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ORIGINAL RESEARCH

Extending the extended self: a mediational-constitutional proposal

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Abstract

This paper explores the mediational and constitutional role of technical images (both analogue and digital) for the definition and continuity of the sense of self, proposing a new framework within the extended mind theory grounded in recent approaches to memory. Traditional cognitive science often views the mind as confined within the brain, but we argue that cognition is not merely extended but fundamentally constituted through ongoing material engagements with technical images within specific sociocultural contexts. Our interdisciplinary approach integrates cognitive archaeology, media theory, and cognitive sciences, emphasising the dynamic, embodied, and situated nature of cognition. This perspective shifts the understanding of the mind from a static, internal entity to a dynamic, distributed process continually mediated through organismic transactions in the environment. Building on this tradition of studies in the extended mind, we introduce the Mediational-Constitutional Principle, arguing that technical images not only trigger cognitive processes but actively constitute them. In the paper, we illustrate how technical images mediate and constitute the sense of self because they are central in how memory is continually re-enacted in specific sociomaterial environments made of people, things, and practices. These images function as automatic ecological records, blending past and present, influencing personal narratives and memory.

Keywords Extended mind · Memory studies · Media studies · Self · Ecological-enactive cognition · Technical image · Records

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1 Pictures for the mind

We inhabit a world made of people, things, and practices. Each social and material setting, both past and present, possesses its unique dynamics. In contemporary times, this world includes a wealth of records and hyperfast information. From birth, we learn to navigate these sociomaterial environments, acquiring and adapting sociocultural practices while developing a sense of identity within social groups and physical spaces. The underlying mechanisms of these processes and the role of sociomaterial environments in human cognition raise crucial questions to explore. Specifically, in which relationship do people and their sociomaterial environments stand?

In this paper, we argue that things *sensu lato* mediate and constitute thoughts, actions, and feelings. By integrating advancements in the philosophy of cognitive science with media theory and cognitive archaeology, we propose an updated Third Wave of the Extended Mind centred on the *Mediational-Constitutional Principle* (MCP). In our formulation of the MCP, cognition is not merely extended into the world; instead, it is a multitemporal process mediated and constituted by longstanding sociocultural practices enacted through embodied interactions within sociomaterial environments. As we fully discuss in the last paragraph, we adhere to a view of cognition that prioritises diachronic over synchronic processes. To support those claims, we explore how "technical images" (Flusser, 2000) mediate and constitute the self. Specifically, we will illustrate how technical images mediate and constitute cognition through their relationship with memory, which influences the characteristics of our material engagements with them (Malafouris, 2004; Prezioso, 2024). It is worth noting that our use of "technical images" serves as a rhetorical strategy to emphasise the continuity between analogue and digital photographs, as well as still and moving images, all of which share an ontological foundation as *automatic ecological records*.

Our discussion begins with an experiment. Psychologists Kimberly Wade and colleagues (2002) demonstrated that participants could recall childhood experiences that never occurred when shown doctored photographs. For instance, participants remembered being in a hot air balloon, even if they had never actually experienced that event. This study suggests that pictures contribute to remembering (also Strange et al., 2005; Sacchi et al., 2007; Garry et al., 2007; Schacter, 2022). Classic cognitive perspectives have produced various explanations for the formation of false memories. Generally, false memories and misremembering are considered mistakes occurring during encoding or retrieval by a typically reliable information processing system (Johnson et al., 1993; McClelland, 1995; Roediger & Geraci, 2007; Zhu et al., 2010; cf. De Brigard, 2014). In this article, we challenge this assumption by showing that memory is a process mediated and constituted *with* and *through* things within sociomaterial environments.

Traditional cognitive science has long explored how the mind operates by examining the brain as the hardware on which logical functions can be implemented, much like a computer. Minds are firmly located inside individuals, spatially stretching from the brain down the spine and along the nervous tissues that compose our bodies (Fodor, 1975; Marr, 2010). According to neurophysiological studies (e.g., Imamizu & Kawato, 2012), the things, people, and phenomena in our sociomaterial environ-

ments serve as triggers that elicit specific sensory impressions, activating the brain systems responsible for recalling internally stored mental representations (i.e., mental states, maps, or images; see Roediger, 1980). This perspective, often referred to as the "sandwich model of cognition" (Hurley, 1998), posits that external things are inputs for the workings of the human brain's internal neural machinery (see also Markman & Dietrich, 2000; Shea, 2018, pp. 4–8). Building on an established line of research within the cognitive sciences and drawing on support from media studies, we adopt a different perspective by proposing an alternative framework.

We will first describe contemporary theoretical approaches that assert cognition is not an activity explainable solely in terms of brain activity, which, at least in the field of cognitive sciences, is labelled as the Extended Mind Hypothesis (Clark & Chalmers, 1998). In Sect. 2, we will briefly introduce this original idea and discuss other trends, or waves, to illustrate its theoretical development. Following this conceptual trajectory, we will refer to various disciplinary fields, namely cognitive archaeology and media studies, to demonstrate how the externalisation of the mind is a cross-disciplinary issue (Sect. 3). In Sect. 4, we will argue that thinking in terms of information processing poses some challenges to developing a holistic understanding of the manifold ways through which people are affected by sociomaterial entities. As in the field of cognitive sciences, matter is what matters. Finally, in Sect. 5, we will formulate our proposal for an updated trend in the extensionality of the mind, using technical images as a case study for the aforementioned MCP.

2 From parity to complementarity (and beyond)

To introduce the core discussion we develop in this paper, we start with another question: do technical images *cause* us to remember some already existing memory stored in the mind or brain, or do they *constitute* that memory? In simpler terms, are things only the cause of our thinking, or should we consider them to be fully cognitive? It is one thing to regard things as triggers for cognitive processes and to define these triggers as active participants in the thinking process. It is another matter entirely to consider them cognitive *tout court*, and hence not simply sufficient but essential for thinking (for an overview, see Gallagher, 2018).

Supporters of the causal view of cognition would suggest that interacting with technical images requires a causal relation that enables the recollection of an existing memory but does not constitute it. In light of Wade and colleagues' experiment, is it possible to develop a sense of self—and, by extension, reflect on ourselves—without relying on the plethora of technical images of us distributed in today's physical and digital environments? Current waves (i.e., trends) in the extended mind theory have partially addressed these concerns.

Before diving into these waves, we clarify that our aim is not to reiterate years of discussions about these waves and the metaphysics behind the extended mind (Carter et al., 2014; Gallagher, 2018; Kiverstein & Farina, 2011; Sutton, 2007, 2008, 2010; Wheeler, 2011, 2018, 2019). Nor are we committed to resolving or providing argu-

ments against the "coupling-constitutional fallacy".[1] While we mention the various positions these waves have taken regarding the degree of extensionality of the mind, our focus in the following paragraphs is to develop a more dynamic ontology that presents novel epistemological considerations on the constitutive relations existing among things, people, and sociocultural practices.

2.1 Parity principle

As Clark and Chalmers (1998) famously stated, "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 recognizing as part of the cognitive process, then that part of the world is (so we claim) part of the cognitive process" (p. 8). In this straightforward concept, the so-called Parity Principle (PP) gave way to what was later defined by John Sutton (2010) as the First Wave of the extended mind. According to the PP, cognitive processes extend into things in the world and generate mental states when they have the same functional role (Menary, 2007; Wheeler, 2011, 2019; Clark, 2008). The PP seemingly suggests that things play some role in cognition. Yet, in purporting the existence of a functional equivalency between inside and outside, the PP presents three drawbacks in addressing our questions regarding the constitutional role of technical images for the self: (1) that things extend cognition when information is involved, meaning that cognition operates in terms of (external or internal) contentful representations (Myin & Zahidi, 2015); (2) it requires pre-existing philosophical concepts of what qualifies as a cognitive process, reiterating ontological discussions between inside and outside; (3) it raises questions about the actual role that things play in cognition (Malafouris, 2019; Menary, 2010a; Kiverstein, 2018). While we do not suggest that the PP prioritises internal over external processes, its interpretation does not help clarify what counts as cognitive.

2.2 Complementarity principle

Building on the proposition made by Clark and Chalmers (1998) that external entities help to extend our biologically inherited cognitive capacities, Sutton (2008) emphasised that "neural, bodily, *material and social resources can complement one another* while retaining their own dynamics in making their distinct contributions to integrated cognitive systems" (p. 38; emphasis added). According to this formulation of the Complementarity Principle (CP), the external world enhances and augments human biological resources to achieve cognitive tasks that would otherwise be impossible to perform by humans alone (Gallagher, 2018; Kiverstein & Farina, 2011; Sutton et al., 2010; Sutton, 2010). Through embodied action, cognition is softly assembled from various neural and extra-neural resources in the environment (Clark, 1997; Wilson & Clark, 2009). Thus, for proponents of this Second Wave, external

[1] The idea that "one cannot simply move from an observation of a causal dependency between cognition and the body and the environment to the conclusion that cognition extends into the body and environment" (Adams & Azaiwa, 2010, p. 91; for a defence of the extended mind against the coupling-constitutional fallacy, see Piredda, 2017).

entities do not have to be functionally equivalent to internal processes to cooperate towards solving a specific issue (Sutton, 2010; also, Hutchins, 1995; Tribble, 2005).

While discussions around the First Wave are, to a certain extent, more straightforward, complementarity has been interpreted in various ways (and not necessarily in extended terms; see Gallagher, 2018). Some have suggested that things must have some functional integration to partake in cognitive processes (Colombetti & Krueger, 2015; Menary, 2007; Sterelny, 2010; Sutton et al., 2010). For these scholars, the mind extends only when inside and outside are fully integrated, producing a new kind of cognition (Menary, 2007, 2010a). This also suggests, more closely aligning with Lambros Malafouris' Material Engagement Theory (MET) (2013), that external and internal mutually reinforce one another: things shape humans' minds, which in turn shape our interactions with them. However, while for Malafouris things constitute cognition, as will be detailed fully in Sect. 3, discussions in the Second Wave typically regard an external element (i.e., things and social institutions) as something that informs how we think about the world "but does not constitute the supervenience base for my belief-forming processes" (Menary, 2013, p. 32). The same applies to Rowlands (1999), for whom external elements and associated practices causally scaffold cognition but do not constitute it.

More generally, several concepts, theories, and explanatory models focus on the various ways in which cognition is shaped by the materiality of both body and world: thinking is not merely extended but can also be experienced through the body (i.e., embodied); it is influenced by external sociomaterial resources (i.e., embedded); it arises from the dynamic interaction of brain, body, and the sociomaterial world (i.e., enacted); and it partakes within a network of heterogeneous resources in space (i.e., distributed). Collectively, these views go by the name of 4E cognition and constitute the epistemological ground upon which we intend to build our proposal (Newen et al., 2018; Menary, 2010b; Rowlands, 1999).

2.3 Beyond PP and CP: ecological-enactive cognition

To overcome some of the points discussed in the First and Second Waves, a Third Wave in the cognitive sciences is emerging within the 4E galaxy. We identify two primary currents: (1) predictive brain theory and (2) ecological-enactive cognition.[2]

The first attempt originates from Clark's (2016, 2023) recent developments on the predictive brain (also Nave et al., 2020). His way of bringing together brain, body, and world draws on the hypothesis that brains analyse sensory inputs to predict the possible outcomes based "on sets of causes distinguished only by their relative (and context-dependent) probability of occurrence" (Clark, 2013, p. 182). The brain does not operate by accumulating information. Rather, sensory inputs are assessed and analysed by a cascade of hierarchical processes that contrast past input-output experiences to predict possible mismatches and generate the most suitable output for a specific activity depending on the situation (Rao & Ballard, 1999; Hohwy et al., 2008; Hohwy, 2013). The brain is no longer regarded as the centre of cognitive

[2] It is worth noting that an alternative view grounded on mechanist theory that distinguishes causality from constitutionality is under development; see Gallagher's (2018) discussions.

experience but rather as a mediator of human experience.[3] Clark's (2013) assertion is that cognition encompasses "not just the neural elements but spans brain, body, and world" (p. 454).

Clark's formulation of predictive processing benefits from integrating discussions on perception, dreams, and imagination into the extended mind. However, since sensorimotor inputs are analysed through internal probabilistic models tested against past interactions, once external information is acquired, bodily activity in the world becomes secondary (for a critique, see Hobson & Friston, 2014). This perspective seems to reiterate some internalist assumptions. Our primary concern is that the purported idea that a brain coupled with the environment suffices to understand cognitive phenomena appears to overlook the importance of organisms' embodied actions within their environment (but see Clark, 2016, p. 171 on affordances).

Our second concern regards the flow of time and experience. Framing the brain's predictive process in terms of online coupling and decoupling from external resources emphasises synchronicity over diachronicity. The diachronic trajectories that contribute to human cognitive experience—such as learning, enskilment, and the connections between developmental, transgenerational, and evolutionary processes—are at risk of being flattened (cf. Kirchhoff, 2012; Malafouris, 2015; Parisi, 2019; Sutton, 2007). The brain's predictive processing theory is still in its infancy, and we anticipate that future research will address its limitations. Kirchhoff and Kiverstein (2019) make a noteworthy attempt in this direction. They argue that we should not only view the brain as coupled with the environment but also as part of dynamic feedback loops regulated through an organism's embodied interactions. By emphasising embodied action and environmental factors, Kirchhoff and Kiverstein align more closely with the ecological-enactive perspective, the second view we recognise as part of the Third Wave.

In combining enactive studies and ecological psychology (Heras-Escribano, 2021), the ecological-enactive framework suggests that the basic unit of analysis for cognition is an organism interacting within its environment (Chemero, 2009; Di Paolo et al., 2017; Kiverstein & Rietveld, 2018; Rietveld et al., 2018; Fuchs, 2018). This paradigm has emerged as an alternative framework for understanding cognition, further expanding the 4E framework. Significantly, it reframes cognitive capacities "in terms of skilful activities in practices and in terms of the material resources exploited in those practices" (Rietveld & Kiverstein, 2014, pp. 346–347). The mind is therefore *constituted* through the body; it is situated in a highly structured environment; it is non-representational and non-computational (Hutto & Myin, 2013, 2017; Kiverstein & Rietveld, 2018; Rietveld et al., 2018). Consequently, the sociomaterial environments in which people's actions unfold are vital for understanding how humans' modes of acting, thinking, and feeling become *constituted* through practices involving things and people (Malafouris, 2019; Rietveld, 2008; Rietveld & Kiverstein, 2014).

[3] Predictive brain theories generally work within the cognitivist framework (e.g., Hohwy, 2013; Jehee & Ballard, 2009). Conversely, Clark (2016) defines the brain not as an internal probabilistic machine but "as an action-oriented engagement machine" (p. 1).

Ecological-enactivism is further reinforced, at least as we understand it, by Kirchhoff (2012). He suggests that the "brain gets enculturated through development in socio-cultural practices" (p. 288) and that the organism is not necessarily the prime mover of cognition. As such, cognition is not centred on the individual or organism but is the whole emergent system composed of dynamic and distributed elements. Thus, cognitive processes are not only causally linked through bodily interactions with things or people, but direct recursive linkages among organisms and environments constitute these processes.

Between the brain predictive processing and ecological-enactive view, the theory that aligns with our suggestions in this paper regarding the constitutional role of technical images for the self is the ecological-enactive stance. While constructing a more holistic cognitive science that considers the whole body-brain-environment system, the predictive brain theory still seems to retain the idea that cognition depends on an individual's capacity to manipulate information online. Whether this theory will develop into a full-fledged unified account without succumbing to the internalist pitfall depends on how future research examines the relationship between internal and external factors in real-world scenarios. Conversely, ecological-enactivism comes closer to dissolving the internal and external boundaries we are trying to overcome here and reinforces our efforts to transition towards a more dynamic ontology where cognition is constituted through sociocultural practices.

What we argue is still missing from the Third Wave approaches discussed above is a more detailed case for the mediational and constitutive roles of things and their correlated practices that account for their temporalities and histories (Sutton, 2002; Malafouris & Renfrew, 2010; Overmann, 2023; Malafouris, 2019). That is, an argument that seeks to dissolve the ontological boundaries between inner and outer realms while emphasising the specificity of sociomaterial situations that uniquely mediate a historically defined experience, thereby reinforcing ecological-enactive commitments (as suggested in Sutton, 2010).

3 Interdisciplinary interlude: cognitive archaeology and media theory

3.1 Cognitive archaeology

Malafouris' (2013) MET is crucial to further supporting our proposal, as it directly addresses questions regarding the co-constitutive role of things in human cognition.

Human cognitive life is, to use Malafouris' (2020) words, "a process genuinely m*ediated and often constituted* by things" (p. 4; emphasis ours). Specifically, this process is enacted during actual occasions of material engagement: that in-between "zone in which brains, bodies, and things conflate, mutually catalysing and constituting one another" (2013, p. 5). Hence, thinking does not concern only the *aboutness* of cognition (i.e., we think *about* things) but "our ways of think-ing are better described as modes of thing-ing", i.e., "the kind of thinking we do primarily with and through things" (2019, p. 7). Moreover, as we are born in a material world that pre-exists our birth, we adapt to the ways things suggest to us according to already-established

traditions of production and consumption (Gosden, 2005; Prezioso, 2024). Therefore, we propose that the linkages among organisms and environments occur over several timescales; things, practices, and humans each have their temporalities that converge in the context of material engagement (Gosden & Malafouris, 2015).

This position on the co-constitution and dependency between cognition and things, implicit in ecological-enactivism and fully developed in MET, aligns with theoretical advancements in the philosophy of technology. Postphenomenology, for example, underscores the importance of the interactivity of various technologies on human cognitive and social life (De Mul, 2002; Ihde, 2003; Verbeek, 2005; see contributions in Friis & Crease, 2015). As Don Ihde and Malafouris (2019) demonstrate in their exploration of the mutual dependency between people and things, MET and postphenomenology share two commitments. The first is the inseparability between people and things, from which cognition emerges as being linked and mutually constituted by the relationship with things (Ihde, 2009; Malafouris, 2019). The second is a rejection of substance ontology in favour of a process ontology that emphasises the continuity among technologies, tools, and varieties of things in the continual constitution of the mind (Gosden & Malafouris, 2015; Malafouris, 2021).[4]

3.2 Media theory

Media theory delves into the core of this phenomenon. Since mediation is a process that encompasses more than just technological stuff but captures the essence of the anthropogenic process, for media scholars every human experience is unavoidably mediated (see Stiegler, 1998). To grasp this, it is worth reconsidering the general perspective on media: they are not merely things we use; they are fundamentally "elemental". Air, water, fire, and earth mediate our phenomenal experience, yet they are frequently theoretically "taken-for-granted" and not recognised as active agents (Durham Peters, 2015, p. 1). Similarly, certain artefacts exhibit environmental qualities, such as screens that modulate spatiotemporal coordinates, sensorimotor surroundings, and ultimately, the sense of presence (for an overview, see Carbone & Lingua, 2023). Media ecology is a vast and heterogeneous field of research where the distinction between the things we use and the spaces we inhabit is methodologically blurred, favouring an uninterrupted continuity between media and ecology, encapsulated by the term "ecomedia" (Parisi, 2021; López et al., 2024).

Within this broad context, Richard Grusin's (2015) concept of radical mediation clarifies the synergies between our proposal and technology studies. Grusin argues for an unexplored, radical dimension of technological mediation that extends beyond the production and consumption of information. For him, media and media technologies "generate and modulate individual and collective affective moods or structures of feeling among assemblages of humans and nonhumans" (p. 125). They do so because mediation operates, as he argues, "physically and materially as an object,

[4] According to substance ontology, elements in the world are entities best conceptualised as persisting things (Broackes, 2006). As such, their being is characterised by stability over time, which captures the intrinsic and immutable essence of things as entities. Deeply engrained in Western philosophical thought, this ontological stance emphasises hylomorphism, for which individual substance is always a combination of matter and form (Ingold, 2012).

event, or process in the world" (p. 126).[5] Radical mediation does not merely presuppose linkages among pre-existing entities. Conversely, "mediation should be understood not as standing between pre-formed subjects, objects, actants, or entities but as the process, action, or event that generates or provides the conditions for the emergence of subjects and objects, for the individuation of entities within the world" (p. 129). Radical mediation also emphasises human becoming as an immanent, situated, enactive, ecological, distributed, non-representational, and relational process, in line with MET and ecological-enactivism.

As we further develop below, a close reflection on media theory, particularly radical mediation, is essential to liberate orthodox cognitive approaches from biases. It suffices to say that cognitive sciences, even those approaches that strongly recognise the role of the environment and tools for cognition, largely maintain an anthropocentric perspective: a perspective that media scholars work to reduce. In proposing a convergence between media theory and ecological-enactive cognition, we emphasise one crucial point: things and people are ontologically indivisible entities that catalyse and mutually shape one another (Ihde, 2009; Ihde & Malafouris, 2019). From simple tools to more sophisticated media technologies, things mediate human cognition: they set the conditions (i.e., modulate) by which thinking, acting, and feeling are constituted in action.

This mediational role of things also implies the ever-changing nature of ecomedia: the capacity to change and adapt things to the sociomaterial coordinates at hand. In purporting a marriage between media theory and ecological-enactivism, we are dedicated to understanding how the mediational nature of things works synergically with their constitutive nature to organise thoughts, actions, and feelings.

In advocating for a framework that integrates 4E paradigms with ecological-enactivism, MET, and radical mediation, we claim that cognition is constituted *with* and *through* things within specific sociomaterial environments. Our modes of thinking, acting, and feeling can only take place in situated contexts under particular sociomaterial coordinates (Hutchins, 1995) and moments in time (Malafouris, 2015; Parisi, 2019). These insights align with the discussions surrounding the Third Wave of cognitive studies.

Although theoretical trends are converging towards a more mediational and constitutional understanding of the extended mind, there is still little agreement on how this applies to things and sociocultural practices (Malafouris, 2018; Wheeler, 2010). This misalignment partially stems from years of theoretical advancements in cognitive science. Specifically, we illustrate below how the lingering informational paradigm in some studies limits our understanding of the mediational and constitutive roles of things and practices in cognition, proposing an alternative view on things as records.

[5] Similar propositions for a situated, immanent, and relational nature of human experience can be found in Barad's (2007) "intra-action"; Latour's (2012) notion of "translation"; Simondon's (1989) "individuation"; and Dewey's (1938) transactional idea of action.

4 The role of (automatic) records in cognition

As cognitive archaeologist Colin Renfrew remarked, "Prehistory ends, in a sense, when history begins: with the written word" (2007, p. 203). Writing, of all human productions, has been the most studied in fields like philosophy and archaeology because it accumulates and communicates information. With the advent of informational systems and mass communication technologies, records production has generated what Floridi (2014) calls the "Fourth Revolution" (pp. 90–98), defining reality as an "informational environment constituted by all informational entities, their properties, interactions, and processes, and mutual relations": the infosphere (p. 41).

In this hegemony of information, what role is left for things? And, more importantly for our aims, what role can things have in cognition from this informational perspective? The constituents of an infosphere are merely informational types: surfaces that can be inscribed with information, regardless of their nature. Floridi describes how things are rethought as abstract entities reduced to bundles of easily replaceable information. We argue that there is something more within the infosphere: recording acts and the resulting records.

4.1 Beyond information: the materiality of records

Innis (1950), a prominent media ecologist, linked the power of past empires to the materiality of their records, highlighting the systemic coupling between cultural history and record production. Although his interpretation can be critiqued for being too deterministic in its deeper implications, we share the idea of the systemic coupling between cultural history and records production. The philosopher Ferraris (2022) recently argued that we are living in a revolution where "recording precedes communication" (p. 3). The immediacy of information exchange among people and technologies in hyperhistory — our historical moment characterised by rapid developments fuelled by technological advancements (Floridi, 2014) — is facilitated by recording acts, producing records that mediate and constitute human relationships, values, actions, and thoughts. If recent communication technologies allow (hyper) fast travelling information, it is because the infosphere rests on the "docusphere" — the accumulated traces of human actions and thoughts stored in records (Ferraris, 2020). At the core of this "documentality" are all those technologies that record people's actions and thoughts into various documents, enabling users to share them with multiple recipients. These records possess the potential to generate future information and communication. Consequently, the emphasis here is on the *recording process and the resulting records rather than the information itself.*

From an archaeological and cognitive perspective, humanity has always been defined by its recordings. Donald (1991) explored the evolution of the human mind, emphasising how the development of human cognitive faculties is closely intertwined with mark-making. He argued that "visuographic invention" — the symbolic use of images and icons — evolved over generations, leading to more elaborate writing systems and enhanced cognitive abilities (p. 275). This transformation was not merely about accumulating information across different visual symbolic systems, as Donald maintained. Instead, we argue that it was how these systems shaped cognitive

processes, enabling new modes of engaging with them (see the example of numeracy, Overmann, 2023).

The key issue concerning "inscription media"—the various ways humans mark surfaces to record and transmit content—is that they transform human relations with space and time. In fact, "what is most important about writing as a medium [is] the temporal reversibility that spatialization makes possible" (Durham Peters, 2015, p. 304). Recordings make human affairs enduring in time but require space; transmissions spread human affairs across space (now at the speed of light) but require time: "telegram cuts across geography; an engraving cuts across history" (p. 306). Mark-making is crucial as it disembodies humans from their flesh, transferring their essence to matter. Through acts of mark-making, i.e., interactions between brains, bodies, and things, humans have engaged in non-representational ways, opening new possibilities for actions and thoughts (Malafouris, 2021). Recording acts and resulting recordings have always been at the heart of (doc)humanity (Ferraris, 2022).

The transition from information to records and the associated recording process is essential for understanding that informational objects, such as texts, images, or anything in between, are not merely vehicles for the information they convey. Rather, they are "fossils" whose meanings differ from the original intentions that motivated their production. Much like a fossil, informational objects carry two kinds of information. The first is the information intentionally inscribed by the person who recorded it. The second is the information that we, as deferred interpreters spatiotemporally removed from the original context of its production, project onto the object. This conception shifts the focus from information per se to the mediational capacities that things, as records, have to organise a potential for future thoughts, actions, and feelings, thereby highlighting their role in shaping cognition.

4.2 Automatic ecological records: the case of photography

These discussions on records clarify two main arguments regarding our proposal. First, things are not mere informational entities but part of a broader ecology capable, among many other things, of also communicating information. Second, despite the hegemony of information, records have always played a crucial role in human becoming, constituting people, societies, and institutions. To explicate our theoretical propositions better, we now focus on a specific, recent type of record and recording act: technical images, here exemplified in the object of photography.

We selected photographs as a case study because they are *automated ecological records* that capture the world rather than merely representing it. Unlike other images, technical images are not produced by human hands, as in mark-making, but are natural representations (Currie, 1991) involving minimal human intervention. While it may seem obvious, this fact is revolutionary in the history of mediation: photographs are not signs, symbols, or any other codified elements that requires to be deciphered. They are optical records where the maker's intention is either erased or, at least, heavily conditioned by mechanical features. This automatic and mechanical nature grants photography an unprecedented representational *automaticity* and *autonomy*, disclosing non-human aspects of documentality. This last aspect is essential from our perspective: by focusing on recording acts instead of information exchange, the non-

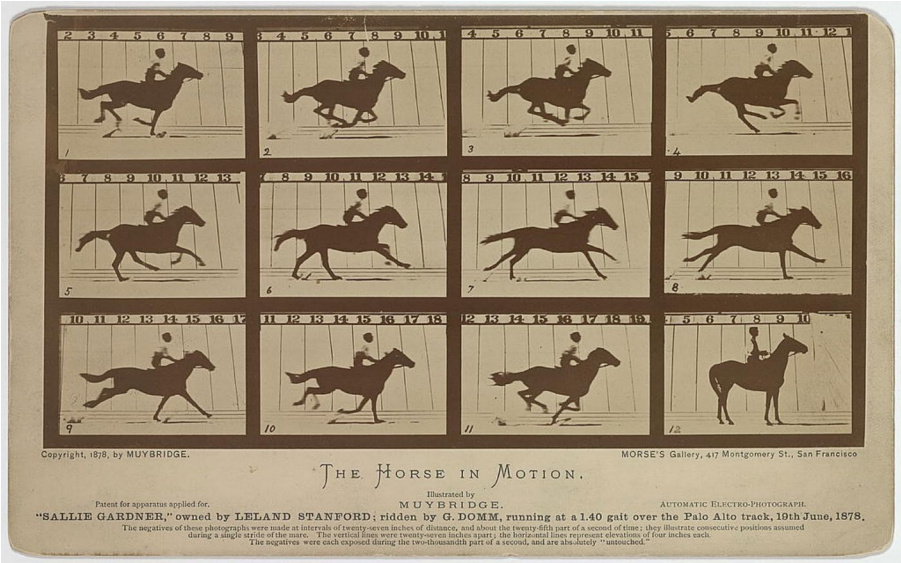

Fig. 1 Eadweard Muybridge's series of small photos of individual racehorses showing successive leg movements. Photograph taken at Palo Alto track, California, in 1872 (Retrieved from the Library of Congress, https://www.loc.gov/item/2005684184/)

human, material facets emerge. This fact acquires an even greater significance when recording processes become automated. The human presence, traditionally guaranteed by the physical appearance of a speaking body, acquired a radically ghost-like form in an unparalleled manner (see Durham Peters, 1999). Automated recordings gave rise to a whole new way of being present, causing, as we shall see, a profound shift in all aspects of human life.

Automaticity concerns the mechanical independence of the photographic device. In 1840, just one year after the invention of photography, Poe (1840) described the new medium as "the most important and perhaps the most extraordinary triumph of modern science" (p. 37). The reason Poe considered Daguerre's invention to be revolutionary was, in fact, the most obvious of all: as Poe concluded, the daguerreotype could verify truths that were previously impenetrable to the naked eye, such as tracking lunar phases. Although the American poet was aware in the same writing that inventions often have unpredictable consequences—positioning him as a precursor among media ecologists and archaeologists—he nevertheless recognised that photographic technology would forever change the perception of the world.

One notable example is Eadweard Muybridge's series of photographs taken on behalf of Leland Stanford, the American venture capitalist who sought to resolve the disputed enigma between horse enthusiasts and artists: how do horses move while galloping? As straightforward as it might appear, horses' movements were inaccessible to the naked eye prior to these pictures. Muybridge's work enhanced human perception (Fig. 1). His methods informed art and science globally (Solnit, 2003). These pictures irrefutably made explicit that technical means could enhance, extend, and empower (but also reduce) human perception. They not only visually recorded

a fragment of reality but revealed aspects of the world that would otherwise be inaccessible. Automaticity is what makes photography a *singularity*: it produces pictures thanks to a physical process that cuts out human intervention. The description provided by the American doctor Holmes (1980) of photography as a "mirror with a memory" (p. 74) emphasises both its automatic nature and prosthetic character, necessary features for enhancing human vision. *Recording as revealing is then a key feature of photography.*

Autonomy is a direct consequence of automaticity. We should keep in mind that the Greek word from which "mechanic" derives (i.e., *mechanè*) signifies not only "tool" or "device" but also "machination" or "stratagem". Therefore, mechanical automaticity renders photography a *contrivance*, a physical apparatus capable of deceiving while clearly showing itself (like the Trojan horse). This feature gives technical images a unique epistemic status (Cohen & Meskin, 2004). Simply put, we assume that what technical images illustrate can be experienced as a real-world event. We do not deny that photographs have or produce meaning in semiological and discursive ways. They can materially embed values and cultural traditions, reinforcing and perpetuating beliefs about people and societies (Liao & Huebner, 2021). Their autonomy does not immunise photographs from cultural trends. Technical images reinforce and create cultural biases *precisely because they are expected to be neutral* despite being contrivances.

We also recognise that technical images can be faked or doctored. The key point is that, although they circulate within highly codified cultural contexts bearing implicit meanings and values (Bate, 2016), their automaticity and materiality become more significant for their cognitive effects when considered diachronically as automatic records. As McLuhan (1964) famously stated, "the medium is the message": photographs record reality, producing unprecedented effects on memory. Even when altered, their epistemic status produces effects that differ from those of handmade pictures. This double feature of the technical image is central to our discussion.

Throughout our biocultural history, we have encountered autonomous images, such as Narcissus's reflection and acheiropoietic images, like the Shroud of Turin, shadows, and footprints. However, technical images are particularly effective because they combine the recording capabilities of other representations with the depth illusion created by the *camera obscura*. When invented in 1839, photographs enabled unprecedented forms of externalisation, serving as revealing recordings capable of enhancing human perception through direct visualisation of reality (Walton, 1984). Like a mirror, photography enhances our vision and duplicates reality; more than a mirror, it preserves in a picture what is captured at a specific moment in time, disrupting the flow of time and allowing for later access.

In our proposal, photography exemplifies the *archetype of automated recordings*, marking a significant point in history when records became the expression of the human *and* the machine. This discussion brings us back to our central question: what role do technical images play in shaping the sense of self? We investigate this by examining the linkages between self and memory.

5 From the extended to the mediated self: the mediational-constitutional Principle

5.1 Towards a mediated self

Known in the history of thought by various labels, the self, or the problem of "who we are", is a cornerstone of every philosophical and psychological inquiry. Beginning with how the subject (i.e., his/her/their body, needs, desires, beliefs, and so forth) interacts with the surroundings, it is possible to prescribe a given concept of the world. For us, the fundamental premise is recognising that the sociomaterial world plays a significant role in shaping our understanding of the self, far beyond what conventional wisdom and certain philosophical traditions typically acknowledge.

Contemporary cognitive sciences adopt a phenomenological and embodied approach to inform the debate about the self. A commonly accepted definition provided by the philosopher Gallagher (2000, 2005) introduces the distinction between "minimal self" and "narrative self". The first term denotes the self as the "consciousness of oneself as an immediate subject of experience, unextended in time" (2000, p. 15), that is, the immediate feeling of existence as felt by the first-person perspective. The latter refers to "a more or less coherent self (or self-image) that is constituted with a past and a future in the various stories that we and others tell about ourselves" (p. 15).

If the minimal self pertains to the mere possession of a body engaging in its environment, the narrative self refers to a person's explicit and temporally extended experience. This distinction suggests that the minimal self is anchored to a body acting in an environment. In contrast, the narrative self consists of the progressive accumulation of the "stories" we produce about our personal experiences (Gallagher, 2000, p. 19). More than that, the narrative self results from the intertwining of our stories and those of others, along with our memories.

Therefore, in its broader dimension, the self is not confined to our body-brain system but extends to incorporate other individuals, things, and places. Moreover, the stories that typically shape our life narratives, being self-produced or narrated by and to others, do not necessarily reflect actual events. Thus, the narrative self extends beyond the body to encompass things, people, and places, and its content is often a fantasy.

The extensive character of the self appears to be intrinsic to its workings. We can hardly define ourselves without considering the sociomaterial environments in which our lives unfold. Belk (1988, 2016) explicitly addressed the externalist character of the self, suggesting that material possessions are part of an "extended self". The primary claim of the paper is that there can be a conflation between what is felt as "me" and as "mine" by a subject (James, 1890). Simply put, we often consider things around us as part of ourselves by recognising that they belong to us. However, as Heersmink (2018, 2020, 2022) extensively explored, there is more to it than just the extended self.

Interested in exploring how autobiographical memory constructs the narrative self, Heersmink (2018) recently argued that things function as "evocative objects"—things connected to "emotionally-laden past events"—capable of distributing and

scaffolding autobiographical memory (p. 1842). In a way, the pictures presented to the participants in Wade and colleagues' experiments can be regarded as evocative objects, despite the fact that they spur false memories and fabricated narratives. Photographs and narratives complement each other, intertwining in autobiographical memory. This also applies to various media and types of technical images, such as lifelogging technologies (Heersmink, 2020). The dynamics through which evocative things scaffold memory are central to constructing the narrative self and its persistence over time. Thus, for Heersmink (2020), the self is extended and distributed as it is "partly constituted by the web of evocative objects in our lifeworld" (p. 1831).

While we largely agree with Heersmink's proposal, which captures many essential issues regarding how the self extends and distributes in sociomaterial environments, we aim to enhance his argument by incorporating our mediational and constitutional perspective. We emphasise the temporally extended, mediated, situated, and non-human aspects of how the self is constituted through technical images.

This assertion carries significant conceptual implications: there is no "self" without the things that mediate and constitute it; thus, the self is inherently extended—or, as we suggest, ecological. For the PP, cognition leaks into the world under specific conditions, whereas for the CP, things integrate and scaffold thinking processes. For us, all things are evocative: records that mediate and constitute thoughts, actions, and feelings according to their material properties and histories of use.

In this context, technical images possess a unique epistemic status due to their inherent automaticity and autonomy, which are crucial properties for our discussion as key features enabling non-human records (Zylinska, 2017). Since the introduction of photography, the "self" has evolved into a multilayered ontology radically intertwined with the machine and its automatic recording activity. Automaticity refers not only to a process performed automatically but also to one carried out by a non-human thing on behalf of humans. Consequently, non-human, automatic records such as photographs manifestly reveal the ecological nature of the self.

These recordings, at times, reflect purely human intentionality, while at others, they are machinic doubles impressed on matter by automated processes that challenge the idea of a static self. With Muybridge, human vision was extended; today, machine vision is autonomous. This automaticity of the photogenic process undermines the centrality of the agent, favouring a centreless process that mediates and constitutes the self through instances of material engagement.

In contrast to the conventional belief in a static self that can be more or less extended or distributed, we advocate for a more dynamic understanding of the self—one that is continually constituted in the transactions between a situated, constantly changing body and records within a continually changing sociomaterial environment (also, Malafouris, 2024).

5.2 The mediational-constitutional principle

Due to the previously discussed epistemic nature of technical images, both analogue and digital photographs mediate and constitutes our sense of self and gives us a sense of continuity by making our connection with the past apparent and providing a sense of time and being in the here and now. The mediational ability of technical images

has this power because they blend past and present in action. In other words, in line with Heersmink and Neo-Lockean perspectives, we contend that the mediational self hinges on memory.

However, our take on memory has little to do with information processing. For us, memory is a multitemporal process stretching across things and people. This does not mean that memory is located in our brains, the things surrounding us, or in the people with whom we engage. What we refer to as memory is a continuous process that emerges from an organism's transactions with a sociomaterial environment made of people, things, and practices (Prezioso, 2024). As a result, remembering a memory is more than just a mental act detached from the environment; remembering, or better "re-enacting", refers to the adaptation of past modes of materially engaging *with* things and people *through* sociocultural practices according to all timescales: the evolutionary trajectory of the human species, the developmental history of the individual, the transgenerational trajectory of sociocultural practices, and the situated coordinates of the present moment (Prezioso & Alessandroni, 2023). Thus, if technical images mediate the self, it is because of how memory and re-enacting operate.

In the case of the doctored photographs (Wade et al., 2002), participants re-enacted personal memories by engaging directly with the pictures. As they interacted with the doctored photos, their eyes followed the lines composing the subjects depicted, triggering the recognition of familiar faces, glimpses of old places, and shapes of long-lost objects. Their thoughts about their "self" were re-enacted due to the physical properties of the photographs and their histories of material engagements with other images of themselves, the people, and the things depicted in the pictures—often informed by others' stories. At that moment, their memory, comprising the narrative of facts and experiences developed since childhood, was updated and adapted according to the mediational and constitutional properties of the photograph. In short, when engaging with a technical image, what we are becomes intertwined with what we were, shaping what we think and feel about ourselves and updating our memory in the here and now.

Central to our arguments is that technical images, such as photographs, mediate the self by constituting an individual's memory due to their physical qualities as automated records and epistemic implications. These qualities help us to re-enact our thoughts and feelings about ourselves because technical images mediate our material engagements with them due to their content, constituting the narrative upon which we ground our personal story in accordance with the present sociomaterial environment. Both digital and non-digital photographs organise a narrative of chronologically arranged events that shape a sense of self and its continuity over time.

Moreover, while our history of interactions with technical images produces a sense of continuity in our narratives, we should not regard this continuity as fixed. The self, hinged on memory, is equally in flux: organised and updated by the sociomaterial coordinates of the particular moment we reflect on ourselves. This means that the meaning we ascribe to our self now might differ from what we believed in the past, creating a potential for how we will think about ourselves in the future. For example, a photograph may have constituted feelings of loss, but now it might evoke pride in overcoming challenges. At times, our sense of self is rooted in fantasies, constituted through the dynamic mediation of technical images. In short, our sense of

self is unstable. It emerges at various times, mediated and constituted by our histories of engagement with technical images, people, and things, shaping our ever-changing personal and subjective narratives.

Of course, technical images are one of the many examples, albeit a unique one, of environmental elements that extend the extended self. As discussed in Sect. 4, we have always been surrounded by records and recording acts. For us, the extended self extends not only in technical images but encompasses varieties of long-lasting sociocultural practices and things that catalyse each other in constituting how we think about ourselves in different sociomaterial environments.

Reflecting on the above discussions, we propose an updated Third Wave of the Extended Mind based on what we term the Mediational-Constitutional Principle (MCP). According to the MCP, cognition is *mediated* and *constituted* in sociomaterial environments *through* embodied organismic transactions *with* things and people. Cognition is a multitemporal process continually enacted in the context of material engagement with surrounding ecomedia. While "mediation" emphasises the recursive nature of things and correlated practices, "constitution" underscores that cognition is widespread in space and time. The distinction between mediation and constitution is subtle yet significant. Mediation highlights that the constitutive environment where cognition unfolds is not merely a natural landscape but a complex matrix of nature and things. Importantly, by virtue of their material qualities and histories of engagements, these things organise organisms' transactions with their environment. As such, different things lead to different modes of constituting cognition. In simple terms, mediation explains why constitution is neither fixed nor universal but depends on the specific sociomaterial coordinates where organismic actions unfold.

Long-standing sociocultural practices with things are precisely what mediate organisms' interactions in their changing sociomaterial environments, constituting modes of thinking, acting, and feeling. Therefore, it is the organism-enaction-environment that generates the possible conditions to constitute our thoughts, actions, and feelings in the present and for the future. As a fundamentally temporal and situated process, cognition is locationally uncommitted. Consequently, the MCP is all about a view of cognition where diachronic processes take precedence over synchronic processes.

This proposal for an MCP has several implications.

Firstly, if cognitive processes emerge, they do so not through processing information but from interactions with things in the environment that shape our actions, thoughts, and feelings. Thus, if cognition is not solely about processing information, thinking is a distributed phenomenon mediated through sociocultural practices and material engagement.

Secondly, the fact that cognitive processes occur in the present is not the same as saying that they do not unfold over timescales. Rather than viewing constitution in terms of synchronic relations between internal or external elements, we should reconsider constitutionality in purely diachronic terms: as a process continually mediated by organismic transactions with things and people. Thus, practices with things and their mediational capacity become central to understanding how human cognitive resources are constituted.

Thirdly, if cognition is completed by being temporally, spatially, and socioculturally situated in ever-changing environments, this multitemporal distribution of things and people constitutes the boundaries of cognition. As a multitemporal process, the dynamics of cognition are continually under discussion and can produce expected outcomes and unexpected consequences. Thus, what were once external elements are now cognitive components of an assembly where environmental elements exist in continuity with cognitive processes.

Ultimately, things mediate and constitute cognitive processes, connecting organisms and environments. Rather than focusing on interactions between things and people viewed as pre-existing static entities, we suggest that understanding cognitive phenomena necessitates investigating the always-changing synergies that emerge through sociocultural practices among things and people across varying human and material timescales.

6 Final remarks

In light of the earlier discussions on cognitive archaeology and media theory, we put forward three significant implications for studying the extended mind in accordance with our formulation of the MCP.

First, we suggest that cognition is not causally linked solely through bodily interactions with external elements but emerges through dynamic, recursive relationships between organisms and their environments. These relationships mediate and constitute cognitive processes, implying that cognition is always extended in the environment and realised through meaningful acts of material engagement *with* things *through* sociocultural practices. This implication bears a significant shift: cognition emerges from interacting with our environments instead of information processing.

Second, we challenge the dominance of information processing in theories of human cognition by emphasising embodied interaction. In the case of Kimberly Wade and colleagues' (2002) study, the physical properties of the photograph, combined with participants' histories of material engagement with other technical images and personal narratives, re-enacted the history of past engagements with and through pictures. What they thought and felt about their "self" at that very moment was not a mere recall but a dynamic adaptation mediated and constituted through the image, its material qualities, and the sociomaterial context in which it was encountered. Thus, cognitive experience emerges through meaningful action rooted in the multitemporal history of engagements people built with technical images. By "multitemporal", we refer to the history of photography as automated ecological records, the developmental trajectory of the person, and the transgenerational memory of sociocultural practices involving technical images.

Finally, we argue that things are not merely information carriers but active participants in shaping cognition. Instead of being static informational entities, we emphasise the importance of considering things as records that cannot be disentangled from their recording processes. The case study of photographs discussed in Sect. 4 exemplifies this concept because they are *automated ecological records*. Unlike other forms of representation, they capture the world with minimal human intervention,

providing a natural representation. We do not assert that things cannot communicate information. Yet, their cognitive significance lies in their material presence and the sociomaterial practices accumulated through their history of material engagements.

Once the MCP is considered, the implications for our understanding of cognition and the boundaries of the mind become more dynamic. Instead of being fixed or extended only if certain circumstances are met, *these boundaries constantly extend and shift in response to the situated sociomaterial context* comprising people, things, and sociomaterial practices—each possessing its own temporal dynamics. Consequently, we advocate for a shift in how we study the mind, emphasising the mediational role of things and the centrality of time in cognition. Instead of prioritising information, we propose examining sociocultural practices and their diachronic development, as cognition is constituted through ongoing material engagements across multiple timescales (also Kirchhoff, 2012; Malafouris, 2015, 2024). It is crucial to recognise that these temporal factors are embedded in the sociocultural practices we re-enact daily and must be considered in any comprehensive understanding of cognitive phenomena, including the self.

With the MCP, we propose a diachronic approach in cognitive science, moving beyond information processing to explore cognitive phenomena in innovative ways. Recognising the mediational and constitutive role of things emphasises the need for a critical examination of how they shape cognition across various timescales of interaction.

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