingencies shaped by the social and technical environment.

REFERENCES

Adams, A.T., Costa, J., Jung, M.F., & Choudhury, T. (2015). Mindless computing: designing technologies to subtly influence behavior. *UbiComp '15: Proceedings of the 2015 ACM International Joint Conference on Pervasive and Ubiquitous Computing*, 719–730 https://doi.org/10.1145/2750858.2805843;

Aydin, C., González Woge, M., & Verbeek, P.-P. (2019). Technological Environmentality: Conceptualizing Technology as a Mediating Milieu. *Philosophy & Technology*, 1–18. https://doi.org/10.1007/s13347-018-0309-3;
Brey, P. (2005). Freedom and privacy in ambient intelligence. *Ethics and Information Technology*, 7(3), 157–166. https://doi.org/10.1007/s10676-006-0005-3;
Clowes, R. W. (2013). The Cognitive Integration of E-Memory. *Review of Philosophy and Psychology*, *4*(1), 107-133. https://doi.org/10.1007/s13164-013-0130-y;
Clowes, R. W. (2015). Thinking in the cloud: The cognitive incorporation of cloud-based technology.;
Philosophy and Technology, 28(2), 261–296. https://doi.org/10.1007/s13347-014-0153-z;
Clowes, R. W. (2018). Immaterial engagement: human agency and the cognitive ecology of the internet. *Phenomenology and the Cognitive Sciences*, 1–21. https://doi.org/10.1007/s11097-018-9560-4;
Duke, É., & Montag, C. (2017). Smartphone addiction, daily interruptions and self-reported productivity. *Addictive Behaviors Reports*, 6(April), 90–95. https://doi.org/10.1016/j.abrep. 2017.07.002;
Fogg. B.J. (2003). *Persuasive Technology Using Computers to Change What We Think and Do*. Morgan Kaufmann Publisher;
Gallagher, S. (2000). Philosophical conceptions of the self: implications for cognitive science. *Trends Cogn. Sci.* 4, 14–21. doi: 10.1016/S1364-6613(99)01417-5;
Gallagher, S., & D. Zahavi. 2012. *The Phenomenological Mind*, 2nd ed. New York: Routledge.;
Gallagher, S. (2013). "Ambiguity in the sense of agency," in *Decomposing the Will*, eds J. Kiverstein and T. Vierkant (Oxford: Oxford University Press), 1–17.;
Guthrie, C. F. (2013). Smart Technology and the Moral Life. *Ethics and Behavior*, 23(4), 324–337. https://doi.org/10.1080/10508422.2013.787359;
Heersmink, R. (2016). The internet, cognitive enhancement, and the values of cognition. *Minds and;*
Machines, 26(4), 389–407. https://doi.org/10.1007/s11023-016-9404-3;
Hertwig, R. & Grüne-Yanoff, T. (2017). Nudging and Boosting: Steering or Empowering Good Decisions. *Perspectives on Psychological Science*, Vol. 12(6) 973– 986. https://doi.org/10.1177%2F1745691617702496;
Jeffares, B. (2010). The co-evolution of tools and minds: cognition and material culture in the hominin lineage, *Phenomenology and Cognitive Science*, 9,503–520. https://doi.org/10.1007/s11097-010-9176-9;
Malafouris, L. (2008a). Between brains, bodies and things: Tectonoetic awareness and the extended self. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 363(1499), 1993–2002. https://doi.org/10.1098/rstb.2008.0014;
Malafouris, L. (2008b). Beads for a Plastic Mind: the 'Blind Man's Stick' (BMS) Hypothesis and the Active Nature of Material Culture Lambros. *Cambridge Archaeological Journal*, 18(3), 401–414. https://doi.org/10.1016/j.cub.2015.10.018;
Malafouris, L. (2008c). Is it 'me' or is it 'mine'? The Mycenaean sword as a bodypart. In J. Robb & D. Boric (eds.) *Past Bodies*. Oxford: Oxbow Books, 115-23.;
Malafouris, L. (2013). *How things shape the mind*. A theory of Material Engagement. Massachusetts Institute of Technology;
Montag, C., Duke, É., & Reuter, M. (2015). A short summary of neuroscientific findings on internet addiction. In Montag, C. & Reuter, M. (eds.) *Internet Addiction* (pp. 131–139). Springer International Publishing. https://doi.org/10.1007/978-3-319-46276-9_12;
Munson, S. (2012). Mindfulness, Reflection and Persuasion in Personal Informatics. *Workshop on Personal Informatics*, 1–4.;

Nagenborg, M. (2014). Surveillance and persuasion. *Ethics and Information Technology*, 16(1), 43–49. https://doi.org/10.1007/s10676-014-9339-4;
Nakajima, T., Lehdonvirta, V., Tokunaga, E., & Kimura, H. (2008). Reflecting human behavior to motivate desirable lifestyle. *Proceedings of the 7th ACM Conference on Designing Interactive Systems - DIS '08*, 405–414. https://doi.org/10.1145/1394445.1394489;
Nakajima, T., & Lehdonvirta, V. (2013). Designing motivation using persuasive ambient mirrors. *Personal and Ubiquitous Computing*, 17(1), 107–126. https://doi.org/10.1007/s00779-011-0469-y;
Oulasvirta, A., Rattenbury, T., Ma, L., & Raita, E. (2012). Habits make smartphone use more pervasive. *Personal and Ubiquitous Computing*, 16(1), 105–114. https://doi.org/10.1007/s00779-011-0412-2;
Smart, P. R. (2017). Situating machine intelligence within the cognitive ecology of the internet. *Minds and Machines*, 27(2), 357–380. https://doi.org/10.1007/s11023-016-9416-z;
Smart, P. R. (2018). Emerging digital technologies: Implications for extended conceptions of cognition and knowledge. In J. A. Carter, A. Clark, J. Kallestrup, S. O. Palermos, & D. Pritchard (Eds.), *Extended Epistemology* Oxford: Oxford University Press;
Spahn, A. (2012). And Lead Us (Not) into Persuasion...? Persuasive Technology and the Ethics of Communication. *Science and Engineering Ethics*, 18(4), 633–650. https://doi.org/10.1007/s11948-011-9278-y;
Tulving, E. (2002). Episodic memory: from mind to brain. *Annual Review of Psychology* 53, 1–25.;
Verbeek, P.P. (2006). Persuasive Technology and Moral Responsibility Toward an ethical framework for persuasive technologies. *Persuasive*, 1–15. https://doi.org/10.1111/j.1600-0668.2005.00303.x;
Verbeek, P.P. (2009). Ambient intelligence and persuasive technology: The blurring boundaries between human and technology. *NanoEthics*, 3(3), 231–242. https://doi.org/10.1007/s11569-009-0077-8;
Walsh, P. J. (2017). Cognitive extension, enhancement, and the phenomenology of thinking, *Phenomenology and the Cognitive Science*, 16, 33–51. https://doi.org/10.1007/s11097-016-9461-;
Zahavi, D. (2007). Self and Other: The Limits of Narrative Understanding. *Royal Institute of Philosophy Supplement* 60: 179–202.