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Epistemic complementarity: steps to a second-wave extended epistemology

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Abstract

In this chapter, I propose a new framework for extended epistemology, based on a second-wave approach to extended cognition. The framework is inclusive, in that it takes into account the complex interplay between the diverse embodiments of extended knowers and the salient properties of technological artifacts, as well as the environment in which they are embedded. Thus it both emphasizes and exploits the complementary roles played by these different elements. Finally, I motivate and explain this framework by applying it to a case of interaction with contemporary technologies.

Introduction

Our lives are permeated by technology. We are currently living at a time of unprecedented technological mediation: a radical transformation of how we think, act and relate to each other. Take the production of this chapter as an example. It is the result of a long chain of bodily movements and sensorimotor encounters with technological devices and informational resources: reading essays, taking notes in notebooks, writing with laptops, late-night searches of the World Wide Web, etc. The list could go on and on.

According to the thesis of *extended cognition,* some of the artifacts we pervasively interact with are, under certain circumstances, literally part of our cognitive processes.[1] *Extended cognition* promotes an egalitarian approach to cognition and invites us to see the material realizers of cognition as encompassing not just activities of the brain and body, but also the activities of some elements of the organism's external environment. In doing so, it challenges the long-assumed *intracranial* view, and submits that cognition

[1] Clark and Chalmers 1998, Clark 2008.

trespasses the old bounds of skin and skull. For the purposes of this chapter, I will assume that extended cognition is not only a genuine possibility but is also instantiated in many actual cases.[2]

During the last ten years, the epistemological implications of extended cognition have received increasing attention, giving rise to the now flourishing project of *extended epistemology*.[3] The recognition of our ability to couple with external devices to accomplish a variety of cognitive tasks has reshaped the debate concerning our epistemic dependence on artifacts, that is, our dependence on artifacts to achieve epistemic goals (e.g. knowledge, justified beliefs) or to extend our cognitive abilities (Pritchard 2010).

Despite the progress that has been made in this field, I believe that standard extended epistemology has led to an inadequate framework for investigating the type of practices required for making extended cognitive processes epistemically good. The principal aim of this chapter is to show why this is the case, and to make room for an alternative, more attractive framework.

In particular, most writings in the field of extended epistemology have built their extended epistemology from a conception of extended cognition modeled from a *first-wave approach*.[4] This approach is characterized by the quest for functional parity between intracranial cognitive processes and extended cognitive ones. This, in turn, has led to what I will call an *epistemic parity* approach to epistemic hygiene. By this I mean, roughly, that whatever makes intracranial cognitive processes epistemically benign, also works for extended cognitive processes. This leads to a stringent account that forestalls any opportunity of capturing the complexity of the epistemic standing of our pervasive interactions with technologies, and the type of individual engagement required for being healthy epistemic agents.

The model I will propose for extended epistemology is built from a *second-wave extended cognition* approach. According to this route to cognitive extension, extended cognitive processes are characterized by the complementary functionalities that they bring to purely intracranial ones. It is not a matter of parity, but rather complementarity and the integration of quite heterodox elements that coordinate towards accomplishing cognitive tasks.

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[2] For discussion, see Menary 2010.
[3] See especially the essays in Carter et al. 2018.
[4] Clark and Chalmers 1998, Clark 2008.

Building on the importance of this complementary relation between purely organic faculties on the one hand, and cultural and technological artifacts and practices on the other, I will take the first steps towards a new framework for extended epistemology. The main idea is that determining what is required for achieving epistemic hygiene in extended cognitive processes will ultimately depend on the complex interplay between the diverse embodiments of knowers and the salient properties of technological artifacts, as well as the socio-cultural environment in which the interaction is embedded. By attending to these three aspects, we will begin the complex task of analyzing the impact of new technologies on our individual cognitive and epistemic capabilities. This work aims to provide a unifying framework, guided by what I will call an epistemic complementarity principle.

The plan for the paper is as follows. First (§2), I briefly introduce two lines or agendas behind extended cognition. Then I present the central tenet behind extended epistemology, based on an epistemic parity principle (§3). In contrast with this, I introduce an epistemic complementarity principle and provide a new model for extended epistemology (§4). I finish the chapter by applying this model to a case where an agent interacts with a smartwatch (§5).

1. Waves of extended cognition

According to extended cognition theory, elements external to the organism can, under certain circumstances, participate in the mechanistic realization of human cognitive states and processes (Clark 2008). Following John Sutton's (2010) categorization, there are different lines or agendas behind extended cognition.

First-wave extended cognition relies on the now-famous *Parity Principle* (Clark and Chalmers 1998). The Parity Principle is a heuristic for detecting cognitive extension, motivated by a common-sense functionalist approach to cognition.[5] The heuristic is simple: if an external process (one that includes elements that trespass the organic boundaries) is such that, were it to happen inside the head, we would consider it *cognitive*, drawing from our common-sense or folk knowledge about cognition, then that process *is* itself cognitive. The original Parity Principle was formulated as follows:

[5] For defenses of this argument, see Clark and Chalmers 1998, and Clark 2008, and for recent rejections of this argument see Sprevak 2009, and Wadham 2016.

> If, as we confront some task, a part of the world functions as a process which, were it to go on in the head, we would have no hesitation in accepting as part of the cognitive process, then that part of the world is part of the cognitive process. (Clark and Chalmers 1998, p. 8)

The parity principle played a historically important role in rejecting the unprincipled exclusion of external objects as parts of cognitive processes. Once such discrimination was removed, it became possible to look for criteria of cognitive extension. To this end, Clark and Chalmers (1998) themselves advocated an approach which emphasizes an object's portability, general availability and constancy across contexts. The resulting criterion is captured by the so-called "glue and trust" conditions (Clark 2010), namely: availability, more-or-less automatic endorsement, and easy access.

Indeed, it appears that what is crucial for cognitive-extending technologies is that they be available, and that they can easily enter an agent's cognitive routines as part of their problem-solving machinery. These criteria capture different functional profiles of cognitive states and processes, drawing from our common-sense knowledge about intracranial cognition. The idea is that candidates for genuine cognitive extension should be available when needed, easily or directly accessed and automatically endorsed, to approximately the same extent as intracranial cognitive abilities.

Andy Clark and David J. Chalmers's proposals have sparked critical discussion from a number of theorists, which have eventually resulted in the development of so-called s*econd-wave extended cognition* (Sutton 2010, pp. 193-201).

The main tenets of the s*econd-wave* approach are driven by a need to move beyond using coarse-grained functional similarities to characterize cognitive extension.[6] The main resistance to the parity line of thinking emerges from the homogenization of inner and outer capabilities, in virtue of the fact that inner and outer resources are heterogeneous in functionally relevant ways.

Building on the work of Merlin Donald (1991), John Sutton articulates the rationale behind extending cognitive processes (memory in particular) in terms of the complementary contributions afforded by their different functionalities.

The complementarity thesis for cognitive extension is captured in the following C*omplementarity Principle*:

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[6] Menary 2006, Menary 2007, Menary 2010, Rowlands 2010, Sutton 2010, Sutton et al. 2010, Heersmink 2014.

> In extended cognitive systems, external states and processes need not mimic or replicate the formats, dynamics or functions of inner states and processes. Rather, different components of the overall (enduring or temporary) system can play quite different roles and have different properties while coupling in collective and complementary contributions to flexible thinking and acting. (Sutton 2010, p. 194)

This principle emphasizes how diverse functionalities across different resources in fact explain the purpose of cognitive extension, since they complement each other. For instance, the typical features of *exograms* or external symbols are quite different from *engrams* or the brain's memory traces (Donald 1991, p. 308; Sutton 2010, p. 189). The former usually last longer, are more easily transmissible across media and contexts, and can be retrieved and manipulated by a greater variety of means (Donald 1991, pp. 315-316).[7]

The challenge is to investigate how these diverse elements integrate with each other to achieve a given cognitive task. In this framework, extension is viewed as a continuous and fuzzy phenomenon, rather than an all-or-nothing matter. The idea is that the level of integration among heterodox resources will vary depending on the agent's cognitive profile and the technology's properties. Higher degrees of integration will entail that they are genuine parts of a cognitive system, while lesser degrees will be seen as a symptom that they are not parts but rather tools or scaffolds.[8]

Once the emphasis on coarse-grained functional similarities is abandoned, room is made for investigating the embodied engagements in virtue of which cognition is extended (Rowlands 2009; Menary 2007). Cognition is extended through the sensorimotor manipulation of external resources, including external representations.[9] Importantly, as Richard Menary has argued, such embodied manipulations are embedded in a wider social, semantic, and normative environment (Menary 2010, p. 11). These manipulations are governed by social practices, some of which are cognitive in nature (Menary 2007, 2018a). It is through processes of enculturation that we get to be readers, writers,

[7] The properties of exograms are not fixed and might in fact change, depending on their format and implementation.
[8] See Heersmink 2014 for a thorough taxonomy of the dimensions of integration, and Sterelny 2010 for an account of scaffolded cognition.
[9] Rowlands 2009, Menary 2007, 2010, 2018.

smartphone users and web surfers. This means that in order to explain and understand extended cognition, we need to look at the complementary interplay between organisms, the technological resources they interact with, and the socio-cultural environment in which they are embedded.[10]

The preceding remarks were intended to illustrate the main tenets of the first- and second-wave approaches to extended cognition. Now, I will show their impact on extended epistemology. Crucially, while second-wave extended cognition provides a well-established framework for modeling extended cognition, its bearing on extended epistemology remains to be explored. In the following sections, I aim to show that it provides the building blocks for a different and more promising way of thinking about the epistemic standing of contemporary and emerging technologies.

2. Epistemic parity

Extended epistemology is concerned with studying the consequences that the program of extended cognition has on our epistemic evaluations. Traditionally, epistemology has taken an intracranial perspective while considering what makes a process a cognitive process. The limits of epistemic agents have thus been determined by their organic boundaries. That is why the program of extended cognition and its extension of the individual agent has led to a fascinating discussion in epistemology, giving rise to the project of extended epistemology.

An analysis of the literature reveals that most accounts of extended epistemology have, almost unreflectively, been built on a first-wave approach to extended cognition.[11] Accordingly, they model cognitive (and epistemic) extension in terms of coarse-grained functional similarities. Moreover, most approaches to extended epistemology have reinforced the importance of similarities between intracranial and extended cognitive processes. This has led theorists to endorse or advocate an epistemic parity principle such as the one proposed by J. Adam Carter (2013), who formulates it as follows:

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[10] Elaborating on the social and cultural dimensions of cognition has led to what can be identified as *third-wave extended cognition* (sketched in Sutton 2010, and developed in Kirchoff 2012, Kirchhoff and Kiverstein 2019, Gallagher 2010, and Cash 2013). The active role of the socio-cultural environment is also captured in the epistemic complementarity approach I present in this paper, giving rise, perhaps, to a third-wave extended epistemology. I plan to return to this in future work.

[11] See Carter, Palermos, Kallestrup and Pritchard 2014, and Carter 2016. Notice that the conditions for evaluation will depend on our epistemological commitments, hence giving rise to different kinds of epistemic parity principles. See e.g. Carter 2016, pp. 9-12.

> E-Parity Principle: For agent *S* and belief *p*, if *S* comes to believe *p* by a process which, were it to go on in the head, we would have no hesitation in ascribing knowledge of *p* to *S*, then *S* knows *p*. (Carter 2013, p. 3)

The idea is that extended cognition should avoid not only any bio-prejudice concerning what does or does not count as the physical machinery of a cognitive process, but also any epistemic bio-prejudice. According to an epistemic bio-prejudice, the difference between intracranial and extracranial cognitive processes can be interpreted as an epistemic difference (Carter 2014, pp. 4202-4203). For simplicity's sake, the principle is framed in terms of knowledge. However, epistemic parity affects other epistemic domains as well, insofar as cases of extended cognition are subject to ascriptions of "justification, understanding, rationality or intellectual virtue" (Carter 2014, p. 4202).

While not every account within the emerging project of extended epistemology has explicitly endorsed an epistemic version of the parity principle, most of them have taken for granted that extended cognitive processes and intracranial ones must be similar from the standpoint of our epistemic evaluations. To see this, it will be useful to introduce the notion of epistemic hygiene (Clark 2015, Carter et al. 2019).

To get an initial handle on the notion of epistemic hygiene, we might draw an analogy with sanitary hygiene. Sanitary hygiene is a set of practices and standards aimed at preserving health and preventing the spread of diseases (cf. Nicolle 2007). Similarly, the notion of epistemic hygiene captures the idea that there are some practices required for our individual and collective epistemic well-being. An agent needs to acquire good habits in order to be epistemically healthy. These might include, for instance, checking or taking care of the reliability of one's belief-forming methods. An *epistemic disease* might be understood as the spreading of unreliable methods for producing beliefs, or the acquisition of bad habits that lead to more false beliefs than true ones. Notice that the analogy also holds concerning the harm of excessive (epistemic) hygiene. Excessively hygienic practices might turn out to be detrimental to one's epistemic well-being, just as excessive hygiene is detrimental to the general health of an organism.[12]

[12] Let me clarify that I do not want to suggest that an agent's epistemic life can be reduced to their epistemic hygiene; rather this notion serves the purpose of illustrating the different ways of thinking about extended epistemology.

Since there is such a thing as epistemic hygiene, we need to establish what kind of engagement is required for an agent to be epistemically hygienic. Given that offering a complete account of these practices goes beyond the purpose of this chapter, we must focus on a minimal requirement. Epistemic hygiene is closely related to the reliability of our knowledge-producing methods and to the preservation of this reliability. We can thus take the reliability (truth-trackingness) of one's belief-forming processes, and some form of reaction to the shifting reliability of one's belief-forming processes, as minimal requirements of epistemic hygiene.[13]

Drawing from the work developed in Clark (2015), we can distinguish two ways of pursuing this minimal epistemic hygiene:

1. *Active pursuit of epistemic hygiene*: Clark (2015) refers to an "active pursuit epistemic hygiene" in relation to those practices involving the agents *themselves*, that is, practices that involve "person-level" engagement. Practices of this sort include, for instance, recognizing the source of the reliability of the technological process, or consciously inspecting the method used to obtain a certain piece of information. In the context of new technologies, this might entail consciously inspecting the reliability of a piece of equipment. This is a form of "deliberate, conscious, slow, careful, agentive attention" (Carter et al. 2018, p. 333).

2. *Passive pursuit of epistemic hygiene*: On the other hand, passive epistemic hygiene concerns those practices that involve little or no person-level engagement by the epistemic agent. For instance, it may be the result of the correct functioning of biologically-endowed sub-personal mechanisms, or of the proceduralization of certain practices in the form of (unconsciously enacted) patterns of behavior (see Menary 2012).

It is important to remark that Clark (2015) does not explicitly refer to a passive pursuit of epistemic hygiene, however he does contrast an agentive form of epistemic hygiene with sub-personal forms of epistemic hygiene, where sub-personal mechanisms react to the shifting degree of reliability of different sources of information, without any type of

[13] For more on this see Palermos 2014.

agential engagement. To this extent, although the active/passive distinction is a bit schematic, it intuitively captures two different aspects of the pursuit of epistemic hygiene, and it allows us to illustrate the difference between an epistemic parity approach and the framework I will present.[14]

The question that concerns me here is what type of engagement is required for achieving a minimal form of epistemic hygiene in extended cognitive processes. I will show that an epistemic parity approach incorrectly limits the answer that can be given to this question.

According to an extended epistemology based on first-wave extended cognition, or motivated by the E-parity principle, extended cognitive processes are evaluated in parallel with unextended cognitive processes. Remember that this way of thinking about extended cognition focuses on the similarities between extended cognitive processes and intracranial ones. The idea is that the technology should be *as* easily accessed as the faculties that lie beneath the agent's skin. In other words, to borrow an expression from Pritchard (2018, p. 96), extended and intracranial processes should be "phenomenologically on par."[15]

This, in turn, has led to a sort of parity principle concerning epistemic hygiene, namely the view that in order to ensure that a cognitive process (be it extended or not) is minimally hygienic, the type of individual engagement required must be the same. This means that if intracranial processes are epistemically hygienic in a passive or sub-personal way, the same goes for extended cognitive processes.

For instance, Clark (2015) argues that a sub-personal form of epistemic hygiene is the only form of epistemic hygiene compatible with extended cognition and extended knowledge. Putting more stringent constraints on extended cognitive processes, such as inspecting the technology, is seen as disrupting parity and thus going against the central tenets of extended cognition. After all, intracranial cognitive processes are not usually subjected to an active type of inspection.[16] Moreover, it can be seen as a manifestation of the feared bio-prejudice. In order to prevent this unwanted situation, Clark concludes that

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[14] The debate concerning epistemic hygiene is orthogonal to the more traditional debate concerning internalism vs. externalism about epistemic justification. However, it is true that active epistemic hygiene involves increasingly strict conditions, and these in turn point to more internalistic aspects of epistemic justification.

[15] Cf. Smart 2018a.

[16] This reasoning is dramatized by the Epistemic Hygiene Dilemma in Carter et al. 2018: 334, and Clark 2015: 3763. See also Andrada (2019) for a new solution to this dilemma.

a sub-personal form of epistemic hygiene is the only form of epistemic hygiene compatible with extended cognition and thus extended knowledge. He does so by relying on the predictive processing framework and the powerful sub-personal mechanisms of precision-estimation.[17]

Despite the pioneering role and great interest of the epistemic parity approach, I believe that it prevents an adequate extended epistemology. No doubt the parity principle has played a seminal role in raising awareness of a diffuse bio-prejudice concerning the role of the external environment in cognition. Nevertheless, tracing the source of extension to coarse-grained similarities prevents us from duly taking into account the deep differences that lie between organic and technological elements, and as we will see, these differences matter epistemically. I will show that from an epistemic standpoint, taking the complementarity framework seriously entails that even if external resources are genuine parts of a cognitive system, the relevant types of maintenance activities or epistemic hygienic practices might vary precisely because of their differences.

3. Epistemic complementarity

In this section I will present the central tenets of an epistemic complementarity framework.

3.1 The epistemic complementarity principle

An epistemic complementarity framework starts from the idea that, in order to fully understand what does it take to achieve epistemic hygiene in extended cognitive processes, we need to offer a careful analysis of the elements that constitute such processes. Drawing from the complementarity principle formulated by Sutton (2010), I will now introduce an epistemic complementarity principle which captures the main motivation for the framework for extended epistemology that I am presenting here.

> **Epistemic complementarity principle:** In extended knowledge cases, the agent needs not mimic or replicate the engagement required for achieving knowledge in virtue of inner states and processes. Rather, different hygienic epistemic practices might be required for flexible extended knowing.

[17] See Clark 2015 pp. 3768-3771.

The central idea behind this principle is that, given that artifacts and other external resources have different properties and functions that complement inner cognitive states and functions, the cognitive processes that involve them might in fact require different types of engagements to achieve epistemic hygiene. Contrary to the epistemic parity principle, it accepts that the differences between internal and external elements might also have an impact on their epistemic standing. For simplicity's sake, this principle is also framed in terms of extended knowledge.

At this point it might be helpful to remember that the central idea behind the complementarity route to cognitive extension is that embodied agents deploy the functional and informational properties of cognitive artifacts to complement their onboard cognitive capacities. Instead of focusing on coarse-grained similarities, emphasis is placed on individual differences (both the cognitive and embodied profile of the organism, and the properties of the artifact) in order to investigate the integration between them. Extended cognitive systems are investigated across dimensions of integration between the embodied agent and the technological artifact, and the wider socio-cultural environment in which their interaction takes place.[18]

The principle of epistemic complementarity goes one step further and states that, even when an artifact is genuinely integrated into an agent's cognitive system, we should not assume that minimal epistemic hygiene requires them to be engaged with it to the same extent that they are with their intracranial cognitive processes. For this reason, instead of seeking epistemic parity, the epistemic complementarity principle compels us to pause and look at the contributions of the different elements that make up an extended cognitive process. This is captured in the following three steps.

3.2 Three steps

For the purpose of this chapter, I have assumed that a minimal form of epistemic hygiene in cognitive processes involves, on the one hand, the reliability (truth-trackingness) of one's belief-forming processes and, on the other hand, some form of reaction to the shifting degree of reliability of one's belief-forming processes. This can be pursued either *actively,* involving some form of awareness or agentive engagement, or *passively*, in a

[18] Sutton 2006, 2008, 2010, Menary 2010, Heersmink 2014.

way that is more or less automatically given, as with the correct functioning of our endowed capacities.

According to the epistemic complementarity approach, in order to determine the sort of agentive engagement required for achieving a minimal form of epistemic hygiene, and thus for being a candidate for extended knowledge, we must look at the interplay between the different cognitive and embodied profiles of the cognitive agent and the salient properties of the technological artifacts, as well as the environment in which they are embedded. These elements will determine whether (and to what extent) epistemic hygiene in these contexts requires an active or passive pursuit, and the type of agentive engagement and effort required.

The moral is that we should not take for granted that extended cognitive processes require only whatever works for intracranial processes in order to be epistemically good. What the epistemic complementarity framework captures is the fact that epistemic hygiene is distributed, given that all the elements that constitute an extended cognitive process (embodied agent, technological artifact and socio-cultural environment) have a bearing on the pursuit of epistemic hygiene. This can be represented in a threefold model (figure 1):

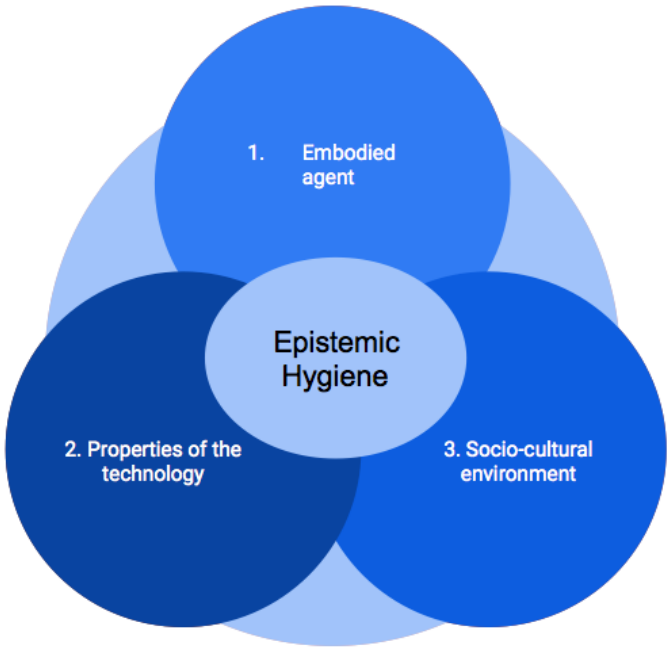

Figure 1: Epistemic complementarity

Step 1: embodied agents

The first step of an epistemic complementarity-based approach is to acknowledge the embodied dimension of extended cognition and extended knowledge. Our body is the interface that allows us to interact with different technologies. Whether this interaction takes place by swiping, touching a screen, or rotating lenses in order to see something, our body is a crucial element in our epistemic engagement with the world. As Robert Clowes has recently stated, we interact with contemporary technologies via *skilled gestures* (Clowes 2018, p. 4). Given this embodied dimension, an epistemic complementarity approach begins by looking at the diverse embodiments of knowers and their embodied and cognitive profiles. The question that needs to be answered is how an agent's embodiment might affect our account of epistemic hygiene.

The importance of diverse embodiments in epistemology has been emphasized by many feminist epistemologists, but has received little attention in extended epistemology, despite the crucial dimension of embodiment within extended cognition. This is why a distinction drawn by Louise Antony (2002) is especially illuminating here.

According to Antony (2002), a knower's embodiment might have two types of effects on epistemology: (i) *ground-level* effects and (ii) *meta-level* effects. The former effects capture the idea that diverse embodiments matter to how agents know. This might be settled partly by empirical studies, similar to those on cultural variation (Nisbet et al. 2001), or to those in the growing field of neurodiversity (Frenton and Krahn 2007). In contrast, meta-level effects focus on how a theorizer's embodiment affects how they theorize about epistemic matters. Such effects reflect how theorizing might depend on contingent and non-universal features of its practitioners' embodiments. Both levels are complex and deserve a deeper treatment than the one I will give here, but I will proceed to show how they relate to each other and their relevance for an extended epistemology.

An epistemic complementarity framework focuses mainly on ground-level effects: how an agent's cognitive profile and embodiment matter for how they acquire epistemic hygiene in extended cognitive processes. The motivation of such a focus derives from the complementarity route to extended epistemology, in combination with a meta-level reflection concerning how theorizers about extended cognition and extended epistemology (including myself) might have been driven by homogenizing assumptions and biases. Let me explain this further.

First of all, as I have just sketched, an epistemic complementarity approach acknowledges that there are relevant differences between extended and unextended processes, and this calls for taking into account the embodiment of potential extended knowers, as well as the bearing and effects that their different embodiments might have on the pursuit of epistemic hygiene. Second of all, a meta-level reflection motivates a study of the ground-level effects of the embodiment of extended knowers, because this helps us identify the different biases that might have guided our extended epistemology. For example, one might assume that all knowers are alike, and in doing so, one might take one's own particular way of experiencing one's cognitive and epistemic life (for instance, in relation to how one *easily* exercises one's own cognitive capacities) to be the standard or even the *only* way of doing so. Not only will this kind of strategy limit our own account of extended knowledge—for instance, by hindering an in-depth analysis of the varieties of ways in which one can exercise one's extended and unextended cognitive abilities—but it will also preclude us from grasping what it takes to achieve extended knowledge in real-life settings, as we will proceed to see.[19]

Concerning ground-level individual differences, little has been studied in relation to extended cognitive processes. This is surprising, since we find an appeal to individual differences, in particular with regard to personality psychology, in some of the canonical texts of second-wave extended cognition (see Sutton 2006, 2010). If we set out to investigate individual differences in the pursuit of epistemic hygiene, the question is not so much the personality or inclinations of a particular agent (for instance, how meticulous they are), but rather how a particular embodiment contributes to fixing the type of engagement that might be required for achieving a minimal form of epistemic hygiene.

To illustrate, let us focus on the reliability of our extended and unextended cognitive processes. Our senses (hearing, sight, etc.) have a long history of evolutionary testing and, when working well, they are tuned to our environment; hence they are for the most part reliable. In this regard, reliability is the result, to a large extent, of the good working of our sub-personal cognitive architecture. By this, I mean that in most cases, we, as cognitive agents, do not have to do much for our *basic* cognitive abilities to be reliable. The problem is that this appreciation, combined with the quest for similarities prevalent in an

[19] See Andrada 2020 on the importance of attending to diverse embodiments when giving an account of the phenomenology of extended cognition.

epistemic parity approach, might mislead us into thinking that this is how reliability is accomplished in *all* instances of extended cognition and knowledge.[20]

The epistemic complementarity framework calls for a more fined-grained analysis. Recognizing the differences between extended and unextended processes, together with the vital role of embodied manipulations and skilled gestures in extended cognitive processes, makes us realize that the type of engagement required for establishing their reliability can vary from one process to another. This means that despite the fact that the kind of coarse-grained cognitive function implemented by an unextended and an extended cognitive process (e.g. *biomemory* and extended memory) can be thought of as the same, what it takes for them to be reliable might be different; more precisely, and importantly, it might differ with respect to the person-level demands it makes on the agent. This will become clearer in section 4, where I will revisit the traditional case of Otto and his notebook (Clark and Chalmers 1998), and address the bearing that Otto's cognitive profile (i.e. his mild form of dementia) has on his pursuit of epistemic hygiene.

Step 2: properties of the technology

The second step of an epistemic complementarity framework takes us to an analysis of the technology's properties. The central idea here is that the very features of the technology have a bearing on the epistemic standing of the extended cognitive process. As we saw before, the central tenet behind an epistemic complementarity-based extended epistemology is that all the elements that constitute an extended cognitive process have a bearing on the pursuit of epistemic hygiene. Obviously different technologies vary drastically from each other. So we need to specify how the diversity of technological properties matters *epistemically*.

When discussing the reliability of a certain technology, we can refer to two different but interrelated aspects.[21] First, a technological device can be reliable in terms of its robustness or resilience. Second, when it comes to the reliability of the information it conveys, we may refer to its factive status. Despite their differences, both of these aspects are relevant for granting a positive epistemic standing to an extended cognitive process. This is because reliability may be a function of the information such technologies support,

[20] See for instance Clark 2015.
[21] Thanks to an anonymous reviewer for helping me to clarify this point.

which in some cases is not entirely disconnected from their working and performing correctly. If we refer to a technological device as being reliable, we are saying that it operates in accordance with our expectations, in terms of both resilience and reliability of content.

The relevance of taking into account the properties of the technology when identifying the individual engagement required for achieving epistemic hygiene, is that it will in fact vary depending on them. This means that when investigating the epistemic standing of a pervasive interaction with a given technology, such as smartphone, we must look not only at the individual agent and her internal cognitive character, but also at the reliability of the technology itself.

For instance, Heersmink (2017) and Sutton and Heersmink (2018) have recently proposed a virtue responsibilist approach to bolstering our epistemic credentials while interacting with the Internet. This basically means instilling virtues such as honesty, diligence and thoroughness into one's character through learning and education. Although this is certainly important, the idea behind the epistemic complementary framework is precisely that, given the distributed nature of cognition and the active nature of external elements, epistemic success does not rest solely on the individual.[22] This means that we must also look at the different epistemic properties of the technologies themselves, for instance, how data and information is recorded and stored, how easily can it be altered or modified, etc. Along these lines, Paul Smart (2008b) has highlighted the importance of taking into account the properties of internet technologies when it comes to analyzing internet-based knowledge, and not just the behavior of the individual agents who deploy or rely on such technologies. The characteristics of an online environment will affect what it takes for an agent to achieve knowledge when relying on such an environment. We can say the same of other technologies we deploy and rely on.

One implication of this analysis is that extended epistemologists should get a better grip on the properties of the actual technologies that we pervasively and stably interact with. This will help us achieve a more realistic picture concerning what it actually takes to achieve extended knowledge in our contemporary high-tech environments. An epistemic complementarity framework is thus poised to bring extended epistemology into contact with vibrant interdisciplinary debates.

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[22] Both John Sutton and Richard Heersmink are leading advocates of a complementarity-based approach to extended cognition. Inspired by their work, I have developed the epistemic complementarity principle whereby all the elements that constitute a cognitive system (embedded or extended) have a bearing on the epistemic standing of an individual's cognitive process.

Step 3: socio-cultural environment

Finally, the last step that needs to be taken to elucidate the demands of epistemic hygiene on extended cognitive processes concerns the socio-cultural environment in which the interaction takes place. Cognition does not take place in a vacuum, but rather is embedded in a normative environment (Menary 2007, 2012). An epistemic complementarity approach starts from the idea that elements of the social and cultural environment have an impact on the epistemic standing of an extended cognitive process, and hence are relevant for determining the type of engagement required for achieving a minimal form of epistemic hygiene.

Recognizing the role played by the socio-cultural environment involves more than simply identifying where the interaction happens; it also involves taking account of any effects that the cultural environment might have on our epistemic processes. This has also been studied in feminist epistemologies, where it is widely accepted that knowers are entangled in social relations, some aspects of which have a bearing on their epistemic life.[23] Moreover, the cultural nature of many of our interactions with technologies has been made clear by leading advocates of extended cognition, although it has not been sufficiently taken on board in extended epistemology.[24]

To illustrate this, I will address the influence that social practices have on the type of individual engagement required to be minimally hygienic epistemic agents. By 'social practices' I mean patterns of action spread over a population, which are transmitted both between the members of a community and across generations.

Let us begin by looking at the role of social practices in extended cognition. The basic idea that we need to incorporate into our extended epistemology is that our skilled interactions with technologies require the acquisition of several social practices. These practices include *cognitive* practices of a specific type, which are acquired in virtue of the process of enculturation (Menary 2007). Some examples of cognitive practices are the manipulation of public systems of representation (such as mathematics, reading and writing), and the practice of epistemic diligence concerning the structuring and maintenance

[23] See also Haraway 1991 and Haslanger 2020.
[24] To the best of my knowledge, exceptions include Menary 2012, 2018b, and Kotzee 2018.

of the quality of information stored in the environment (Menary 2012, 2018b). Enculturation is a form of non-genetic inheritance, and such practices are quite recent in phylogenetic terms; hence social practices and cumulative cognitive niches are needed to guide our learning histories (Menary 2018a).

Acknowledging the role that cognitive practices have in our extended cognitive processes is relevant for determining what is required for an individual agent to be epistemically hygienic, mainly because the type of engagement will vary according to such practices. For instance, cognitive practices are acquired mainly through interpersonal relations (e.g. infant and caretaker), and some hygienic practices might also be institutionally supported, in the form of standards, educational programs or pedagogical methods. These reliable practices might make the type of individual engagement less demanding. However, this cuts both ways, in the sense that a lack of practices, or the presence of unreliable ones, might place more demands on the individual agent.[25]

This interplay between individual agent and social practices is connected to a recent account of our social and material epistemic dependence.[26] According to Sandford Goldberg (2017), whether the members of our epistemic community do or do not comply with the relevant norms governing our social practices has a positive or negative impact on our epistemic standing.

This can be illustrated by looking at our epistemic reliance on technologies. To simplify somewhat, the idea is that if someone relies on a technological device made by a socially recognized manufacturer, they are entitled to expect that the manufacturer has complied to the social norms and standards regarding the manufacture of the device. The agent has, to use Goldberg's terminology, a practice-generated entitlement (Goldberg 2015, 2017, 2018). Thus they are entitled to expect that the information conveyed is accurate and reliable, at least insofar as the designers comply to the norms of design and the user complies to the norms of use (e.g., follows the instruction manual and performs all relevant maintenance activities).

I take this analysis as evidence that the type of engagement that is required to be even minimally epistemically hygienic will vary depending not only on the individual's

[25] Care is needed here insofar as, given the long time spans of enculturation, the reliability of a given practice might take transgenerational intervals to be understood or even recognized. For more on this, see Levy and Alfano 2020.

[26] For a thorough taxonomy of the varieties of epistemic dependence, see Broncano-Berrocal and Vega-Encabo (2017).

acquisition of social practices, but also on how other members of our epistemic community act. For instance, flaws exhibited by members of our epistemic community might make it harder for an individual agent to acquire epistemic goods, but also their active contribution might relieve some of their individual burden.

Importantly, this type of epistemic dependence on others is more "profound", as Goldberg (2017) remarks. It is manifested not only in our reliance on instruments, but also through the design of our shared environments. To elucidate one possible way in which this could happen, Goldberg appeals to the notion of 'epistemically engineered environments'. By that, Goldberg means "an environment that has been deliberately designed so as to decrease the cognitive burden on individual subjects in their attempts to acquire knowledge" (Goldberg 2017). For instance a *classroom* is a learning environment in which students benefit from the specific design which is "pre-screened, and chosen with an eye on epistemic standards". Social practices can thus guide the design of specific shared environments, and can promote and enhance the epistemic goods available to the individual agent, and minimize their cognitive load.[27]

To sum up, an epistemic complementarity approach compels us to attend to the interplay between the embodied profile of a cognitive agent, the properties of a technology and the socio-cultural environment in which the interaction takes place. All of these elements contribute to the epistemic hygiene of an extended cognitive process. In the next section, I will briefly illustrate how this model works by applying it to a case in which an agent interacts with a technological device.

4. Epistemic complementarity meets Otto

The deeply anchored individualism that characterizes most theorizing about epistemic and cognitive agency makes us more likely to recognize the active role of the social and material environment in cases that concern people with compromised organic cognitive systems. This is in fact why the most compelling cases of extended cognition, including the one I will present here, concern an agent suffering from Alzheimer's disease. How-

[27] Goldberg (2017) identifies the effect of this sort of epistemic dependence by the status of epistemic justification. In this respect, the account on offer is one in which our epistemic dependence on designers and manufactures entails that their behavior with respect to the design of an instrument, or even an environment, can undermine or defeat the belief we form in virtue of using such an instrument. Here I am adopting a more general perspective, by focusing on the type of engagement required for achieving a minimal form of epistemic hygiene.

ever, we should not forget that the central idea of the epistemic complementarity framework is that the social and material world plays an active role in our cognitive and epistemic lives, whether or not our organic cognitive faculties are compromised.

The canonical example of extended cognition, since the publication of Clark and Chalmers's seminal paper, is the case of Otto and his notebook. Otto is someone who suffers from a mild form of Alzheimer's disease and heavily relies on a memory notebook. He writes down every new piece of information he acquires, and looks it up whenever he wants to perform an action. Given his pervasive interaction with it, the notebook is part of his (extended) memory system. Otto's interaction with his notebook is contrasted with Inga's interaction with her biological memory when undertaking an action. The case I will analyze is an adaptation of Otto's case.

Currently smartwatches are being introduced into healthcare practices, as a form of assistive technology for people with dementia and Alzheimer's (Thorpel et al. 2016). Hence I will apply the epistemic complementarity model to a revised version of Otto's case where he interacts with a smartwatch, as follows:

> **Smart Otto:** Otto suffers from a mild form of dementia. He wears a smartwatch wherever he goes, which helps him to organize his daily routines. He has developed the following habit: whenever he finds something interesting or worth remembering, he stores the corresponding information using an app which allows him to record voice notes. During the afternoon, Otto carefully updates his information concerning future plans (and directions, in case he has to go to certain places) in a different app which supports reminders. Once a fortnight, Otto uses this information to meet his friend Inga and head to the MoMA museum.

The question that needs to be addressed is what makes Otto a minimally hygienic epistemic agent, to the extent that we can attribute knowledge to him (for instance, to the effect that he knows when he is meeting Inga, and the address of the MoMA Museum, etc.). We must take for granted that he relies on his smartwatch in quite an intimate way, and that his interaction with his smartwatch is integrated with his other cognitive routines, just like in the original case.

According to the epistemic complementarity framework, the type of engagement required for being minimally epistemic hygienic is determined by the interplay between

the embodied agent, the properties of the relevant technology, and the socio-cultural environment in which they are embedded. Minimal epistemic hygiene can be understood as the reliability (generally truth-conducive) of the belief-forming process and, importantly, reacting to the shifting reliability of this process. This means, for instance, that if the process is unreliable, the agent reacts accordingly (i.e. does not trust it). We have established that this can be done either actively or passively (sub-personally).[28]

First of all, we should look at the embodied and cognitive profile of the agent. The story tells us that Otto suffers from a mild form of dementia. People with dementia experience, as part of their progressive cognitive impairment, short-term memory problems, including language deficits, difficulties in initiating tasks, planning, monitoring and regulating behavior, visuospatial difficulties, agnosia and apraxia.[29] Accordingly, interacting with a smartwatch and engaging in different epistemic practices is not an easy task for them.

Second, we must attend to the properties of smartwatches. A smartwatch is portable and attached to the agent; consequently it is less likely that an individual with dementia would forget about it. This means that it makes less stringent cognitive demands on agents who use it, at least as far as reliability *qua* consistency and robustness is concerned. Like smartphones, these devices support a wide variety of apps, since they are run by similar operating systems. The reliability of its information partly depends on the correct functioning of the apps it supports, and partly on the reliability of the user's implemented content, since smartwatches are open to a fairly high degree of customization.

Third, we must attend to the socio-cultural environment in which the interaction takes place. First of all, we should look at the social practices surrounding Otto's interaction with his smartwatch. In order for such interaction to be reliable, Otto needs to learn, train and acquire complex patterns of action. In fact, if we look at studies of real patients who compensate for their ill-functioning biological memory by successfully learning to deploy smartwatches, we see that their effectiveness relies on careful training (Boletsis et al. 2015). That is why, the reliability of Otto's extended cognitive process is largely a matter of reliable practices.

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[28] Remember that this is a schematic characterization, and that in real life we might deploy both strategies. See Andrada 2019 and Andrada 2020 for more on the role of conscious epistemic care and extended cognition.

[29] World Health Organization: *Towards a dementia plan: a WHO guide* http:// www.who.int/mental health/neurology/dementia/en/. Last accessed: August 31, 2018.

Let us imagine for the sake of the argument, that Otto relies on his smartwatch but has not been trained to do so; thus he follows no method of organization. Moreover, Otto lives in a place where there are no caregiving practices that can help him acquire the relevant hygienic practices. In this situation, relying on the smartwatch is a highly demanding process for him. However, his position could be enhanced by instilling practices that help him structure the information diligently; and with the proper scaffolding, Otto could be trained to do so to the extent that he might end up being much better off. The fact that many of these practices are social in nature lends further support to the idea that the reliability of extended cognitive processes requires more than the good working of Otto's sub-personal mechanisms. Without such a display, not only might Otto struggle more, but he might also be unable to acquire knowledge in virtue of his interaction with the smartwatch. This shows why the engagement required from Otto will vary according to such practices or any lack thereof.[30]

Another aspect of the socio-cultural environment's contribution to Otto's interaction with his smarwatch can be illustrated by pointing out that Otto is entitled to expect that certain epistemic norms (e.g. norms concerning minimal reliability and GPS accuracy) were followed by the people who designed his smartwatch. This compliance might take some weight off his shoulders, to the extent that he is entitled to trust its output without actively inspecting its reliability.

However, reacting appropriately to any shifts in the reliability of this belief-forming process might be harder to do, depending on the stage of Otto's progressive cognitive impairment. If someone tampers with the information in Otto's smartwatch, it might be very hard for Otto to detect those changes and act accordingly. In fact, according to ethnographic work done with people with dementia, such individuals are heavily dependent on technologies and caregivers, usually family members, in order to conduct their daily lives (Boletsis et al. 2015; Yatczak 2018). That is why we should be open to the idea that some degree of monitoring or maintenance of Otto's belief-forming process might be distributed to the technology (for instance, in the form of monitoring apps that detect when things are not working normally and let Otto know through buzzes and vibrations),

[30] I want to remark that many of our cognitive abilities are *enculturated*, although they might not be extended in the sense that concerns me here; that is, their material realizers might not be partly constituted by something external to the organism. This might be the case, as I have previously stated, for basic abilities and tasks, but not in many human cognitive activities. This should lead us to revisit the idea that reliability in intracranial cognition is entirely sub-personally achieved.

as well as to the specific layout of the environment he inhabits, and also, importantly, to other member's of Otto's epistemic community.[31] Without them, Otto's epistemic and cognitive life might be severely compromised.[32]

All this suggests that, in order for Otto's epistemic hygiene to be less individually demanding (or even feasible), we might need to revise our previous formulation of the case. This could leave us with the following case:

> **Smart Otto (and Greg).** Otto suffers from a mild form of dementia. He wears a smartwatch wherever he goes, which helps him to organize his daily routines. He has developed the following habit: whenever he finds something interesting or worth remembering, he stores the corresponding information using an app which allows him to record voice notes. During the afternoon, Otto and his caregiver Greg carefully update Otto's information concerning future plans (and directions, in case they have to go to certain places) in a different app which supports reminders (including buzzes). Once a fortnight, Otto uses this information to meet his friend Inga and head to the MoMA museum.

This case more accurately resembles a real-life setting. We should note that if we had followed an epistemic parity approach, we would not have been able to properly understand the many factors that contribute to Otto's epistemic life, or the engagement required for him to acquire epistemic goods. On the contrary, following the steps set out by an epistemic complementarity framework provides us with a more comprehensive picture. However, one might want to object right away that a *veridic* case such as that of *Smart Otto (and Greg)* is not an instance of extended cognition, nor of extended knowledge, precisely because of a lack of individual control, due to the heavy dependence on artifacts and other people (see Drayson and Clark *forthcoming,* p. 24). The epistemic complementarity framework, invites us to reflect on the active role that social, material and cultural factors play in our (extended) epistemic lives. That is why figuring out the distribution of this dependence, where the relevant individual might not be the principal

[31] We can imagine an app that warns Otto (for instance through a vibration) of a failure in performance, or alerts his caregivers. Currently there are many apps that support complex ways self-tracking and monitoring (see for instance the Quantified Self Movement), many of which are deployed by people with dementia and their caregivers.

[32] The extent to which such epistemic monitoring might be completely outsourced to technologies is an empirical question, which raises complex ethical and sociological challenges. Notice also that this sort of extended monitoring might be used for cognitive and epistemic enhancement (see Clowes 2014).

locus of control, is one of the central challenges for an epistemic complementarity approach to extended epistemology.

Conclusion

Let me recapitulate the main outcomes of this chapter. Its central aim was to propose a framework for modeling extended epistemology, based on second-wave extended cognition. First, I have shown how modeling cognitive extension from a first-wave extended approach favors an epistemic parity principle, according to which the type of individual engagement required to ensure that an unextended process is minimally hygienic also ensures the epistemic hygiene of an extended cognitive process.

In contrast with this approach, I have introduced an epistemic complementarity principle, drawing from second-wave extended cognition. Its central tenet is that, given the complementary roles played by intracranial and external elements in extended cognitive processes, we cannot determine the sort of individual engagement required for them to be minimally epistemically hygienic by focusing only on what we know about intracranial cognitive mechanisms. We should not forget that their complementary roles are in fact afforded by their differences, some of which might be epistemic. This has been implemented via a threefold model, where the individual engagement required for epistemic hygiene varies according to the particularities of the embodied agent, the properties of the technology, and the social and cultural environment in which the interaction takes place.

The resulting extended epistemology is a more inclusive one, in that it vindicates the fact that not all knowers and technologies are alike and their differences, including those of their socio-cultural environments, matter epistemically. There is, of course, more conceptual and empirical work left to be done; here we have taken the first steps.

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