Chapter 19
Embodied Cognition and the Archaeology of Mind: A Radical Reassessment

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Introduction: The Internalist View

Evolutionary cognitive archaeology (ECA) is a relatively recent field that attempts at reconstructing the properties of past cognitive systems from the material remains identified within the archaeological record of ancient hominins. During its first era, this discipline was deeply influenced by cognitivist accounts about the evolution of the mind, and in particular evolutionary psychology (Barkow et al. 1992; Buss 2012; Cosmides and Tooby 2013). According to this view, natural selection designs the mind as a series of computational systems, which use internally specified and brain-bound mental representations to identify and appropriately respond to adaptive problems (e.g., environmental, socio-demographic, or nutritional; Tooby and Cosmides 1992; Symons 1992; Barrett et al. 2014, p. 2; Delton and Sell 2014). In particular, mental representations encode knowledge about the world, which is deployed to filter and decode relevant perceptual input and turn it in the most appropriate behavioral output (Hurley 2001; Tooby and Cosmides 2005; Miłkowski 2013; cf. Malafouris 2013, pp. 25–29). Cognitive evolution is therefore seen as the incremental addition of new computational systems coupled with the enhancement of older ones (e.g., Mithen 1996, 2014; Carruthers 2006). At the same time, culture, including artifacts, institutions, traditions, and systems of values, is conceived as information stored within evolved neurocognitive systems, which is transmitted downstream through social learning, made concrete through a set of goal-oriented operations, and ultimately selected for its adaptive value (e.g., Mesoudi et al. 2006; Mesoudi 2011; Richerson and Boyd 2005). This view implies that culture evolves with approximately the same mechanisms as biological systems. Indeed, cultural traits are distributed along patterns of variation, transmitted to offspring, selected for their effects on fitness, subject to drift, and thus ultimately understandable through the concepts and methods of Darwinian evolutionary theory (see Goodale and Prentiss and Laue, this volume for review). Accordingly, some scholars consider cognition and culture as separate and yet complementary systems, which coevolve following a dual inheritance logic (after Boyd and Richerson 1985). Within this framework, biological selection operating on cognitive functions and neural substrates is paralleled by cultural selection acting on artifacts and other practices, while these dimensions mutually influence each other. Grounded in this background, ECA initially focused on the

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identification of artifacts within the archaeological record, which could mark the selection of such representational and computational mechanisms. Conversely, this discipline attempted to identify the appearance of the "algorithms" responsible for bringing these artifacts into being (e.g., Mithen 1994; see Mendoza Straffon and Abramiuk this volume for review). For example, the emergence of progressively more sophisticated utilitarian tools in human prehistory was associated to the selection of internal visuospatial algorithms, possibly specific to toolmaking and technical intelligence (Wynn 2000; Silverman 2002; see German and Barrett 2005 for a more general perspective).[1] A crucial part of this program in ECA implied identifying the time in prehistory when humans became "what they are today", namely, they acquired the condition of behavioral and cognitive modernity (Mellars and Stringer 1989; Conard 2010; Shea 2011). In evolutionary psychology terms, this program required finding out the archaeological evidence for the acquisition of the algorithms and representations universally shared by ethnographic human populations. Consequently, scholars have been grappling with defining appropriate categories of artifacts that could constitute the hallmark of modernity (McBrearty and Brooks 2000; Wadley 2001; Henshilwood and Marean 2003; see also Shea 2011, for discussion). With this respect, the aforementioned utilitarian behaviors did not appear as particularly promising for capturing this concept, since archaic hominins showed capable of quite sophisticated pragmatic behaviors (Mania and Mania 2005). For example, the miraculously preserved wooden spears excavated at Schöningen, Germany, and associated with *Homo heidelbergensis* at ca 320 ka in the Lower Paleolithic (Thieme 1997) support the existence of ambushing tactics and coordinated social maneuvers, which add upon the already complex operations required for carving the spears out of a tree shaft (Thieme 2005; Haidle 2009). Nevertheless, while these hominins were undoubtedly characterized by a level of sophistication in technical abilities comparable to that of early modern humans, for some scholars they lacked a uniquely modern cognitive ability, which marked their difference with modern humans—symbolism (Chase and Dibble 1987; Henshilwood and Marean 2003; d'Errico et al. 2005, p. 4; Nowell 2010; Pettitt 2011; Barham 2013, p. 347).

A common line of argument in ECA maintains that symbolism is the outcome of a quite derivate evolutionary process. Specifically, natural selection provided hominins with the ultimate capacity for internally representing and ascribing meaning to material items, thereby leading to the evolution of the "modern" cognitive architecture (e.g., Mithen 1996; Henshilwood and Dubreuil 2009, 2011). This architecture is considered to explain the origin of quintessential examples of "symbolic artifacts," such as bodily painting and ornamentation currently bound to early modern human Middle Stone Age contexts in Africa (Henshilwood et al. 2004; Bouzouggar et al. 2007; d'Errico et al. 2005; d'Errico and Vanhaeren 2007; Vanhaeren et al. 2013).[2] In sum, this "internalist" view in ECA depicts cognitive evolution as a series of updates within a symbolic code bound to the brain, which culminates in the ability to build material representations of brain-bound representations, namely, a form of "outer" symbolism (see also Abramiuk this volume). During the latest decades, internalist ECA reached center stage in the cognitive evolution debate and currently keeps motivating, at least indirectly, the search for modernity in contemporary archaeological research.

[1] A similar mechanism can explain, for example, the shift from the Oldowan single-edged cutting tools to the grossly symmetric Acheulean industry at ca 1.4 ma and lately to the coherently symmetric ones of the Late Acheulean at ca 600 ka (see Wynn 2002, for review). Specifically, the combination of an adaptive problem (e.g., butchering animals) and some utilitarian reasons (e.g., maximizing cutting efficiency) selected for the ability to first process bidimensional symmetry and then appreciate the tridimensional coherence between the two sides of a handaxe. This augmentation was based on the addition of mental representations for symmetry and the computational bases for mentally rotating and comparing the two faces of the artifact in an increasingly more accurate way (Silverman 2002).

[2] Nevertheless, some researchers contend that the same categories of artifacts appear also in late Neanderthal Middle Paleolithic sites in Europe, thus showing that cognitive and behavioral modernity are not bound to hominins' physical anatomy (d'Errico 2003; Zilhão 2007; Peresani et al. 2011; Radovčić et al. 2015).

Problems with Internalism

During the last 15 years, criticism arose about the core assumptions with the internalist paradigm in ECA. Firstly, skeptics argued that this view has deterministic implications, because on the one hand internal functions are considered inevitably coupled with specific behavioral outcomes (Tallis 2011). On the other, such functions are entirely shaped through a mechanism of random mutation and passive selection (e.g., Dawkins 1982, quoted by Riede, this volume). Specifically, spontaneous events of mutational enhancement alter the internal computational machinery, by providing a pool of possible algorithms/representations and resulting behaviors. Subsequently, natural selection eliminates the maladaptive cognitive-behavioral packages, thereby creating the modern cognitive architecture provided with the complete set of modern behaviors. This mechanism allows explaining the alleged existence of cultural universals, which at least in their general form are supposed to characterize all contemporary human cultures (e.g., Buss 1994; Atran 1998; Boyer 2001).

This account, currently known as the neo-Darwinian view of cognitive evolution (Ingold and Palsson 2013), encountered resistance at the empirical level, since several scholars argued that both ethnographic and experimental evidence do not confirm the existence of such cultural and cognitive universals, nor do they mark the presence of an inflexible relation between cognition and behavior (Buller 2005; Everett 2005). At the same time, from a theoretical point of view, this view faces the problem of agency, because it reduces humans to mere replicators of internal codes (Ingold 2007) and artifacts to epiphenomena of the mind (Malafouris 2016; Iliopoulos and Garofoli 2016). No room is left within this conception for intentionality, development, and the active construction of the human lifeworld.

Similarly, the internalist view faces problems in explaining the evolution of hominin sociality. Evolutionary changes are indeed confined within an isolated mind, which at the same time coexists with a series of many other individuals and objects. Far from being based on actual relations between people and things, hominin sociality is thus reduced to the juxtaposition of many independent codes (Di Paolo and De Jaegher 2017, p. 94), which are stabilized by natural selection over time through the elimination of unfitting ones, until a sustainable equilibrium is reached. Secondly, the internalist view appears as a contemporary version of Cartesian dualism, according to which mental representations stand as a mental substance divorced from the physical world (Thompson and Cosmelli 2011; Malafouris 2013, chap. 2). These representations are considered to have content, in that they are "about" the world or the body in a truth-conditional way, namely, they provide true descriptions of reality (Evans et al. 1982, pp. 226–227). Natural selection can alter these representational contents, in order to accommodate adaptive needs (e.g., Delton and Sell 2014).

Nevertheless, representationalism is confronted with serious metaphysical problems that threaten its validity. A fundamental issue lies in the fact that it is unclear how changes in the physiological state of neurons that are in *structural correlation* with the external world can become *about* it (i.e., acquire representational content). Indeed, such a structural coupling per se does not generate aboutness, unless we assume that either content is an irreducible property of the world to which neurons get connected (e.g., Chalmers 2010), or there exists a homuncular system within organisms' brains that decodes stimuli through an interpretive code (call this the "Hard Problem of Content" after Hutto and Myin 2013, 2017, 2018). Furthermore, two additional but related issues affect mental representations, respectively, the problem of substance and origin (Zahidi and Myin 2016). According to the former, if mental representations are supposed to exert actual changes on the brain-body-world physical system, then they require a plausible and realist ontological characterization (i.e., what representations really are; see also Hutto and Myin 2017, Chap. 2). According to the latter, it is necessary to explain the derivation of such representations (i.e., where they come from; see Zahidi and Myin 2016) and, in particular, how content can be inscribed in the brain more than it could be in any other aspect of the material world (i.e., why only neurons can host content).

In light of these problems, during the last decade, a growing minority of scholars in ECA has urged for abandoning the internalist view, by arguing against the idea that material culture, behavioral practices, institutions, and social interactions are just passive by-products of an internally evolved symbolic code. Inspired by the embodied and extended cognition movement in cognitive science (e.g., Menary 2007; Clark 2008; Robbins and Aydede 2009; Rowlands 2010; Shapiro 2014), these scholars contended that the aforementioned elements in fact actively constitute and shape social systems and even cognitive processes. Consequently, they advocated a relational conception of cognitive evolution, based upon the long-term transformation of integrated systems of brains, bodies, and culture. Within the next section, I will illustrate this critique more in depth by focusing upon two of the most relevant relational models in ECA, namely, the distributed approach (Gamble et al. 2011, 2014; Gowlett et al. 2012) and the theory of material engagement/enactive signification (Malafouris 2013; Iliopoulos 2016b).

The Embodied and Extended Turn

Let us introduce the embodied and extended turn by focusing upon the recently proposed distributed approach in ECA. Such an approach is grounded in the social brain hypothesis and accordingly argues that hominin encephalization is primarily explained by social reasons (Aiello and Dunbar 1993; Dunbar 1998a, 2003). In its broader formulation, this hypothesis supports the existence of a positive feedback loop between brain size and cognitive-social complexity (Barton and Dunbar 1997; Dunbar 2003, 2007). Evolutionary drivers led hominins to living together in large groups in order to address the metabolic costs of a large brain. As a consequence, natural selection fostered the cognitive abilities that were able to maintain the social complexity required to support the expansion of such an expensive neural tissue. However, in contrast with the internalist view, cognitive functions did not evolve as merely contained within the head, for this would have imposed on them an unbearable computational burden. Rather, they were extended through their hybridization with behavioral practices, artifacts, and other social forms, which were scaffolded around a core of emotions and material affordances (Dunbar et al. 2010; Gamble et al. 2011; Gowlett et al. 2012). In line with the well-known hypothesis of extended cognition (e.g., Clark 2008), the making of artifacts thus appears as a relational process that taps into other people's cognitive operations. Indeed, artifact makers can adopt the activity, knowledge, and emotional reactions of social partners as a part of their computations, thus avoiding the necessity to internally conceptualize and individually figure out all the aspects of crafting. Similarly, within the domain of social cognition, material culture and embodied practices scaffold the understanding of others, because they obviate the need to represent and compute social concepts and relationships only within the mind. In addition, social complexity, namely, the organization that a society can take, is not passively dictated by an evolved internal code. In contrast, artifacts and social practices have agency in shaping and constraining hominins' interaction (Knappett 2002; Gosden 2005; Verbeek 2005; Hodder 2012). Indeed, they segregate and unite, contain and alienate, emphasize meanings, and offer social affordances, so as to deeply transform the social world (Gamble 2010). Thus, by combining their ability in extending cognition with their social agency, these practices allow reconfiguring the connection between people, thereby broadening the range of the social space, and taming its complexity. As a consequence, they allow group size to scale up in a way that would be unfeasible with the internal mind only (Coward 2016). In synthesis, the distributed approach can be visualized as a system at equilibrium, in which hominins extend their social cognition through a series of different social forms, which they use to stabilize the complexity of large groups under adaptive pressure (Fig. 19.1).

The shape of the Paleolithic, namely, the emergence of innovations observed in the archaeological record over time, reflects the different means employed in this structuration process, by privileging

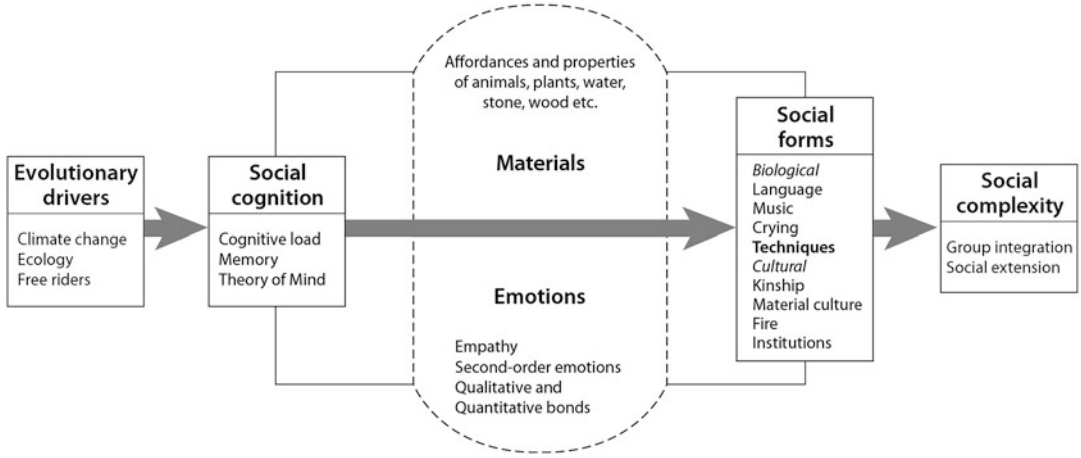

Fig. 19.1 Cognitive evolution mechanism according to the distributed approach (Gamble et al. 2011). Ecological and social problems lead groups to scale up and raise their social complexity, thereby placing adaptive pressure on the socio-cognitive abilities required to accommodate these changes. Since the computational burden of handling such complexities cannot be sustained by internal cognitive resources only, these functions, as well as the structure of social systems, are extended through a set of social forms (e.g., language, institutions, and material culture), which are built around a core of material and emotional affordances (dashed box in the center). These extended cognitive functions evolve in order to stabilize increasing social complexities under selective pressure. Reproduced with permission from Gamble et al. (2011)

in some cases the evolution of internal functions, in others that of immaterial practices (such as language, music, or dance), while in further ones amplifying material culture (Gamble 2010; Gamble et al. 2011).[3] This differential negotiation of societal structures characterizes the entire hominin evolutionary history and obviates the need to think about a single event of mutational enhancement that led to the evolution of a symbolic cognitive package for the stabilization and expansion of the social sphere (Mithen 1996; Mellars 2005; Klein 2008). Symbolism, in fact, is only one of the many ways in which hominins exploited material things and emotions to shape their own sociality, and thus it assumes no privileged role, nor does it mark the advent of a "modern mind" (Gamble 2010, p. 30).

The theory of material engagement (Renfrew 2004; DeMarrais et al. 2004; Knappett 2005; Malafouris 2004, 2013; Overmann and Wynn in press) adds a further step to the distributed approach, by contending that artifacts do not simply participate to the cognitive process. Rather, similarly to the way they actively shape the social world, artifacts profoundly transform the mind, by creating new ways of conceptualizing reality (Malafouris 2010b). Such a transformative process is particularly evident within the theory of enactive signification, according to which the material engagement with artifacts leads to the discovery of new meanings for signs that is accompanied by parallel cognitive restructuring (Malafouris 2007, 2008; Iliopoulos 2016b). This theory is grounded in Peirce's (1931–1936) semiotic account and accordingly advocates a continuous transformation of meaning along three categories of signs, namely, icons, indexes, and symbols. Within this basic triad, the link of a sign to its object is, respectively, interpreted through criteria of physical resemblance (icons), contiguity or factorality (indexes), and conventional and arbitrary agreement (symbols). As a consequence, far from being the latest update of a modern mind, symbolism developed on top of more basic categories of signs as the result of the relational engagement with artifacts and social agents (Iliopoulos 2015).

[3]The lags observed in the archaeological record between increases in brain size, inferred population growth, and innovation spurts can be explained by the selective amplification of internal cognitive abilities or external practices that do not leave archaeological traces (unlike material culture; see Gamble et al. 2011).

Following the example elegantly discussed by Froese (2019), the handprints made with pigments on cave walls not only allowed Upper Paleolithic hominins to discover the expressive affordances offered by such media but also to co-perceive their own presence through this material action. The pigments, indeed, exposed the causal coupling between the handprint and the body and led to interpreting this signs as indexes of their makers. At the same time, this action led users to discover that colors can create icons of things, namely, figures that look like real things and yet differ from them. Over time, further explorations of the material properties of pigments and bodily affordances invited humans to produce negative shapes by, for example, spraying the color with their mouths onto hands placed on cave walls. This action in turn led to discovering the concept of outline and then the possibility of creating icons that are not necessarily coupled with the body of their makers, thus discovering figurative drawing. Simultaneously, these lines attracted the attention of other people and created social reactions, leading their makers to wonder about the social meanings of such drawings. This ultimately could have allowed the creation of abstract patterns, whose meanings could exist only within a mental dimension, thereby scaffolding the acquisition of symbolism. The case study of Upper Paleolithic cave painting therefore shows that materiality bootstrapped the emergence of symbolism along a developmental trajectory (see also Hodgson and Pettitt 2018), where a semiotic metamorphosis (in this case, from indexes to icons and ultimately to symbols) is accompanied by a change in the perception of affordances, conceptual categories (e.g., the outline), and the cognitive processes necessary to process such a shared mental dimension (e.g., meta-representation and theory of mind, see below for further discussion).

This enactive transformation is driven by a deep integration of the properties of material culture with the plasticity of the brain (i.e., metaplasticity; Malafouris 2010a, b; Garofoli 2016; Roberts 2016). Indeed, the material engagement with artifacts restructures the connectivity of the brain, thereby fostering new ways of perceiving the world and exploiting material culture and ultimately initiating a positive feedback loop (see below for further discussion). As a consequence, this approach sharply departs from the internalist view, in that it assumes that the mind does not evolve as a complete package, which restitutes a fixed material and social world. Rather, mind and world emerge as a result of their mutual entwinement, thus being co-constructed (Malafouris 2016).

Overall, the distributed approach and the theory of enactive signification share a sense of distributed agency, whereby humans, respectively, structure their own lifeworld and mind through the opportunities (but also the constraints) presented by artifacts and more in general cultural practices. Given the existence of the aforementioned problems with the internalist and neo-Darwinian view, the critique advanced by such embodied and extended models in ECA is therefore as welcome as crucial. However, as I illustrate within the next sections, there exist fundamental problems within the current formulation of these models, which threaten their reformatory enterprise.

Aims

Within this chapter, I analyze the aforementioned families of embodied and extended cognition models in ECA, namely, the distributed approach defended by supporters of the social brain hypothesis and the enactive signification associated with the theory of material engagement. I argue that these models, although leaning toward the idea that the mind is not merely contained within the head, fail to break with the internalist tradition. In claiming that the mind is extended, they still admit the existence of prior conceptual representations that are combined with pieces of material reality. Thus, they conceive cognitive extension as the flooding of conceptual resources from the internal mind to the outer world, which results in the inclusion of artifacts and the relational structures they create within the internal computational architecture. Nevertheless, the a priori representational and conceptual bases that expand upon the world remain affected by the very metaphysical problems

mentioned for the evolution of fully internal architectures, such as the problems of substance and origin. I argue that the failure of these models in disengaging from the conceptual apparatus of representationalism seriously jeopardizes their revolutionary scope toward the Cartesian mind. In fact, by maintaining residual forms of representational apriorism, these "conservative embodied" proposals cannot effectively differentiate themselves from the internalist/Cartesian tradition they intend to criticize (Hutto and Myin 2013, Chaps. 1–2; Hutto 2005).[4] Most significantly, I illustrate how they can even be assimilated with some amended versions of the internalist view, thus risking to appear as mere "correctives" within this paradigm. The reform advocated by embodied and extended cognition in ECA in fact requires a more thorough break with such a tradition.

In the positive part of this chapter, I suggest that this rupture can be performed by drawing upon the Radical Enactive and embodied account of Cognition (REC; Hutto and Myin 2013, 2017, 2018). According to this view, basic cognitive acts such as perceiving, recognizing, and imagining are conceived in anti-representational terms. Namely, they are the product of the direct coupling of an agent with the structure of the world and the reenactment of such relational states, given the organism's developmental and evolutionary history. In contrast, representations emerge as the result of shared cultural practices, as exemplified by language and narratives.

Drawing upon these principles, I RECtify the conservative embodied views, by depriving them from residual representationalism while maintaining their embodied and extended lean to cognition (see Hutto and Myin 2017, p. 52). Accordingly, I argue that artifacts do not combine with internal representations in order to provide extended computations, as assumed by these conservative models. Rather, they create structures for the direct perception and imaginative reenactment of the world and scaffold the construction of linguistic representations over the long time. To this goal, I adopt the example of the Acheulean handaxe, by focusing on its pragmatic and social aspects concerning its technical realization, as well as its alleged semiotic value as a communicative sign.[5] Overall, this case study allows laying down guidelines for a radical enactive cognitive archaeology. Ultimately, I discuss the advantages and costs of going radical over investing in the current conservative embodied accounts in ECA.

The Distributed Approach and the Acheulean Handaxe: Residual Internalism

In order to understand where residual internalism lies within the distributed approach, let us consider the case of Acheulean toolmaking mentioned by Gamble (2010). Against an internalist and symbolic view, Gamble proposes that Acheulean handaxes were not the passive by-product of the evolution of internal mechanisms for the appreciation and tridimensional manipulation of symmetry (Wynn, 2002, for review) nor could they be reduced only to the personal satisfaction or disappointment associated with the realization of the finished product by an individual agent. Although individual mechanisms remain crucial, handaxes were in fact also the outcome of social and emotional interactions with other group members (see also Gamble et al. 2014). They indeed contributed to the formation of extended cognitive functions and actively restructured hominin society through their material properties.

Specifically, handaxes could have created an epistemic structure at the social level, which could have been exploited for the making of the artifact. Knappers could indeed adjust and modify their

[4]Following Hutto and Myin (2013), the conservative aspect of such models in embodied cognitive science is restricted to their acceptance of representationalism.

[5]This case study is particularly valuable in this context, because it is incidentally discussed by the vast majority of the conservative embodied models hereby taken into account, although with different emphasis.

decision-making process and performance by relying upon the actions and indications of others rather than on mental representations. The emotions of other people could be further adopted as an external basis for assessing one's own performance, thus bypassing the need to evolve internal criteria of evaluation. At the same time, the importance of these tools could have led to the formation of progressively more structured "workshops" and teaching-learning contexts (cf. Sterelny 2012). In this way, the artifacts established durable relations between social members and allowed an agent to constantly monitor individual abilities and social relevance without the need to keep them in memory as mentalistic constructs. Similarly, by instantiating centers of attraction of cognitive and emotional mechanisms, handaxes constituted by themselves the motivation for social interaction.

However, the relational conception advocated by the distributed approach is still subject to Cartesian pitfalls. Indeed, the behavioral contingencies created by handaxes are analyzed and computed by (or get integrated with) a priori evolved cognitive mechanisms and in particular the representational bases for theory of mind (see "social cognition" in Fig. 19.1). For instance, let us consider the case of an agent who needs to assess which companion of hers best knows how to craft a handaxe. Within the internalist approach, this agent observes her companions' performance and builds a mental ranking of all the relevant abilities in stone knapping (e.g., dexterity, aesthetic sensibility, effectiveness, etc.). Subsequently, she could infer from this list which results better capture who the "best knapper" is. However, rather than adopting this mentalistic strategy, the agent can simply compare the knappers' finished artifacts to one another. The conformation of the handaxes, indeed, offers a direct way to assess "online" the performance of the others and become part of a wide computation. Nevertheless, this computation implies that the agent uses this material basis to conclude who the knapper that best *knows* how to knap is. Accordingly, the material basis would be in any case the starting point for an inference that connects one's behavioral performance to his or her *knowledge* of the procedure. This process is mediated by theory of mind, namely, the ability to infer other people's mental contents *as such* (Hutto 2011). This ability implies the use of mental state terms such as "know" or "believe," which define propositional attitudes toward a particular content (e.g., I know X; you know Y) and meta-representations, which mediates the embedment of propositions within one another (e.g., I know that → you know Y; see Pylyshyn 1978; Doherty 2009, Chaps. 2–3).

Partisans of the distributed approach conceive the architecture for theory of mind as constituted by sub-personal (meta)-representations independent from natural language, which allegedly evolved as early as with *Homo erectus* at ca 1.4 ma (Dunbar 1998b, 2003, 2009; Gamble et al. 2011; Cole 2015). However, in the absence of language, it is unclear what these (meta)-representational abilities are and how they could be innately specified within the brain. They appear indeed as disembodied entities a priori inscribed in the organism by natural selection while remaining their content, substance, and origin unclear (cf. Hutto 2008a, b). Accordingly, within the distributed approach such internal representations get integrated with external vehicles by forming various sets of possible extended algorithms. As it becomes clear from Gamble's (2010, p. 27) words (emphasis added):

> People did not arrive in Australia because they first thought of symbolic sandy beaches and convinced themselves that was sufficient reason to move. They arrived because they had first accomplished the cognitive task of *manipulating symbols in conjunction with the external world*, which then allowed them to achieve the task of extending their social worlds, and coincidentally in this instance, their geographical extent.

However, these extended algorithms depend on the nature and constraints of the internal representations specified within the brain. Thus, the role of artifacts within this approach is limited to amplifying internal functions through their material properties by extending their computational basis (e.g., Wilson 1994; Wilson and Clark 2009). The distributed approach in this way accepts the existence of representational primitives, provided that they can be integrated with external vehicles, and cognition not only symbolically realized within the head. Furthermore, these substrates can still evolve through mechanisms of mutational enhancement and biological selection acting on the representational bases for theory of mind. Accordingly, the evolution of these representational primitives is still deemed as an a priori condition for the emergence of particular cultural innovations

within the archaeological record. Thus, this view remains grounded in internalist tenets, which face the metaphysical difficulties introduced earlier. Furthermore, insofar as cognitive extension is conceptualized as the mere amplification of internal and fixed representations, this approach would still lack a genuine developmental perspective. In order to fulfill this lacuna, it is necessary to shift from the idea that artifacts amplify internal cognitive processes to the conception that they actively create new ones.

Enactive Signification and Internalist Pitfalls

Material engagement theory and in particular the enactive signification account perform the aforementioned conceptual shift by contending that artifacts have cognitive agency and accordingly scaffold the emergence of new classes of signs and conceptual categories (Malafouris 2007, 2013, Chap. 5; Iliopoulos 2016b).[6] Within this section, I will illustrate the principles of such a semiotic and cognitive transformation by relying upon the recently proposed interpretation of handaxes as signs. Indeed, some scholars contend that the coherent tridimensional symmetry of late Acheulean handaxes (see Footnote 1) cannot be explained by mere utilitarian reasons. Rather, *Homo heidelbergensis* populations deliberately produced this shape in order to transmit meanings to other people, thus turning these artifacts into signs. According to some proposals, the handaxes' form had communicative implications, and in particular they might be used for aesthetic purposes (Hodgson 2008; Machin 2009) and in particular as indexes of individual ability for sexual selection (Kohn and Mithen 1999; but see Nowell and Chang 2009, for a counterargument). In contrast, an alternative proposal contends that handaxes were employed to signify identity (Pope et al. 2006; Shipton 2013). The alleged existence of stylistic traditions of handaxe shapes in the Lower and Middle Paleolithic indeed suggests that style could have been used as a marker of membership within a particular group. In any case, this interpretation remains quite controversial at the empirical level, for the presence of coherent symmetry in the Lower and Middle Paleolithic could have been overestimated (McNabb 2013; Cole 2015). Nevertheless, the semiotic interpretation of handaxes provides an effective model for achieving the theoretical objectives of the current section, namely, highlighting the problems of residual internalism with the theory of enactive signification.

This theory disagrees with the internalist view, in that it assumes that handaxes do not receive their meaning through the arbitrary and conventional imposition of an abstraction (i.e., identity) to the artifact, as in the case of symbols (e.g., Cole 2015; cf. Quinn this volume, for a view of semantic transmission of meaning through material culture). In contrast, in order for handaxes to signify something, their meaning needs to be enacted at the conjoint of materiality, the body, and the mind. In order to illustrate this process, we can apply the analogous analysis of enactive transformation of meaning provided by Iliopoulos (2016a) on Middle Stone Age ochre pigments (Watts 2009; Marean et al. 2007) to the current case study with handaxes and the concept of identity (cf. Iliopoulos 2016b, p. 116). This approach allows understanding how indexical signs emerge from brain-body-world complexes and further ground the rise of full symbolism.

To start, we can assume that handaxes were initially produced as tools for pragmatic use. Over time, the teaching and learning of handaxe-making within local contexts unintentionally biased these artifacts to acquiring some particular stylistic form. Subsequently, the particular features of the handaxe and the physical presence of their makers (associated with a sense of ownership of the

[6]Malafouris' formulation of the theory of enactive signification and more in general Material Engagement seems committed to anti-representationalism, thus being compatible with the radical enactive perspective advocated in this paper. Nevertheless, some specific aspects of his (2013) approach hinge on some more conservative embodied models, and these will be the target of the current critique.

artifacts), both lying in preexisting phenomenal domains, were projected into a third one, namely, the enactive or "blended" space (Fauconnier 1997; Fauconnier and Turner 2002). The stylistic features of handaxes therefore acted as material anchors for the projection of ownership by group members, so that these elements were blended within a concept of identity (Hutchins 2005). Thus, the handaxe is eventually turned into a sign, which "stands for" its meaning, even though not in a symbolic way. Indeed, the concept of identity is warranted by the physical contiguity and causal derivation of group membership and style (the so-called indexical ground) and not by arbitrary convention, thereby representing a Peircean index (Iliopoulos 2016b).

From this level, such an indexical sign could then be exploited to signify, for example, ownership of a particular territory or item. In this case, the concept of ownership capitalizes upon the indexical meaning of handaxes, namely, the fact that they stand for identity. Consequently, an internally specified concept of ownership is now blended upon this indexical relation on the basis of a conventional and arbitrary agreement among the sign's users, whereby the hanging of a handaxe on a tree, for example, can be used to communicate normative rules (e.g., do not trespass). This eventually leads to the emergence of a symbolic usage for handaxes.

However, if the previous characterization is accurate, then the theory of enactive signification is still bound to a form of representational apriorism and computationalism, albeit more moderate than the standard internalist one. Indeed, there exist two main problems with the current formulation of this theory. The first concerns the fact that it postulates the existence of a sub-personal architecture for the processing of signs. By relying on Sonesson's (2006, 2010) approach in semiotics, it claims that a sign acquires its meaning when a sign function ascribes some content to its expression, so as to make the sign "standing for" a specific meaning. This happens independently of whether the sign is an icon, an index, or a symbol. In other terms, the mere existence of a semiotic ground between the stylistic features of a handaxe and the recurrent presence of individuals belonging to a group (see Fig. 19.2 above) does not per se make the handaxe a sign (i.e., an index of identity). In contrast, the handaxe becomes an index only when the system analyzes the two elements of the semiotic ground and binds them to a concept of identity through the sign function (Iliopoulos 2016a). However, this operation seems to be realized through an inferential process, in which some premises are evaluated (i.e., there exist an indexical ground in the world and a concept of identity) and conclusions are drawn (i.e., the indexical ground can be plausibly categorized as an instance of identity). According to Malafouris (2013, p. 114), indeed, a core aspect of the theory of enactive signification is that artifacts create opportunities for *abductive thinking* (which is also inherent to the concept of "abductive index," see Iliopoulos 2016b, p. 116), thereby leading to the discovery of new categories of signs, concepts, and relations (e.g., the concept of index emerges from this blending process), and ultimately restructure cognition itself.

Nevertheless, it is worth noting that the premises and conclusions manipulated within abductive reasoning are propositional states of the mind that correspond to states of the world in a truth-conditional way, namely, they are contentful mental representations. These representations in turn are used to ascribe contentful meaning to handaxes and ultimately create external representations. The reliance of the process of signification upon an inferential architecture creates a daunting problem for the theory of enactive signification. Such an architecture indeed seems to be sub-personally realized through a language of thought, namely, a language-like system characterized by syntax and grammar, which nonetheless is "spoken" by neurons (Davies 1998; Fodor 2008). Accordingly, our brain would be provided with a set of disembodied representations that processes and displays into consciousness the meaning of reality, thereby reintroducing a Cartesian view of the mind.[7]

[7] Alternatively, one could assume that these propositions are actually mediated by a natural language. Nevertheless, this would suggest that all Peircean signs are realized through language, a position that backfires against Malafouris (2013, p. 135) and Iliopoulos' (2015) critique against the centrality of language in material signification.

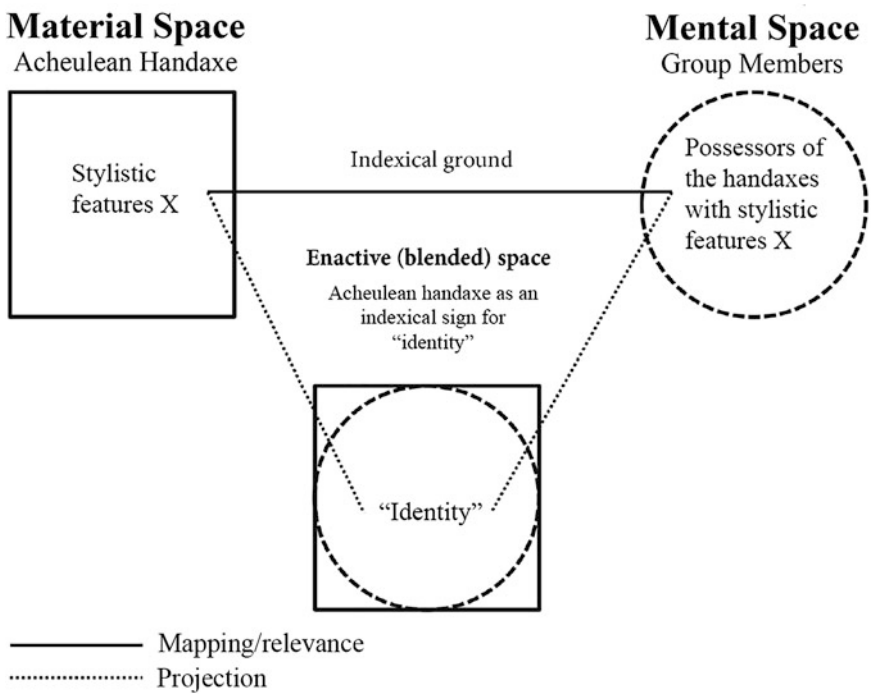

Fig. 19.2 Diagram of the blending process for the concept of identity from the indexical ground created by the recurring association of handaxes' stylistic features and the presence of the same individuals (group members). The stylistic features X of a local tradition of handaxes occupy the material space (above, left). A viewer understands that the handaxes are owned by the members of a certain group, and this happens within her mental space (above, right). The physical contiguity between the X-shaped handaxes and the presence of some group members embodies the indexical ground. A concept of identity allegedly emerges out of the blending of the two aforementioned elements. Redrawn from Iliopoulos (2016a)

Related to the previous point, the second problem with the theory of enactive signification lies in the fact that the conceptual blending involved in the formation of a sign, although assisted by the material world, still requires a priori conceptual representations. Indeed, the contiguity between the stylistic features of a handaxe and the presence of group members scaffolds the inferential processes described above, by providing affordances for the blending of the concept of identity. However, this concept needs to be internally specified within the mind, before it can be applied to the iconic ground, thereby positing again the question about its origin. At the same time, this assumption raises a well-known problem with conceptual categorization in the standard internalist view. In order to categorize the indexical ground within a concept of identity, and consequently form the indexical sign, the brain needs to select precisely that concept among a library of possible conceptual categories it stores. However, it seems that the only way to perform this task would lie in assuming that the internal concept of identity "knows" in advance which aspects of reality it can categorize. To concretize through an analogy, this means that the indexical ground existing in the world displays a label on itself. The brain in turn picks up that label and searches within a library of conceptual representations the corresponding label exposed on the internal concept of identity (Fig. 19.3).

However, this computation is possible only because the concept of identity is innately provided with all the appropriate conditions for matching some particular aspects of the world, including the iconic ground (i.e., the two labels are there since the beginning). Without such an a priori specification, this computational task would in fact be intractable, because there would be no way to reconnect the

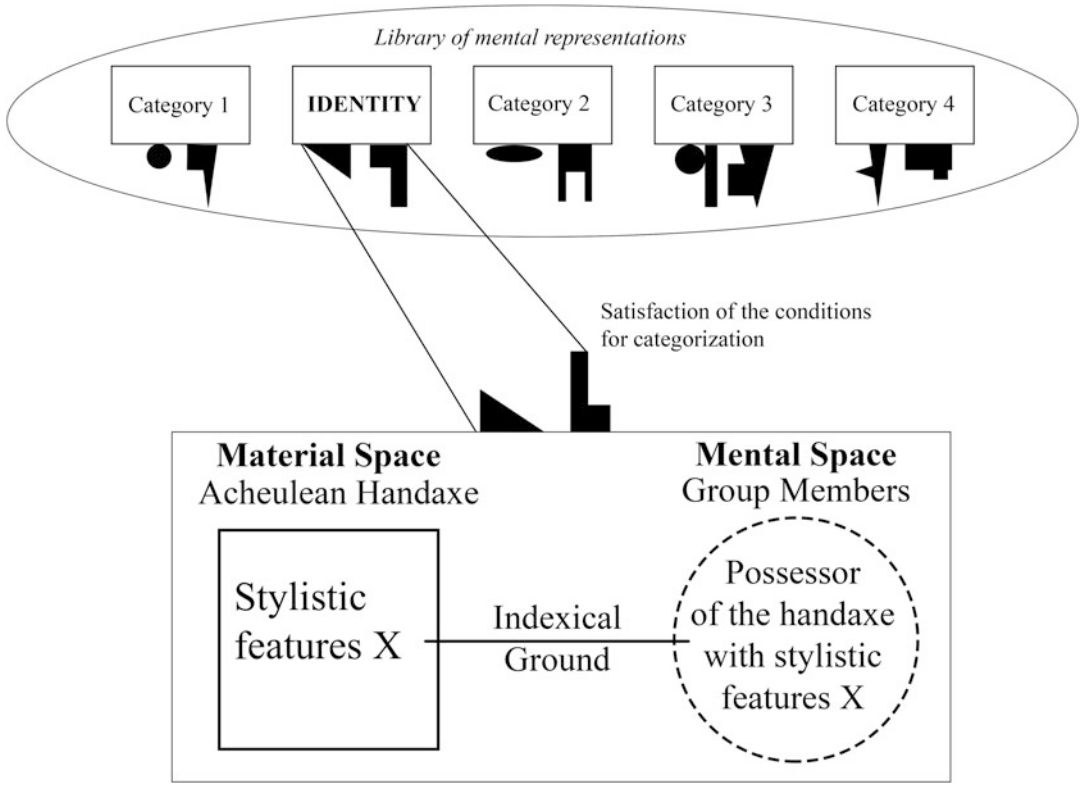

Fig. 19.3 Computational architecture for the categorization of the iconic ground within the concept of identity. The brain needs to select the appropriate concept that matches the indexical ground from a library of mental representations, in order to categorize it as an instance of identity. Aligning the target state (below) with the appropriate concept within the library (above) requires the existence of appropriate labels on both the iconic ground and the identity concept. This in turn implies that the indexical ground displays a label that can be reconnected to the complimentary one on the concept of identity. As a consequence, the computational process requires that the relationship between the identity concept and its target states is hardwired within the system and thus innately specified within the brain. Without this prior specification, it would be unclear how the iconic ground could be categorized in any conceptual category, since each of the categories within the library would have no instruction for matching their targets

iconic ground to any concept appearing within the library (cf. Robbins 2014, 2017, for an example of this problem concerning analogical reasoning).[8]

Overall, the theory of enactive signification maintains elements of representational apriorism in both the sub-personal (propositional) architecture and the a priori meanings used to construct signs, thereby remaining bound to the internalist paradigm. However, this theory departs from standard internalism because it accepts the existence of more general and flexible brain-bound functions, such as those for the creation of "signs," as opposed to full-fledged symbols.

[8]In alternative, one could argue that the blending process creates a completely new concept of identity out of the iconic ground. Accordingly, the brain creates the mental representation "identity" in the same fashion of an abstract word, namely, by selecting a label and using it to define a set of conditions for the belonging of instances of identity to such a category. This strategy implies that the brain can establish the content of words by itself and without an intersubjective dimension of reference. Nevertheless, the possibility of realizing a private language independent from a social dimension currently faces daunting philosophical problems (Hutto 2008b; Wittgenstein 1953).

Conservative Embodiment Assimilated

Within the previous sections, we have seen that the conservative embodied approaches succeed in opposing the deterministic leans at the basis of the neo-Darwinian view of cognitive evolution while failing to completely disengage from the Cartesian conception of the mind. This residual representational apriorism risks to hamper the whole critique moved toward the internalist view in ECA, by fostering a series of possible counterarguments. A particularly insidious line of response implies reducing conservative embodiment to a peculiar version of the internalist paradigm.

Proponents of the internalist view could indeed renounce deterministic leans and concede that humans did not evolve algorithms and representations that bring into being specific artifact templates, social organizations, and symbolic meanings. They could add that in fact few evolutionary psychologists currently support this deterministic view of cognitive evolution (i.e., the *real* neo-Darwinian account) and that the relational approaches actually have built a straw position on this matter (Kurzban 2010). In contrast, humans were bestowed by natural selection with a series of internal representations, which they creatively combined in order to craft artifacts capable of solving highly demanding environmental and social issues (Carruthers 2006, Chap. 5). Human agency is therefore maintained in the flexible combination and creative use of mental representations. A sense of agency persists also in the idea that human cognitive functions and cultural outcomes do not passively adapt to a fixed external environment, as per the neo-Darwinian view. In contrast, they transform the environment itself, introduce new sources of pressure, and offer further opportunities for natural selection to shape cognition and culture. Accordingly, humans actively shape their own evolutionary dynamics, a conception that overlaps with some formulations of niche construction theory (Odling-Smee 2007) and consequently oppose strict neo-Darwinian interpretations (see Riede and Prentiss and Laue this volume for review). In addition, internalists can contend that evolved cognitive substrates need not be divorced from materiality but could hybridize with aspects of it. Accordingly, natural selection would still shape cognitive functions in response to evolutionary drivers as per the internalist view, but it would now do this by operating upon "wide algorithms." Namely, it would act on composite structures formed by internal cognitive substrates subject to random mutation and genetic inheritance and cultural practices transmitted through social learning to further generations.

The resulting conception is nearly the same as the one illustrated in Fig. 19.1 for the distributed approach, consequently showing that the internalist view can accommodate the critique about cognitive extension. At the same time, even the mechanism of cognitive and semiotic transformation advocated by the theory of enactive signification could be assimilated within the idea of "extended selectionism," inasmuch as this transformation relies upon internally specified functions for the creative production of new meanings.

A parallel point can be made in ECA for the definition and causal origin of the "modern mind" and its relation to the appearance of "behaviorally modern" artifacts within the archaeological record of ancient hominins. Supporters of the internalist view can concede that a symbolic internal architecture is in fact unnecessary for defining the concept of modern cognition. In fact, the conceptual primitives and propositional vehicles introduced earlier are quite sufficient signatures for the modern mind. Such minimal representations and functions could still be subject to mechanisms of biological selection, as in the standard internalist view, albeit in a non-deterministic way. Accordingly, these cognitive bricks could have been created by some mutational events incurring at some point in human prehistory and adopted to build the innovations characterizing the Upper Paleolithic and analogous techno-complexes (e.g., the Australian case of rock art). Thus, cognitive modernity could lie in the flexibility and types of transformations afforded by these foundational bricks (e.g., a sign function), rather than in specific algorithms that restitute modern artifacts (e.g., a cognitive package for symbolism). Overall, it appears that each of the objections raised by the relational models can be reconciled with an emended version of the internalist view.

Radicalizing ECA

The conservative embodied and extended approaches introduced earlier risk to foster an "evolutionary psychology v. 2.0," which accommodates the relational critique, while maintaining the deeply problematic assumptions with representationalism. In order to remain connected to a naturalistic framework and avoid the pitfalls of dualism, the Radical Enactive and embodied account of Cognition (REC) urges for abandoning the idea that minds manipulate brain-bound and sub-personal representations about the world. In contrast, cognitive activities such as perceiving, recognizing, imagining, and simulating—what REC defines the "basic mind"—need to be conceived in non-representational way (Hutto and Myin 2013). In other terms, they are the result of the direct coupling of the organism with the external world, given its developmental and evolutionary history. REC allies with the ecological approach to cognition (Gibson 2015 [1979]) and accordingly assumes that the world is provided with deep structure, which offers information *for* the perception of affordances and the understanding of meaning (van Dijk et al. 2015). Given the structural relationship existing between the brain, the body, and the environment, the various aspects of reality invariantly react to the action an organism performs on it. By operating in the environment, the organism creates some variations in sensorimotor contingencies and exploits them to enact the perceptual meaning of reality (Hutto and Myin 2013, Chap. 2; cf. Brooks 1991; O'Regan and Noë 2001; Noë 2004). Accordingly, rather than a computer that processes and makes sense of meaningless stimuli through hardwired symbols, as per the internalist view (Barrett et al. 2014, p. 2; Tooby and Cosmides 2005), the mind is better conceived as a resonating system. To concretize, we can imagine it as a sort of radar emitting waves that propagate into reality on the basis of the embodied movement of the organism. Such waves hit objects and their reciprocal structural relations, thereby bringing forth their meaning (see Gibson 1966, p. 5, and Raja 2017 on the concept of resonance). At the same time, the impact with objects modulates the internal frequency of the wave and sets the whole brain-body-world frequency (a dynamic system) on a certain signal. If the agent leaves a hypothetical room wherein she was situated and then comes back again, her mode of interaction with the previous objects in the room becomes the same as before, with the brain resonating with the same objects with the same frequency. Thus the agent *recognizes* what she saw earlier (cf. Robbins 2006). Similarly, *imaginative reenactment* implies putting oneself in the same relational status with objects one had in the past, although this time without an actual connection with external structures (Hutto 2015). Consequently, given that the reenacting wave now lacks any external structure of resonance, the phenomenological result implies having a fading and less vivid experience of the object. In sum, for REC there is no image of the world that is mentally represented by the brain and displayed to consciousness during perception (Myin and O'Regan 2009), no snapshot of an event that is picked up from a memory deposit and compared to reality in recognition (Robbins 2014; Gibson 2015 [1979], p. 238), nor is there any internal picture that is selected from a library and displayed into the theater of consciousness during reimaging (Thompson 2007, Chap. 10; Gibson 2015 [1979], pp. 243–244). On the contrary, all these aspects of basic cognition imply a relational connection between agents and the material world, and they do not tap internal representations (Hutto and Myin 2017, Chaps. 8–9).

Nevertheless, REC accepts the existence of representations, insofar as their content is conventionally created within a cultural dimension. In particular, words and propositions within a natural language acquire their content through a conventional agreement, which establishes the truth of their reference, thereby counting as genuine representations (Hutto and Myin 2013, Chap. 7.4). At the same time, language is not conceived as an ostensive tool that serves to simply communicate internally specified meanings but rather brings forth new ways of cognitively processing reality (Garfield et al. 2001; Gauker 2003). Indeed, language restructures human cognition by allowing cognitive agents to think in propositional terms and use such propositions for meta-representation (Hutto 2008a, b; Fenici 2012; Fenici and Garofoli 2017). For example, some linguistic beings could

build hypothetical models of reality based on if-then inferences or understand other people's actions in terms of mental reasons (i.e., theory of mind). Human children are situated in cognitive niches culturally constructed and inherited from the elders, and thus they get accustomed to such linguistic practices, which become an integral part of their cognitive architecture and are in turn bequeathed to further generations (see discussion in Fenici and Garofoli 2017; Zahidi and Myin 2016; cf. Stotz 2014; Sterelny 2012; Menary and Gillett 2016 for a general analysis of extended cognitive niche construction and inheritance). Accordingly, REC defines this culturally acquired representational thinking and the resulting cognitive opportunities it carries within as the "scaffolded mind." This conception of niche construction differs from the one usually adopted by conservative accounts. Within these proposals, natural selection operates upon a series of biological substrates affecting mental representations, which are causally responsible for or merely coupled to the production of cultural practices. These in turn modify the environment, by shaping the human niche, create new selective pressures, and restart the cycle (e.g., Odling-Smee 2007, see Riede's Fig. 17.1 in this volume). Development is seen as a modulation process, which flexibly alters the cognitive and cultural outcomes of biology in relation to the environment (Laland et al. 2014), while culture stands as semantic information that is transmitted downstream across generations through social learning (Richerson and Boyd 2005; see Prentiss and Laue, this volume for review). Despite the role of agency in influencing natural selection, this approach still maintains that (1) the organism is divorced from the world; (2) culture is epiphenomenal, neutral, or merely instrumental to the mind; and (3) cognition and culture are the result of natural selection operating on these parallel channels (see Ihde and Malafouris in press for critique). In contrast, the radical enactive account in cognitive archaeology (RECA) attempts at eliminating such residual conservative elements by assuming a combination of enactive and post-phrenological theories in cognitive science. Specifically, by endorsing material engagement theory, it argues that artifacts bring forth new material and social affordances, which in turn lead to the acquisition of novel ways of making sense of reality and thus restructure cognitive functions (Malafouris 2010a, b; Roberts 2016; Ihde and Malafouris in press). At the neurobiological level, this transformative process is accounted for through the recently proposed theory of neural reuse (Anderson 2010, 2014), according to which brain regions are not functionally determined by natural selection in a way similar to the tools of a Swiss Army knife, as contended by evolutionary psychologists (e.g., Cosmides and Tooby 1994). In contrast, they are deployed and redeployed in a vast amount of cognitive tasks and dynamically brought together in order to construct new cognitive functions in relation to the degrees of freedom offered by their structural constraints (Anderson 2007a, b). Lying at the conjoint of these two accounts, RECA therefore conceives cognitive evolution as a long-term developmental process, whereby humans actively construct their own minds and lifeworld through artifacts and cultural activities.

However, this focus on creative agency and plasticity does not imply completely ignoring biological selection in cognitive evolution but rather rethinking the way it works, a problem that has been unfortunately underestimated by "materiality approaches" in ECA (see Abramiuk this volume for critique). Instead of acting on single functional traits, linking internal representations to cultural outcomes, selection alters some constraints within the plasticity of the brain and ultimately affects the whole relational entanglement between neurons and materiality that defines cognition (Garofoli 2016). New neural affordances can thus resonate with the world and allow humans to create further material affordances while reconceiving old ones. As a consequence, the unidirectional arrow that connects environment to biology, biology to culture, and culture back to a modified version of the environment in Riede's Fig. 17.1 (this volume, after Odling-Smee 2007) needs to be radically reconceived. For RECA, biology and culture are not separate channels subject to specific mechanisms of selection nor can the environment be in any way decoupled from them. Given the radical mediation of human experience through technology (Ihde 1990, 2002, 2009), and the participation of the material world to cognitive and even neurobiological mechanisms (Anderson 2014, Chaps. 5–6; Malafouris 2010a, b; Mareschal et al. 2007, Chap. 10), RECA conceives the modified ecological niche as simultaneously

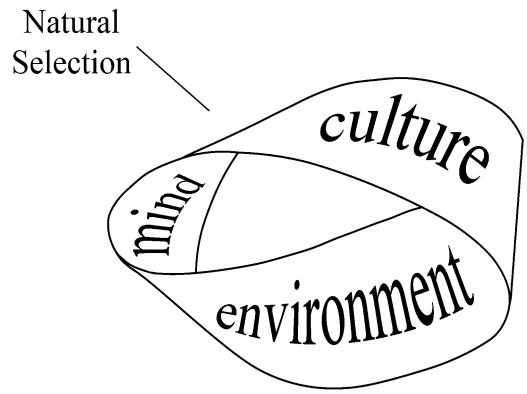

Fig. 19.4 Integrated system of mind, culture, and modified environment illustrated as a Möbius strip. This non-orientable figure (down right) is characterized by no actual distinction between the external and internal surface, so that by moving on the former an agent would find herself on the latter and vice versa without ever crossing an edge. The Möbius strip captures the ontological continuity of mind, culture, and environment and their dynamic shift into one another. Natural selection (top left) is considered to act on such a continuous loop rather than on separated interacting channels

cultural and cognitive. Furthermore, the cultural alterations of the niche are no longer meant as semantic information residing within the individual and transmitted downstream across time like a form of linguistic knowledge. Rather, through their cultural activity, humans construct and bequeath their niche in the shape of a "landscape of affordances," which they learn to navigate and exploit (Rietveld and Kiverstein 2014; Rietveld et al. 2018). The new generations do not simply inherit semantic information from the elders, but are rather guided through this landscape of affordances, which they reenact and transform through the embodied interaction with others (e.g., De Jaegher and Di Paolo 2007; Laroche and Kaddouch 2014). Overall, instead of a series of juxtaposed channels, the dynamics of cognitive evolution are better depicted as a Möbius strip, according to which culture, modified environments, and mind conflate into one another and their distinction persists only in the eye of the observer (Fig. 19.4).

In evolutionary cognitive archaeology, RECA aims at identifying the material conditions for the transformation of these cognitive systems within the archaeological record of ancient hominins while placing particular emphasis on the emergence of scaffolded minds and their integration with basic ones.[9] This radical program renounces the traditional goal in ECA of linking cultural innovations to specific events of mutational enhancement and environmental change occurring at specific evolutionary times (see Mendoza Straffon, Chap. 20, this volume for review of the cognitive enhancement approach). On the contrary, it considers mutational events as necessary conditions for cognitive transformation that happened along trajectories of human becoming (Garofoli 2016). In reconstructing these trajectories, RECA employs a minimalistic agenda because, after denying in principle the existence of sub-personal representations, it wishes to establish to what extent is possible to explain the archaeological record of ancient hominins without invoking linguistic practices (*a la*

[9]It is worth noting that radical enactive approaches in cognitive archaeology do not exclusively apply to the study of cognitive transformations in early human prehistory but extend also to more recent contexts. Specifically, a significant part of material engagement theory, which can be made compatible with RECA, has been formulated through examples of semiotic and cognitive transformations in Mycenaean and near eastern cultures (e.g., Malafouris 2012, 2013, Chap. 5), as well as used in the context of art history (Woodward 2019) and ethnography (Walls in press). The higher preservation of this material record indeed allows a better reconstruction of trajectories of cognitive changes scaffolded by artifacts than the Paleolithic record. Accordingly, the radical account stands as a general epistemological framework for the human cognitive becoming.

Chemero 2009; see Garofoli 2017a for further discussion). Overall, RECA welcomes Abramiuk's (this volume) epistemological critique by attempting to reconcile conditional approaches in ECA to the concept of long-term development defended by "materiality approaches" and ultimately to the process of natural selection.

A crucial aspect of this enterprise lies in showing that even sophisticated practices, such as early body adornment (Garofoli 2015, 2017b), can be grounded in structures of embodied relations created by artifacts. In this way, agents can make sense of them by relying on the properties of the basic mind only (e.g., direct perception, recognition, and imaginative reenactment) and without necessarily recurring to language and the imposition of representational meaning on objects (contra d'Errico et al. 2005; Henshilwood and Dubreuil 2009, 2011; see Quinn this volume; cf. Garofoli 2015 for a similar critique about spear-making). In contrast, RECA is interested in understanding how these embodied relations could have brought forth representational practices over the long-term. With these concepts in mind, within the next section, I proceed to RECtify the analyses of handaxes introduced earlier for the distributed approach and the theory of enactive signification, and I highlight the similarities and differences between RECA and these conservative embodied models.

The Acheulean Handaxe RECtified

RECA agrees with the distributed approach that handaxes are not the passive by-product of internal algorithms and pre-specified social contexts, but are constitutive of cognition and actively structure the social world. In both the programs, handaxes created behavioral relations that act as a proxy for judging the performance of a knapper. However, the two programs differ from each other in the way hominins make sense of such relational structures. Within the distributed approach, the meaning of these relationships is understood through a priori existing meta-representations and mental state concepts underlying theory of mind (Barham 2010; Gamble 2010; Gamble et al. 2011; Cole 2015). The adoption of such representational primitives in processing materially scaffolded actions creates what we have defined as "wide computations" (e.g., Wilson 1994), which are used to make sense of other people's conduct. These functions remain grounded in evolutionary psychology mechanisms of selection.

In contrast, for RECA, within these intersubjective engagements, the embodied activity performed with and through the handaxe is already significant of the intentionality of action (Garofoli 2018). Indeed, it creates a structure that can be exploited as information for the direct perception and reenactment of meaning. Thus, there is no need to display the shape of a finished artifact to the internal theory of mind in order to *know* that the knapper has a good *knowledge* of the knapping procedure. In contrast, the proficiency of a knapper lies in the invariant relationship between the knapping activity and the emergence of finely crafted handaxes. Agents, therefore, can directly assess one's performance from this set of embodied relations, without the need to process it through metaphysically problematic representational primitives, such as brain-bound meta-representations and mental state concepts (e.g., knowledge; cf. Hutto 2011; Gallagher 2008 ;Fenici 2015).

A similar argument can be made in order to explain the use of standardized handaxe templates in signifying identity concepts (e.g., within *Homo heidelbergensis* contexts, see Pope et al. 2006; Hodgson 2008; Shipton 2013). RECA agrees with the idea of semiotic and cognitive transformation generally proposed by the theory of enactive signification. However, it contends that artifacts need not stand for their meanings, nor do they necessarily acquire such meanings through an inferential logic (i.e., they are not necessarily *about* something in a contentful way). On the contrary, some categories of artifacts can directly embody their meaning, by virtue of their material properties and contextual relations (Hutto 2008b, pp. 54–56). Thus, RECA opposes the traditional view in semiotics according

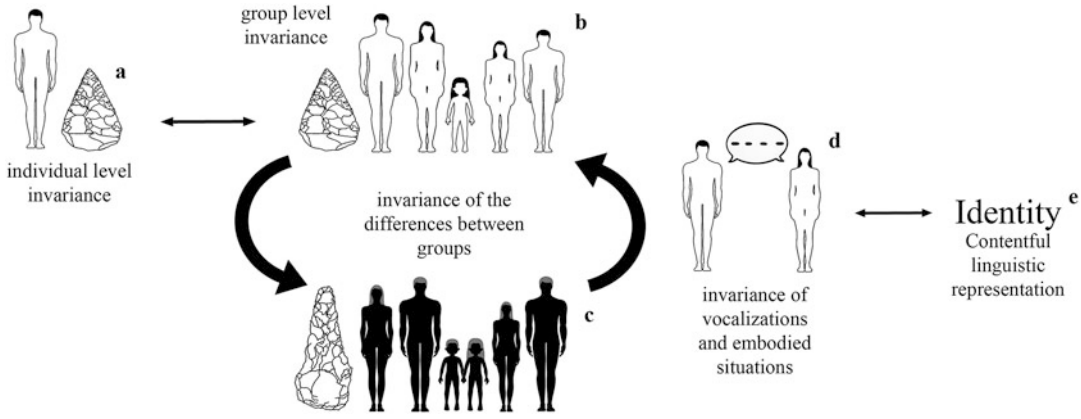

Fig. 19.5 Schematic illustration of the emergence of the contentful concept of identity from a basic (contentless) level of embodied engagement with handaxes and their makers. (**a**) The repeated causal coupling of an agent with a specific handaxe style (drop shaped) creates an invariant relationship at the individual level. (**b**) The handaxe style is transmitted to other group members and establishes an invariant relationship between style and the members of such a group (individuals in white). (**c**) A different (pointed) handaxe style is invariantly associated with the members of another group (individuals in black). Agents can learn to directly perceive the identity of the groups by contrasting the different style-membership relationships (i.e., perception of the invariance of the differences between groups). (**d**) Agents can start accompanying each of these embodied situations with vocalizations, thus gradually establishing an invariant pattern between specific vocalizations and sensorimotor features. (**e**) The contentful concept of identity is socially defined by grounding its content in the previous embodied relations

to which artifacts can act as signs only when referential content is separated from artifacts' expression (Sonesson 2006, 2010).[10]

The inferential production of significative artifacts remains a viable option, but it cannot any longer be based on sub-personal representations and propositions, given the metaphysical problems introduced earlier. In contrast, the inferential strategy needs to be REConceived in terms of an actual linguistic construction. In line with the radical enactive principles of culturally scaffolded mind, this implies creating a language-based "stand for" function and then using it to ascribe declarative concepts to artifacts. Accordingly, rather than a distinction between icons, indexes, and symbols as per the computational logic of sign, object, and interpretant delineated by Peirce, RECA divides signs in contentless (directly perceivable) and contentful (inferentially and language-based) ones. Such a division is transversal to the Peircean classification, so that some categories of signs such as indexes can be either contentless or contentful.

Contextualized to our case study, the regular creation of a particular form for Acheulean handaxes, defined by a set of group-specific habits, establishes a behavioral norm. This contingency creates a reliable association between the members of a certain group and the shape of a tool, thereby instantiating an extended visual icon for these individuals (Fig. 19.5). Consequently, identity is directly perceivable within the collection of bodily and artefactual features that characterizes the visual icon of the members of a specific group. It lies in the structured relations between the observers, the shape of the artifact, and its recurrent association to the body of particular individuals. And it emerges in comparison to the bodily icon of other agents that are not showing the same artifact. The meaning of the handaxe as an index of identity is therefore understandable from this cluster of sensorimotor contingencies (Garofoli 2018). Or, adopting our radio-wave metaphor, the brain

[10]See Garofoli and Iliopoulos (in press) for a detailed discussion about the differences between the theory of enactive signification and RECA.

becomes progressively attuned to more sophisticated aspects of the world, such as the recurrence of artifact shapes and hominin bodies. Recognizing and imaging this situated concept of identity imply reenacting the same relationship, respectively, in the presence or absence of the external material scaffold.

Furthermore, RECA rejects the conservative embodied idea that abstract concepts, abductive inferences, signs functions, propositions, and meta-representations are brain-bound representational primitives. In contrast, these cognitive properties emerge as linguistic constructs from a culturally scaffolded process. For example, within intersubjective contexts, the material engagement with handaxes can be initially accompanied by the use of prosodical vocalizations, in order to emphasize particular embodied actions (cf. Mithen 2005 on Neanderthals). Later, the invariance of vocalizations and embodied situations can lead to the formation of words referring to such specific contingencies. The accumulation of many of these tokens in turn leads to the progressive development of linguistic propositions that describe states in the world and can be used to communicate empirical aspects of the making of a handaxe and reinforce its use in marking identity. The very abstract concept of identity can emerge as a language-based abstraction, whose content is grounded in embodied situations (Barsalou et al. 2008). Furthermore, propositional strategies can allow exploring the reasons behind actions, by inventing language-based meta-representations (e.g., the linguistic expression "I know that you know"). The human niche therefore changes over time by integrating a landscape of affordances for direct perception and imagining with narrative practices, and accordingly the mind turns into a hybrid of basic and representational processes. In sum, RECtified handaxes offer an example of how representational and propositional thinking is the outcome of cultural engagement with artifacts and other hominins and not its premise, as maintained by the conservative models.

Concluding Discussion

I started this chapter by illustrating the core assumptions behind the internalist view in evolutionary cognitive archaeology and the critique advanced by the relational conservative embodied models. However, I argued that the internalist view can accommodate the relational objections by renouncing deterministic and epiphenomenalist leans and assuming a constructivist perspective. Within this emended version, internal representations, instead of been numerous, specific, and completely internal to the mind, are few and more general and can extend themselves into material reality, thereby widening their computational basis. However, these representations are still subject to the metaphysical problems of content, substance, and origin (see the *Introduction*) and maintain a Cartesian view of the mind. After this assimilation process, rather than a sharply different paradigm from the internalist view, the conservative embodied critique restitutes a milder version of it.

In contrast, I have argued that such remaining problems can be overcome only through a radical reassessment of embodied and extended principles in evolutionary cognitive archaeology, which implies abandoning even minimal forms of representational apriorism. Through the example of RECtified Acheulean handaxes, I have shown that material engagement need not be conceived as the amplification of internal representations. In contrast, we need to see it as a process of resonance to deeper properties of reality brought forth by artifacts, which constitutes the roots for the construction of representational thinking. This move not only allows escaping the aforementioned metaphysical issues, but it also sets aside residual ideas about an evolved modern human nature resurfacing within the more conservative approaches. Insofar as cognitive functions are thoroughly relational and fully

constituted through cultural and material reality, the idea of a complete and modern mind becomes difficult to defend, for there is no more fixed component where to anchor the concept of "intrinsic human nature."[11]

Overall, the handaxe case study offers a gist of how the radical enactive agenda proceeds in evolutionary cognitive archaeology. In its negative part, the radical critique argues against the conservative account by showing that it (1) incurs unbearable metaphysical costs by assuming that handaxes are coupled to deeply problematic representational primitives, (2) lacks a genuine developmental perspective, and (3) fails the (empirical) criteria of minimalism at the core of conditional and realist accounts in evolutionary cognitive archaeology (see Abramiuk this volume, 2012, pp. 30–33; Garofoli 2017a). In relation to the third point, radical analyses of Acheulean contexts have indeed shown that a priori representations are not necessary cognitive conditions to explain a set of Acheulean artifacts that include and go beyond handaxes. In contrast, the abilities of basic minds are quite sufficient to account for these artifacts, thereby disconnecting the conservative explanations from the archaeological record (see Garofoli 2015). Thus, there exist metaphysical, developmental, and empirical reasons to consider the radical account superior to the conservative one. Conversely, in its positive part, the core of the radical enactive program lies in identifying different trajectories of integration of basic and scaffolded minds, by pinpointing the conditions for such a cognitive metamorphosis within the archaeological record. Accordingly, the handaxe case study discussed in this paper sets forth a content-relaxed, developmentally plausible, and minimalistic proposal for the long-term emergence of identity concepts and meta-representations, which needs to be assessed for its plausibility through contextualization with additional trajectories of cognitive/cultural transformation (Garofoli 2017a).

Nevertheless, the critique advanced by RECA implies relevant costs. On the one hand, RECA's metaphysical discourse engages with the ambitious task of eliminating internalist concepts that are currently deeply entrenched within cognitive science. Among these, it stands out the idea that theory of mind is a sub-personal and innately specified ability present in all human beings, which currently exert great impact in developmental and comparative psychology (e.g., Baron-Cohen 1995; Leslie et al. 2005; Onishi and Baillargeon 2005; Krupenye et al. 2016; Buttelmann et al. 2017). The radical enactive program accordingly presupposes that this basic tenet need be renounced and argues for a language-based construction of theory of mind abilities. On the other hand, this radical program pursues its aims without allying with its cousin, namely, the conservative embodied approach. Although RECA agrees with some aspects of this critique, it urges for a more substantial revolution in the way of criticizing the internalist view. Accordingly, it invites us to deeply rethink theories that are currently on the rise in ECA and more general in cognitive science and archaeology. In particular, as shown by the distributed approach, the application of the extended cognition paradigm to cognitive evolution is in its earliest steps and has shown promising in explaining the scaling up of groups beyond the computational limits of the human brain (Coward 2016). At the same time, Peircean approaches have only recently reached a deeper and more analytic form within ECA (e.g., Preucel 2007). After a decade of imperfect multidisciplinary overlapping between archaeology, cognitive science, and semiotics, the latest years have seen a more thorough application of Peircean semiotics to the study of cognitive and semiotic transformation in human evolution (Malafouris 2013, Chap. 5; Iliopoulos 2016b). This integration helped undermine the idea of a clear-cut emergence of symbolic thinking intrinsic to the standard internalist view. Similarly, the application of niche construction theory in interpreting archaeological changes have invited scholars to abandon narrow neo-Darwinian accounts to cultural and cognitive evolution (see Prentiss and Laue and Prentiss this volume). Nevertheless, although these new theories undoubtedly have powerful epistemological reasons to their favor, their

[11] See Hutto and Myin (2013) on the difference between the conservative idea of "extended cognition" and the radical one of "extensive" cognition.

reliance on representationalist models motivates RECA's skepticism. Indeed, no epistemological advantage can compensate the risk of maintaining positions that are incompatible with naturalism, reintroduce mysterious mental entities, and foster dualistic views about the relationship between the mind, the body, and the world. Thus, the reasons for RECA's worries remain valid and justify steering away from internalism and fully going radical.

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