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Transformations in Cognitive Science: Implications and Issues Posed

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Cognitive science currently offers models of cognition that depart substantively from those of information processing models and classical artificial intelligence, while it embraces methods of inquiry that include case-based, ethnographic, and philosophical methods. To illustrate, five overlapping approaches that constitute departures from classical representational cognitive science are briefly discussed in this paper: dynamical cognition, situated cognition, embodied cognition, extended mind theory, and integrative cognition. Critical responses to these efforts from members of the self-proclaimed cognitive science orthodoxy are also summarized. The paper then discusses ethical and epistemological implications arising from the "new" cognitive science and from critical responses to it and considers the broader importance of this literature for theoretical and philosophical psychology.

Keywords: cognitive science, representation, epistemology, methods

An important thread connecting ecological (Still & Costall, 1987), social constructionist (Burr, 1995; Gergen, 1994), phenomenological (Wertz, 1993), discursive (Harré & Gillett, 1994; Potter & Wetherell, 1987), and critical (Fox & Prilleltensky, 1997) psychologies is an oppositional stance toward the doctrine that the mind is fundamentally computational in operation (i.e., like a digital computer) and that it processes units of information in the form of mental representations or symbols (Fodor, 1980). Because this doctrine, dubbed "cognitivism" (Dreyfus, 1972/1992) has informed traditional cognitive research in psychology, the very term "cognitive" suggests problematic assumptions and methodologies for many psychologists adopting a critical stance toward psychology in the main. Indeed, it is fair to say that criticism of cognitive psychology has emerged as one of the central projects of theoretical and philosophical psychology. Criticisms converge around the individualistic framework and dualist implications following from the study of mind in isolation, mechanistic accounts of intentionality, and shortcomings of the experimental protocols required for isolating cognitive mechanisms.

However, this paper is written with conviction that cognitive science is undergoing important transformations, and that its newer approaches to understanding and studying cognition are more friendly than otherwise to psychologists critical of the central directions their own discipline has taken. Several of these approaches are here surveyed. At the same time, newer approaches pose important questions deserving of considerable attention on the part of theoretical psychology: more, perhaps, than they have received to date. Some questions have been raised by those faithful to the tenets of traditional cognitive psychology, as will be also outlined here. However, the paper suggests that opportunities for critical engagement on the part of critics of traditional cognitivism are likewise evident. This article can offer only brief review of some exemplary new approaches in cognitive science and a reaction from traditional cognitive

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psychologists (Part 1), as well as a sketch of relevant questions and implications posed (Part 2); there is little hope of giving the thorough treatment deserved. I shall focus a bit more intently on one issue with central relevance, namely whether it is important in the first place to distinguish "cognitive" from processes or activities of other kinds, and what might be the principled grounds for doing so. However, my primary aim is to bring the "new" cognitive science and its questions into clearer focus as part of a wider project of considering future directions for theoretical and philosophical psychology.

Part 1: Cognitive Science Old and New, and Old Again

Important changes are well underway within the interdisciplinary field of cognitive science, if not yet so noticeably within the narrower province of cognitive psychology per se. Many circles of academic practice maintaining a primary identification as cognitive science currently exhibit radical alterations in fundamental assumptions about the nature of human cognition, and corresponding methods of inquiry that bear little resemblance to those of formalist, internalist models of cognition long associated with or definitive of cognitive science. The extent to which these represent "new" efforts is debatable. Over the past three decades cognitive science has included important work on situated cognition: Neisser and others have bemoaned the lack of ecological validity in information processing paradigms, Lakoff and Johnson, Damasio, and many others have made strident efforts to offer richer theories of cognition's embodiment. Moreover, cognitive theory now called revolutionary draws with varying degrees of explicitness and detail from Heidegger, Merleau-Ponty, Dewey, Vygotsky, and the Gibsons. But what seems to be happening currently is a greater consolidation of some rather divergent strands of departure from the orthodoxy into a more robust and coordinated countermovement *within* cognitive science. More tellingly, a corresponding critical response from traditionalists is flaring. Thus from the point of view of the cognitive science orthodoxy, movements discussed in this paper are threatening cognitive science at its core and, along with the hegemony of neuroscience, are slowly disintegrating the distinctive realm of the cognitive on a conceptual, not merely disciplinary level (e.g., Adams & Aizawa, 2008). But from the perspective of those long disgruntled with information processing models, the orthodoxy's loss represents a gain. There is much reason to be hopeful, even excited about cognitive science these days. But it remains unclear what best to do with the excitement, and there is substantial room for caution.

Representation and Computation

First, to make the case that something is new or changing, we need to position it in relation to something old, or prior. Although the meaning and uses of *cognitive* vary widely, what will be taken here as the doctrinaire view in *cognitive science* is the so-called representational view and computational theory of mind, foundational to the development of artificial intelligence. Accordingly, mind consists of a complex system of representations of the world; these are the building blocks of thought from which more complex thoughts are constructed. The fundamental operations of mind are computational, and the computations take place over the representational system. Fodor's *Language of Thought* (1975) and Newell and Simon's physical symbol system hypothesis are among the best known examples of this approach (Newell & Simon, 1976). By the 1970s abstracted study of computational operations on representations was essentially definitive of cognitive science.

As one branch of contribution to cognitive science, cognitive psychology's information processing paradigm (e.g., Broadbent, 1958; Neisser, 1967) helped to shape and was further shaped by this conception of cognition. Implications that follow for cognitive psychology include a focus on the individual cognizer in isolation from the "real" world, the overarching goals of decoupling cognitive processes to discern their individual effects, and articulation of internal structures and mechanisms underlying cognitive states, all of which are accomplished most effectively with controlled laboratory research design.

This approach to human cognition, with its focus on the structure of internal symbols and the formal rules for their manipulation and resultant "methodological solipsism" (after Fodor, 1980; see Wilson & Clark, in press, p. 3) still has many vocal advocates some 30 years

later, but now customarily bears the moniker of "GOFAI" (Good Old Fashioned Artificial Intelligence). The 'good old-fashioned' feature serves as both an anchor for the faithful and as emblematic of its status as quaint relic for dissenters, much as one's response to the term "good old-time religion" or "good old boy" depends upon one's commitments. If AI is old-fashioned, critiques of its premises are similarly showing wear. A critical reaction to AI erupted within cognitive science itself as early as the 1960s (Anderson, 1964; Neisser, 1963); the first major alternative models were offered by connectionism which, in view of advances in neuroscience, were intended to more adequately capture the weblike complexity of neural organization. Although connectionist models reject the central and sequential processing assumptions of artificial intelligence, and the nature of representation shifts from mediating units to connection strength between units and embodied neural systems use external representations such as mathematical symbols, nevertheless representation remains fundamental to these models and explanation is required at the level of individual processing of representations (McClelland, Rumelhart, & Hinton, 1986). Brain is the boundary of mind; or, cognition is "bounded by the brain," meaning that cognition is contained within the brain and limited to its unique modes of processing.

Critical responses to the tandem assumptions of representationalism and computationalism (labeled "cognitivism" by the early 1970s) have accompanied artificial intelligence almost from its inception. However, apart from Dreyfus (1972/1992) and Haugeland (1985), these have been levied primarily from those outside of cognitive science per se.

Thus against the widely criticized but deeply entrenched and doctrinaire cognitivism *within* cognitive science, the stated aim of a newly launched series, entitled "*New Directions in Philosophy and Cognitive Science*" edited by John Protevi, and positioned as a vehicle for dialogue between continental and analytic philosophers, appears remarkable:

"This series brings together work that takes cognitive science in new directions. Hitherto, philosophical reflection on cognitive science—or perhaps better, philosophical contribution to the interdisciplinary field that is cognitive science—has for the most part come from philosophers with a commitment to a representationalist theory of mind. However, *as cognitive science continues to make advances*, *especially in its neuroscience and robotics aspects*, there is growing discontent with the representationalism of traditional philosophical interpretations of cognition. *Cognitive scientists* and philosophers have turned to a variety of sources—phenomenology and dynamic systems theory foremost among them to date—to rethink cognition as the direction of the action of an embodied and affectively attuned organism embedded in its social world, a stance that sees representation as only one tool of cognition, and a derived one at that" (Protevi, 2007, emphases added).

The passage suggests that the dissatisfaction prompting the search for new directions arises from advancements in cognitive science itself—neuroscience and robotics—for which explanations framed in terms of orthodox representationalism are no longer proving to be adequate. So the assumption is that alternatives to representationalism will provide not merely plausible, interesting, or even ethically superior approaches, but that they will better fit the newly converging empirical data. That is, the emphasis on fit of evidence might be contrasted with that of some critical departures from cognitivist frameworks that focus on the adequacy of the human subject emerging from mechanistic accounts or from the mind-as-computer metaphor (e.g., Rychlak, 1988). With an emphasis on the fit of evidence, some advocates of newer approaches stress that new metaphors and models will lead not merely to richer articulations but to more accurate, real, or true conceptions. Robert Wilson, for example, notes that "locational externalism is not simply a view of how we "talk about" or view cognition and the mind—about the epistemology of the mind, one might say—but about what cognition and the mind *are*–about the ontology of the mind" (forthcoming, p. 5). Andy Clark emphatically asserts his view of humans as "natural-born cyborgs" to be "the plain and literal truth. . .above all a SCIENTIFIC truth, a reflection of some deep and important facts about (a whiff of paradox here?) our special and distinctively HUMAN nature" (2003, p. 3).

This effort to ground rejection of orthodox representationalism in a commitment to accuracy and inference to the best explanation poses a set of interesting questions and tensions that are

among the reasons this literature is deserving of greater attention than it has received on the part of psychologists critical of mainstream frameworks. I will return to some of these issues in the context of discussing implications, but will first briefly review several prominent lines of dissent from orthodox cognitivism that have emerged *within* the cognitive and learning sciences, offering summary of their central assumptions and examples of the kinds of evidence on which their claims rest. Brief discussion of a critical response from the orthodoxy follows, after which important implications and questions generated by the debate are offered for consideration.

Note that these perspectives overlap substantially and that there are many ways of organizing discussion of their respective contributions. Also note that many important lines of theorizing are left out. However, the following is one imperfect scheme offered principally for the purposes of illustration:

Dissent From Orthodox Representationalism

Dynamical cognition. The dynamical approach to cognition forwards a claim that human agents are dynamical systems: quantitative systems that differ in form from that of digital computing systems. As the dynamical hypothesis appears in a founding paper by van Gelder (1998), dynamical cognition makes use Dynamical Systems Theory (a branch of mathematics concerned with nonlinear systems and chaos) in much the same manner that traditional cognitive science makes use of computer science to inform the computational model. Dynamical Systems Theory construes time as central to understanding the changes in a system itself, but distinguishes between the nature of time sets that pertain with concrete and abstract systems. A central assumption is that the human cognitive system, because of the particular form in which it is embodied, is a concrete system rather than a system of abstract symbols: "The real time of concrete systems is the set of instants at which things can actually happen, ordered by temporal priority (before/after). Concrete events are paired with instants or periods of time, and hence stand in temporal relations with each other" (van Gelder, 1998, p. 5). A system of abstract symbols (consistent with the GOFAI model of mind), in contrast, is "not situated in real time at all, and so must take some other set as their time set; usually, it is the positive integers or the real numbers" (van Gelder, 1998, p. 5).

The dynamical approach builds upon the earlier general systems theory, influential at midcentury, but considers more specifically the unique properties of the human cognitive system, emphasizing the importance of interactions over real time to practices such as decision making. The conception of real time as central to cognitive processing is regarded as a more accurate conception of human functioning than is artificial intelligence. In *Mind as Motion* (1995), van Gelder and Port comment as follows:

Cognitive processes and their contexts unfold continuously and simultaneously in real time. Computational models specify a discrete sequence of static internal states in arbitrary "step" time (t1, t2, etc.). Imposing the latter onto the former is like wearing shoes on your hands. You can do it, but gloves fit a whole lot better (van Gelder & Port, 1995, p. 2).

Other features of the dynamical perspective include a focus on change (vs. state), position (vs. structure), parallel processing (vs. serial), and continuous change (vs. output). Moreover, moving beyond connectionism's system focus, dynamical cognition approaches conceive of an agent's *body and environment* as a "coupled" dynamical system, whereby "coupled" is understood as "reciprocal, direct dependence" (van Gelder, 1998, p. 5). Thus the notion that cognition is embedded is a central thrust of the dynamical perspective: "Any account of cognition must eventually explain how it is that cognition relates to that which grounds and surrounds it" (p. 14). Complementary to the hypothesis that cognition might be construed as a dynamical system is the assumption that it must be studied as one. Thus evidence taken to support the dynamical hypothesis and the temporal structure of cognition is taken from specific, real-world contexts of human decision making, analysis of the way people outside of laboratories make decisions that impact their lives in commonplace ways (e.g., selecting stereo equipment). Analysis focuses on the operation of coupled systems in real time, noting changes that occur with what appears to be principally a matter of the passage of time. As van Gelder notes, "often, getting the timing right is critical to the success of cogni-

tive performance; this is especially so when in direct interaction with surrounding events" (van Gelder, 1998, p. 14).

Situated cognition/Situativity theory of cognition. Systems theory and complex systems are also antecedents of the situated learning movement, as are transactionalism (Dewey & Bentley, 1949) and activity theory (Vygotsky, 1978). The focus of situated cognition as a movement has been epistemic, with a particular application to revisioning the focus of education: "A theory of situated cognition suggests that activity and perception are importantly and epistemologically prior—at a nonconceptual level—to conceptualization. . .An epistemology that begins with activity and perception, which are first and foremost embedded in the world, may simply bypass the classical problem of reference" (Brown, Collins, & Duguid, 1989, p. 41). This is an epistemology that like that of Dewey, challenges the basis of any clear distinction between knowing and doing. The situated approach also construes intelligent behavior as arising within particular settings such that its features are beholden to that setting, in contrast with a view of cognition as an abstract realm or self-regulating process. Anthropology provided further frameworks, methods, and case material to support the epistemological claims of situated learning, particularly Jean Lave's ethnographic analyses of the inventive activity of "Just Plain Folks" in everyday problem-solving contexts, as when dieters asked to serve one quarter of two thirds of a cup of cottage cheese displayed novel solutions such as measuring out a three quarter portion and scooping away two thirds (see Lave, 1988). According to Brown, Collins, and Duguid, "This sort of problem solving is carried out in conjunction with the environment and is quite distinct from the processing solely inside heads that many teaching practices implicitly endorse. By off-loading part of the cognitive task onto the environment, the dieter automatically used his environment to help solve the problem" (19751989, p. 36).

Although the most visible applications of situated learning are in the classroom, characterized by conception of the classroom as a practice community and learning construed as participation in a local knowledge-generating community (Greeno, 1998; Lave & Wenger, 1991), insights emerging from the situated cognition research have been used successfully in robotics. Suchman (2007) suggests that the transfer of "the trope of the "situated" (p. 14) from education to robotics might be attributable to discussions taking place between doctoral students Phil Agre and David Chapman at the Massachusetts Institute of Technology (MIT) AI lab in the 1980s, and through them to Agre's supervisor Brooks. Brooks (1991) similarly notes these discussions and interprets them as focusing on the suggestion that people do not always engage in planning or problem-solving when carrying out mundane, day-to-day activities. In any case, the incorporation of situated learning principles into robotics technology has been christened "the New AI" to distinguish this approach from that of the "old-fashioned" variety that focuses on central representational and planning capacities (e.g., Anderson, 2003). Rodney Brooks, pioneering in this effort, "deliberately changed the modularity from the traditional AI approach," and developed a new architecture based upon "task achieving behaviors rather than information processing modules . . . used on robots which explore, build maps, have an onboard manipulator, walk, interact with people, navigate visually, and learn to coordinate many conflicting internal behaviors" (1991, p. 1229). Brooks defines situatedness as having to do with "the 'here' and 'now' of the environment that directly influences the behavior of the system" (1991, p. 1227). His best known example is "Herbert," programmed to collect empty soda cans from a rather messy and chaotic lab environment. Rather than building Herbert to construct an internal map of the lab environment and compute the optimal route to each can, Brooks instead built in a structure of subsystems controlled directly by environmental features specific to the lab space:

> There was no central locus of control. In general, the separation into perceptual system, central system, and actuation system was much less distinct than in previous approaches, and indeed in these systems there was an intimate intertwining of aspects of all three of these capabilities. There was no notion of one process calling on another as a subroutine. Rather, the networks were designed so that results of computations would simply be available at the appropriate location when needed. The boundary between computation and the world was harder to draw as the systems relied heavily on the dynamics of their interactions with the world to produce their results. For instance, sometimes a physical action by the robot would trigger a change in the world that would be perceived and cause the next

> action, in contrast to directly executing the two actions in sequence (Brooks, 1991, p. 1229).

Herbart stands in marked contrast to "Shakey," a mobile robot constructed 20 years earlier to operate according to symbolic translations of the environment which then prompted appropriate sequences of action. The task of programming robots to construct complete representations of complex environments and then to update them with every change in that environment was, according to Brooks, getting rather unwieldy; moreover, "Shakey only worked because of very careful engineering of the environment." (1991, p. 1228), which became a problem in "dealing with the real world" (1991, p. 1228). Thus Brooks explicitly cites departure from representationalism as well as situatedness and embodiedness as guiding principles in his approach to robotics and as a demonstrated advantage to the functioning of his robot in the complex environment of the laboratory (1991, 1999). It is worth noting, however, that Suchman critiques Brooks' notion of situatedness as nonrepresentational, on grounds that it veers toward forms of neobehaviorism, wherein behavior is construed as reactive and contingent. She clarifies that her own "use of situated does not mean acting in the absence of culturally and historically constituted resources for meaning making" (i.e., as might be taken to be implied by nonrepresentational), but that "situatedness is presupposed by such practices and is the condition of possibility for their realization" (2007, p. 15).

Embodied cognition. As Brooks points out, situatedness and embodiment are subtly different notions: "An airline reservation system is situated but it is not embodied" (Brooks, 1991, p. 1). Thus an embodied cognition movement is artificially extracted here as a complement to the situated movement. One research area in which the movement designated "embodied cognition" emerges is developmental psychology, wherein the focus is on goal-directed infant activity patterns in real time (Thelen, Schöner, Scheier, & Smith, 2001). Other work in cognitive science more broadly has helped to provide a richly textured and convincing account of cognition as embodied, with this understood as entailing the claim that bodily experience is integral to, even preconditional to cognition (Varela, Thompson, & Rosch, 1991). Among the best known contributions is Lakoff and Johnson's reformulation of once-rarefied and formalized reason into something entirely carnal, for example 1999s *Philosophy in the Flesh.* Neurological studies of the centrality of emotion in directing rational decision making, supported by the somatic marker hypothesis (Bechara, 2004; Damasio, 1994, 1996) and Johnson's work on the bodily foundation of metaphor have similarly contributed to a genuine reappraisal of the nature of rationality and irrationality that is approaching something like a received view (Adams & Aizawa, 2008), The complementary assumption is that forms of cognition are determined by forms of embodiment, in stark contrast to the earlier formalist view of the medium's irrelevance.

Though the embodied cognition movement is promoted most frequently by appeal to advances in neuroscience and robotics, it corresponds, along with renascent philosophical interest in consciousness, to new awareness of the philosophical relevance of phenomenology to cognitive science (e.g., Gallagher & Zahavi, 2008; Noë, 2004; Petitot, Varela, Pachoud, & Roy, 1999). The methodological relevance of phenomenology becomes clear as the development of noninvasive imaging techniques provides images of neural processing that require reliable descriptions of conscious experience: "There is currently a growing realization that we will not get very far in giving a scientific account of the relationship between consciousness and the brain unless we have a clear conception of what it is we are trying to relate" (Gallagher & Zahavi, 2008, p. 9). Although there are disagreements as to the particulars of phenomenological method, its tradition of obtaining experiential data and analyzing patterns and structures emerging therein is potentially of great help in this project of relating brain states to conscious states.

Extended mind/Distributed cognition. A parallel philosophical movement takes the embodiment of cognition as a given but focuses more centrally on what extends beyond the body. Robert Wilson (2004); Andy Clark (2003), and others adopt a strong or radical externalism commonly called "the extended mind thesis" after Clark and Chalmers (1998). It also goes by the name "environmentalism" (Rowlands, 1999; Nersessian, 2005) and "locational externalism" (Wilson, 2004). The latter

term positions the extended mind thesis in relation to a tradition of externalism in philosophy of mind usually traced to Putnam (1975) and Burge (1979), each of whom challenged the suitability of entirely individualistic frameworks to account for mental content or meaning, arguing that semantics and normativity cannot arise in and are therefore not metaphysically determined by mental processes. However, Clark and Chalmers identify their version as "*active* externalism" in contrast to earlier instantiations of externalism in which environmental structures are *passively* involved in cognitive processing (1998, p. 7). By identifying environmental features/structures as actively involved in processing, the intended meaning is that they play "a crucial role in the here and now," being "coupled with the human organism" (p. 7). However, despite the use of the term "coupling" the extended mind thesis identifies brain, body, and environment, not merely as interactively linked but as *coconstitutive* processes. By this is meant that the processes mutually impact and constrain one another. Neural processes are indeed one part of the story but only one part; the 'skin-bag' boundary (Clark, 2003) is merely an arbitrary and conventional stopping point for analysis. The "parity principle" is central to extended mind arguments: If both processes in the head and processes in the environment are necessary to successful completion of a cognitive act or task, then environmental processes are just as "cognitive" as brain processes (Wilson, in press). According to Clark and Chalmers, environmental features thus deserve "epistemic credit" (1998, p.8), on par with the credit we give the brain for its role in the production and acquisition of knowledge.

As Rowlands (1999) points out, environmentalism (extended mind) contains an epistemological as well as an ontological claim. The ontological claim concerns the location of cognitive processes (i.e., not exclusively inside the skin), but the epistemological claim is that such processes cannot be understood by focusing on the area inside the head in isolation. Thus the unit of analysis is the intelligent act or practice as performed in real world settings, local practice communities, rather than mechanisms underlying intelligent action as studied in isolation: "human cognition in its natural habitat" (Hutchins, 1995a, p. xiii). The practices in question, sometimes called "cognitive practices" include applications of memory, problem-solving, and model-construction, and communication in real world contexts of both routine performance and innovation. Within the branch of cognitive science designated 'distributed cognition,' brain and environment are similarly construed as a coconstitutive system, and this drives and structures the investigation and analysis. Among the better known efforts is Hutchins' analysis of the navigation bridge of a working Navy ship and the cockpit of a commercial airline. In each case Hutchins uses comprehensive ethnographic methods to understand the process of navigation as it is accomplished by the practice community as a whole and as it incorporates not only social role and negotiated identities but also training, traditions, instrumentation, and representational functions of charts, maps, and manuals (1995a; 1995b). Nancy Nersessian and colleagues investigate scientific problem solving in biomedical engineering labs, theorizing the labs as innovation communities within which model construction and manipulation are activities embedded in and inextricable from networks of tradition, social convention, and ongoing negotiation of identities through relationships with other persons and with laboratory objects and artifacts (Nersessian, 2005, 2006; Nersessian & Patton, in press; Osbeck & Nersessian, 2006).

In addition to the arguments from active practice and the arguments from meaning making, one important contribution to the case for extended mind, as for externalism, comes purely in the form of thought experiments and fictional scenarios. Clark and Chalmers (1998) based much of their original argument for extended mind upon the Otto and Inga argument, a thought experiment that involves a very typical kind of situation: Inga is cognitively unimpaired and Otto has dementia, requiring Otto to use many environmental supports to perform tasks for which Inga relies on biological memory. They both wish to see a new exhibition at the Museum of Modern Art. Inga remembers that it is on 53rd St.; Otto has to look the information up in a notebook. Indeed, across many contexts Otto relies upon his notebook just as Inga relies upon her memory. Clark and Chalmers use this to argue that "The information in the notebook functions just like the information constituting an ordinary nonoccurrent belief; it just happens that this information lies beyond the skin" (1998, p. 13). In *Natural Born Cyborgs,* Clark

(2003) likewise relies upon arguments from thought experiments critically dubbed "cyborg fantasy arguments" by Wilson; however, Clark's thesis that we are ourselves "human-technology symbionts: thinking and reasoning systems whose minds and selves are spread across biological brain and nonbiological circuitry" (2003) relies more substantially on analysis of the philosophical significance of actual technology in use or undergoing development.

Integrative efforts. Obvious areas of overlap between dynamical, situated, embodied, distributed, and extended accounts of cognition are prompting heightened efforts to articulate integrated frameworks, sometimes under the banner of "Four E" cognition*: Embodied, Embedded, Extended, Enactive* (Protevi, 2007).

Richard Menary's "*Cognitive Integration*" is the inaugural work in Protevi's series on "*New Directions in Philosophy and Cognitive Science*" mentioned earlier. The integration in Menary's title refers to biological and environmental processes in the operation of memory and other forms of cognition. As for extended mind theorists, the advantage offered by body and environment integration is an augmentation in cognitive function that such coordination makes possible. However, Menary rejects the remnants of 'internal-external' distinctions that continue to plague even embodied and extended accounts of cognition. Menary similarly takes issue with the parity thesis and the assumption of functional similarity between "internal" and "external" processes: "There are genuine and important differences in the way that memories are stored internally and externally and these differences matter to how the memories are processed" (Menary, 2007, p. 59).

On Menary's account cognition is both embodied and normative, and it is by means of manipulation of objects and representations that embodied engagement is achieved. Manipulation is itself a "hybrid process" of body and environment: "It is in the fluid manipulation of objects in the environment and in fluent skilled activities that we are most likely to find the unconscious integration of the body schema with the environment" (p. 79), such as when body and car integrate in the act of driving. Thus, "cognitive integration makes sense when we understand it as not just externalizing what is already in the head" (p. 75). Moreover, manipulations include physical instantiations of inscriptional schemes: alphabets and numerical systems, musical notations, flowcharts, and so forth, which are elsewhere called external representations. Manipulation of these inscriptions is highly normative:

> Within the wider setting, manipulations of representations are embedded in a practice, which has a normative as well as a physical/causal dimension, such as the practice of manipulating mathematical notations. The practice of manipulating a representation is normative because we learn how to manipulate the representations correctly and because of the cognitive purpose of the practice. The purpose is to achieve a particular kind of goal, such as solving a problem, planning or making inferences which I call the cognitive task (Menary, 2007, pp. 5–6).

Bodily schemas and unconscious sensorimotor action programs emerge both by evolutionary adaption and by norm-governed practices of all kinds. They are fine tuned through training and reinforcement. Emerging representational systems ultimately constitute culture, as they are passed along to present and future communities.

Summary of Departures From Cognitivist Orthodoxy

Excellent reviews of situated cognition (forthcoming; Suchman, 2007) and embodied cognition (Anderson, 2003) provide much more detail than can be offered in this space. This paper has tried to identify some of the more prominent perspectives for the purpose of illustrating the nature and extent of contemporary departures from the cognitivist assumptions that have so long been a focus of criticism for theoretical psychologists. Published in *Artificial Intelligence*, of all places, is Anderson's instructive purview:

> For over 50 years in philosophy, and for perhaps 15 in Artificial Intelligence and related disciplines, there has been a rethinking of the nature of cognition. Instead of emphasizing formal operations on abstract symbols, this new approach focuses attention on the fact that most real-world thinking occurs in very particular (and often very complex) environments, is employed for very practical ends, and exploits the possibility of interaction with and manipulation of external props. It thereby foregrounds the fact that cognition is a highly *embodied* or *situated activity*— emphasis intentionally on all three— and suggests that thinking beings ought therefore be considered first and foremost as acting beings. This shift in focus from Descartes' "thinking thing", and the picture of human being and subjectivity it suggests, to a more Heideggerian approach to being in the world, in which agency and interactive coping

> occupy center stage, is an extremely important development, the implications of which are only just beginning to be fathomed (Anderson, 2003, p. 91).

Methodological implications that follow from the shift in emphasis from internal symbolic structure to embodied or situated activity are profound. They include 1) a change from controlled laboratory design to *analysis of real world action/practice*; there is little if any imposition of artificial (laboratory) constraints except as informed by analysis in real practice contexts. This necessitates 2) a shift to a focus on systems and *communities of practice* rather than individual (brain-bounded) processes. In a related fashion, this implicates attention to problems arising in real contexts and cognitive tasks employed to resolve them, in contrast to the traditional focus on mechanisms and their isolation. That is, there is no effort to "decouple" processes assumed to be inextricably linked. Finally, we might note the new lines of interdisciplinary cooperation emerging in relation to new developments in cognitive science, not merely between philosophy and computer science or philosophy and neuroscience, but between fields as traditionally divergent as robotics and anthropology.

An Orthodox Response

Particularly in the form of Menary's *Cognitive Integration* and other approaches that fall under the banner of enactivism (e.g., Noë, 2004), the assumptions forwarded by the "new" cognitive science seem so familiar (i.e., so like earlier articulations by Dewey, Merleau-Ponty, Vygotsky, and others), that it is difficult to imagine them as inflammatory and "radical" in their aims. Yet that is precisely how they are interpreted by critics such as by Fred Adams and Ken Aizawa: self-titled "representatives of the benighted cognitive science orthodoxy" (Adams & Aizawa, 2008, p. vii). An extensive body of critique of extended mind in particular has appeared, with the focus of the criticism ranging from a claim that the thesis relies upon an insufficiently sophisticated model of sensorimotor processing (i.e., as closed-loop feedback systems) (Grush, 2003), to the claim that extended mind theorists inaccurately or illegitimately appeal to functionalism in support of the model of cognition as extended in the directions indicated (Shapiro, 2008; see also Rupert, 2004). It is not this paper's purpose to review this literature but rather to point to its emergence—principally, as noted earlier, to emphasize that the development of a concerted critical response signals the growing influence of alternative perspectives. I highlight the response of Adams and Aizawa here not only because of its comprehensive scope but because the substance of their argument is accessible to the general reader and because these authors are open in their defense of the traditional projects and commitments of cognitive psychology, to which I have contrasted extended mind and other movements reviewed in this paper.

In "*The Bounds of Cognition*" (2008) Adams and Aizawa focus their remarks on the extended mind thesis; which they call "outrageous," "a radical break from orthodoxy," "a crazy hypothesis," and "off-track." Because of the focus on the extended mind thesis, their primary targets are philosophers of mind. However, they note clearly that "this is not to imply that the extended cognition movement is only embraced and advanced by philosophers. There are obviously clear statements of the hypothesis of extended cognition in the work of developmental psychologists, roboticisms, dynamical systems theorists, and cognitive psychologists" (Adams & Aizawa, 2008, p. 14). Thus the discomfort Adams and Aizawa express extends to other forms of dissent from the 'rules and representations' view, and their remarks on extended mind have bearing on the assumptions of embedded, situated, and dynamical cognition. Among their goals is "to keep cognitive psychology on track" (p. ix). Moreover, Grush (2003) notes that it is from the premises of these forerunning movements in cognitive science that the extended mind thesis has been 'extended.' This view is also evident in Adams and Aizawa's references to van Gelder (1995); Brooks (1999); Noë (2004) and Haugeland's theory of systems (1998) for example, in directing specific points of critique to extended mind.

The substance of the critical response developed in *The Bounds of Cognition* is organized around three main challenges the authors frame as "demands for further elaboration or clarification" (p. 174). One objection is that the generalizations made by extended mind theorists are too sweeping and too hasty given the form and extent of evidence used in support of the thesis. As an example, they review the evidence

Noë (2004) uses in support of what he calls the enactive approach, the central claims of which are that our ability to perceive "not only depends on, but is constituted by" the use of our sensorimotor skills, framed as a kind of knowledge (Noë, 2004, p. 2). They view Noë as offering "a special case of the extended cognition hypothesis according to which perceptual processes are constituted, in part, by bodily processes" (Adams & Aizawa, 2008, p. 154). They consider case by case the sources of evidence Noë presents, including reports of problems with sensory integration for adult patients who have had cataracts removed. Noë credits the integration problems to "experiential blindness" rather than sensory deficit, yet Adams and Aizawa assert that he does not sufficiently rule out the possibility that sensory deficits might be to blame, and that beyond ruling out the logical possibility of such deficits, there is "abundant experimental evidence indicating that congenital cataracts do lead to deficits in sensory processing" (Adams & Aizawa, 2008, p. 159). They also suggest that the enactive hypothesis would lead to predictions concerning effects of paralysis on perception that are not supported by available evidence. Paralysis, as they note, presents particular problems for the enactive theory because it prevents the deployment of sensorimotor skill Noë views as preconditional to experience. Yet they suggest that perception under neuromuscular block appears quite unimpaired according to several studies, the clearest of which is that of Topulow, Lansing, and Banzett (1993). Adams and Aizawa thus conclude that "the weight of currently available evidence goes against the hypothesis that bodily skills are an important constitutive element in perceptual experiences" (Adams & Aizawa, 2008, p. 172). They qualify their remarks by noting that this evidence is not an indictment of extended mind as a whole, given that its fit with available data must be evaluated on a case by case basis. Nevertheless, the critique of Noë's account of perception is the single case considered under the chapter heading: "*Inference to the best explanation and extended cognition*" (Adams & Aizawa, 2008, pp. 152–174).

Calling its proponents "transcranialists," a second line of criticism centers around what Adams and Aizawa identify as the "coupling-constitution fallacy:" the move from the assumption that processes are coupled to the conclusion that the coupled environmental processes are actually part of, constitutive of the agent's cognitive processing (p. 175). They credit several other critics, (e.g., Block, 2005; Prinz, 2006) for independently identifying the issue and similarly formulating it as problematic. Although the term "coupling" is used by cognitive theorists of different persuasions "each in their own proprietary sense" (p. 89), Adams and Aizawa note that it is a very prevalent form of argumentation to point to the way structures external to the brain are involved interactively with it in performing some cognitive task, and from this fact to argue that brain and body or brain, body and world thus are part of the system that accomplishes cognitive processing. In addition to the Otto and Inga problem originally presented in Clark and Chalmers (1998), examples include efforts to theorize intentions as distributed across persons and across persons and the environment (Gibbs, 2001), Wilson's example of a children's puzzle game for which problem solving is accomplished only by continually turning the head to and from the board and exploiting environmental structures (Wilson, 2004), and Clark's analysis of the academic paper writing, during which the brain "acts as a mediating factor in a variety of complex and interrelated processes which continually loop between brain, body, and technological environment. And it is this larger system which solves the problem" (Clark, 2001, p. 132, cited in Adams & Aizawa, 2008, p. 95). In each case mentioned, at issue for Adams and Aizawa (as for other critics) is the implication that material and cultural are themselves cognitive processes: "It simply does not follow from the fact that process X is in some way causally connected to a cognitive process that X is thereby part of that cognitive process" (Adams & Aizawa, 2008, p. 91). They also note a second version of the coupling-constitution fallacy which involves a move from the assumption that processes external to the brain are part of the cognitive system to the claim that this therefore implicates extended cognition. However, their pivotal point is that coupling and manipulation relations should not be collapsed with constitutive relations, making an external object cognitive by means of connecting it causally with a cognitive agent.

Note that Adams and Aizawa consider the view that cognitive processes are *causally* dependent on bodily and environmental processes

to be "an orthodox view in 21st century cognitive science" (2008, p. 177), one not disputed by traditional cognitive psychologists in the main. Thus they advocate greater attention to the distinction between causal and constitutive dependencies in articulating these interactions. The problem with the move from coupling to constitution, according to Adams and Aizawa (and the third line of critique), is that the inclusion of environmental processes into the conception of the cognitive agent itself prevents us from identifying any process as distinctively and meaningfully 'cognitive.' The 'mark of the cognitive' problem might be reworded as "What regions of spacetime contain cognitive processing?" (Adams & Aizawa, 2008, p. 6). Note that this does not stipulate human cognitive processing but, rather, cognitive processing in general.

Adams and Aizawa are on one hand mindful of historical considerations underlying any answer that might be given to the question of what demarcates cognitive processing: "It is not enough for transcranialists to argue that something extends beyond brain boundaries. . . There must be some appropriate theoretical affinity between what they call "cognitive" and what has traditionally gone under the name of "cognitive" (2008, p. 6).[1] On the other hand, they dismiss arguments to the effect that "it is some accident of intellectual history that common sense and orthodox psychologists speak as they do" (p. 22). They underscore the need for a "principled reason for thinking that the processes that are plausibly construed as cognitive occur, almost exclusively, in the brain," the provision of which depends at least in part on the theoretical basis for distinguishing cognitive from noncognitive events (p. 22).

The principled answer Adams and Aizawa provide to the question of what demarcates the cognitive consists of two claims. The first is that "the cognitive" involves at least some nonderived (nonconventional, i.e., non-normative) content. By nonderived content, they refer to "original" representations, which they distinguish from derived representations with examples: "Traffic lights, gas gauges, and flags are paradigm cases of items bearing derived content. Thoughts, experiences, and perceptions are paradigm cases of items bearing nonderived content" (2008, p. 32). Thus it appears they equate nonderived content with private experience. They defend the theoretical need for representations in general with appeals to the human capacity for using experience (storing information) to inform future actions, a capacity shared with many animals but not with Rodney Brooks' efficient robot. They note that need for underived representations specifically in part in relation to the need to explain "lone thinkers." This is a common appeal tied to some readings of the evolutionary story. The idea is that there was once in some organism a newly evolved state that effectively constituted the first "thought." Because this was the first of its kind, it could not have been transmitted from another organism. Adams and Aizawa affirm that natural language is entirely ("merely") derived, thus they are in essence arguing that cognition is demarcated by nonlinguistic thought. There is a long literature here from which they draw, particularly that of naturalized semantics, and another long literature which might be brought to bear upon problems with the distinction between derived and nonderived content and the extent to which it is necessary or helpful in terms of explaining the kinds of tasks specific to human beings. And because their argument for nonderived content appeared originally in their 2001 paper (Adams & Aizawa, 2001), proponents of extended mind have responded critically to the distinction. Clark (2005), for example, challenges the clarity of the distinction and the reality of nonderived content. Menary points out that nonderived content implicates a preexisting cognitive agent, and that, moreover, it poses no real challenge to claims made at least by cognitive integrationists, for whom perceptual experience is necessary to the event of thinking. Adams and Aizawa (2008; in press) review these critical responses but remain convinced of the importance of affirming nonderived content as common to cognitive processes, though they qualify this assertion as "an empirical hypothesis" (2008, p. 55).

The second distinguishing mark of cognition for Adams and Aizawa relates not to content as

[1] There is evidence that defining convergence around the meaning of "cognitive" is less clear than the authors assume. For example, Anderson and Ausebel's introduction to the1965 volume *Readings in Cognition* distances "the cognitive position" from "the computer model" of human functioning. Indeed, the authors claim that the computer model cannot be identified with the cognitive approach because they view the cognitive as essentially concerned with meaning, and new learning as "coextensive with meaningful learning" (Anderson and Ausebel, 1965, p. 11).

much as to the nature of the processing mechanisms involved, tied to their conviction that the business of all legitimate science is the identification of underlying mechanisms. That is, the first mark relates to the content which defines cognition and the second to the underlying process. The crux of their claim is that "human and many nonhuman brains contain many forms of information processing that manipulate and transform information in ways unlike those found in processes spanning the brain, body and environment" (2008, p. 31). Vision, memory, and attention are offered as examples of the kinds of processes categorized as cognitive, and their processing of nonderived content turns out to be the point of commonality between these.

Part 2: Implications and Issues Posed

At this point an anticipated response runs along the lines of, "Adams and Aizawa are presenting another version of 'The only game in town' (Fodor, 1975). And although *Four E* cognition sounds like a reasonable alternative, *x* said it better," *x* being Heiddeger, Merleau-Ponty, Dewey, Gibson, Vygotsky, Mead, and so forth. And it is easy to feel sympathy with this view. Cognitive science displays a tendency to privilege present research and scholarship despite frequent charges that it harkens back to Descartes.[2] However, outlined here are several reasons why the entire literature—both the positive statements of extended mind and *Four E* cognition and the critiques levied by traditionalists against it—are worthy of consideration and commentary on the part of psychologists with philosophical concerns. That is, I will here map out what amounts to a series of opportunities for collaborative engagement between theoretical psychology and the "new" cognitive science. Again, the intent here is not to fully develop responses to any of the questions raised so much as to point to areas in need of further development by this and other authors.

1. There is first the rather obvious point that although much of cognitive science and cognitive psychology plod on in traditional vein, much has been challenged from within and is changing. Thus critiques of the cognitive perspective need to be qualified in light of these developments.

2. There is work to be done by critics generally sympathetic to the direction of theorizing outlined by newer approaches, not merely those in the cognitive science orthodoxy; not only those threatened or appalled. More focused alignment with conceptual forerunners (classical pragmatism, phenomenology, and ecological psychology and others) can help to develop the connective tissue needed to fortify the newer approaches to cognition into a robust integrated alternative and at the same time, might strengthen and extend the influence of historical perspectives. In reference to phenomenology in particular, Gallager and Zahavi point out that "the very attempt to engage in dialogue with cognitive science forces phenomenology to become more problem-oriented and may thereby counteract what remains one of its greatest weaknesses: its preoccupation with exegesis (2008, p. 220). . . It is, moreover, by means of this dialogue that phenomenology "can demonstrate its vitality and contemporary relevance" (p. 221).
   Specification of differences from, or constraints on the alignment with historical systems is also a important task For example, lingering appeals to internal representation and related concepts "left over" from orthodox cognitive science continue to inform some representatives of the "new" cognitive science (e.g., Hutchins, 1995a). An appeal to internal representation is far from a seamless fit with the historical figures referenced (e.g., Gibson, Dewey, Heidegger), for whom internal representation is a concept to be eschewed out of hand. Therefore the extent to which some examples of the new cognitive science problematically combine ontology of practice with ontology of process is an open question, and one to which theoretical psychologists are particularly well suited to respond.

3. Third, clinical and ethical implications of newer approaches, particularly 4E cognition, cry out for exploration. Although applications to education have accompanied

[2] A recent volume locates "the prehistory of cognitive science" in contributions beginning with Descartes and Hobbes (Brook, 2007).

situated learning research in particular (e.g., Lave & Wenger, 1991), the focus for most cognitive scientists has been to provide the most accurate model of cognition available, therefore the full range of psychological problems generated by transformed understandings of cognition have yet to be identified, let alone addressed. Robert Wilson (forthcoming) has been most direct in his assessment that the extended mind thesis carries heavy implications for notions of selfhood, identity, and responsibility, and social memory phenomena. He has written on both the question of intentionality from the extended mind perspective and has broadly suggesting the extended self as the proper unit of analysis of psychopathology, theorizing trauma as rupture in the extended self, and therapy as a process for its rebuilding. Clark likewise acknowledges "that most puzzling entity, the self" to be "the most compelling source of our anxieties" (1997, p. 216). But there is more to be done. Unanswered questions, for example, concern the limits of "self" and the grounds for perceiving "otherness" in systemic conceptions of agency. Clark for example, is content "to let the notions of self and agency fall where they will" (1997, p. 218). In this regard, more attention to the constraints and possibilities imposed by speech acts in relation to specific episodes of problem-solving would be highly useful to integrate with the case-based detailed analyses focusing on technology use. Clark calls language "the ultimate artifact". . ."a tool that alters the nature of the computational tasks involved in various kinds of problem solving," with reference to a range of theorists from Vygotsky to Dennett (Clark, 1997, p. 193). However, there is little of the kind of detailed analysis of language use that could be helpful in addressing for example, important contrasts in function between descriptive and expressive speech and corresponding pronoun use (e.g., Wittgenstein, 1953). Here contributions from discursive psychology (e.g., Harré, 1998) and positioning theory (Goffman, 1981; Harré & Moghaddam, 2003) in relation to questions of identity formation might be incorporated very constructively with insights emerging from extended mind literature to address questions related to self and personhood.

4. Epistemologically, the new cognitive science prompts greater attention to the unsettled business of what questions are genuinely empirical questions, and how the empirical is best understood. As noted, the newer approaches share a commitment to upgrading cognitive frameworks and assumptions in order to better accommodate data. Yet the evidentiary base of at least the extended mind thesis includes thought experiments as a primary source of support. Across these movements interpretive methodologies are used to unpack the particular practices in specific problem-solving contexts. The analysis is case-based; the methodologies fundamentally rest on insight and argument rather than experimental control in the most rigorous investigations of acts and practices in context. On one hand, the legitimacy of this evidentiary base to support the grand nature of the claims made might be questioned, as it has been by the cognitive science orthodoxy (Adams & Aizawa, 2008; Kukla & Walmsley, 2006). On the other hand, the sanctioned use of case study, ethnographic, and philosophical methods within frameworks of scientific realism, as demonstrated by these new movements, might be a resource to theoretical psychologists in the ongoing struggle against the mainstream's still shrill view of science and its methodologies. It provides an important counter to the all too frequent conflation of realism and positivism.

5. Of all questions, the one with greatest bearing on this project of highlighting newer developments in cognitive science and criticisms of them is the value of distinguishing *cognitive* phenomena in the first place. One need not affirm the answer provided by Adams and Azaiwa, that genuinely cognitive processes are limited to brain processes, to recognize the potential

for muddle[3] and the importance of addressing their question concerning the "mark of the cognitive." Dissolving conceptual boundaries between cognition and culture, while it overcomes certain difficulties, introduces others. And thus I am in sympathy with the project of finding a principled basis for the demarcation. However, in pursuing the principled grounds for demarcation, it is important to acknowledge that the potential for muddle pertains not merely when mind is extended into the environment but also when it is restricted to the brain. Moreover, the requirement that cognitive processing necessarily involves nonderived content leads to some problematic philosophical consequences. These consequences do not emerge clearly in Adams and Aizawa's discussion of the issues primarily because their examples of nonderived content are ambiguous. At times they seem equivalent to private experience ("thoughts") and at times to representations stripped bare of any social contact or influence. Given that Adams and Aizawa refer to all linguistic content as derived, the contrast between derived and nonderived representational content seems parallel to that drawn by Searle between "language-dependent facts/thoughts" and "language-independent facts/thoughts." Therefore the examples Searle gives of "language-independent thoughts" are instructive here:

> The most obvious cases of language-independent thoughts are noninstitutional, primitive, biological inclinations and cognitions not requiring any linguistic devices. For example, an animal can have conscious feelings of hunger and thirst and each of these is a form of desire. Hunger is a desire to eat and thirst a desire to drink, and desires are intentional states with full intentional contents; in the contemporary jargon, they are "propositional attitudes." Furthermore, an animal can have prelinguistic percpetions and prelinguistic beliefs derived from these perceptions. My dog can see and smell a cat run up a tree and form the belief that the cat is up the tree. . .Other cases of prelinguistic thoughts are emotions such as fear and rage. We ought to allow ourselves to be struck both by the fact that animals can have prelinguistic thoughts and by the fact that some thoughts are language dependent and cannot be had by prelinguistic beings (Searle, 1995, p. 62).

In these examples, desire and rage are among the kinds of things to be covered under the umbrella of thought and cognition. In other words, "thought" and "cognition" are generalized to include all bodily states that might be represented in consciousness or bear some relation to action. Among the problems this presents is the distancing of thought and cognition from any distinctively *human* capacities. Such distancing is arguably necessary in the interests of providing a coherent evolutionary account of cognitive capacities, and is a byproduct of the effort to "naturalize" epistemology (Quine, 1969). Yet in distancing "the cognitive" from any distinctively human capacities we introduce a host of other problems, including the problem of coherently accounting for the relation between "the cognitive" and "the epistemic." Traditional epistemic notions such as "evidence" and "justification" traditionally are regarded as *normative* notions, meaning that they are tied to standards of accountability reliant at least in part on community consensus (Kim, 1988/2008).

An alternative strategy for demarcating "the cognitive" might be accomplished with taxonomy of *activity* rather than of process or content. Although act, activity, and practice are related and, frankly, fuzzy conceptual categories themselves, it is important to remember how a turn to activity as a unit of analysis, in contrast to representation or process, was used by Dewey (1930), Vygotsky (1978), and others, in attempt to capture the coordinated operations of persons in and on the world. As expressed in relation to the recently named "mereological fallacy," activity as a category is ascribed to intentional persons and thus activities are distinguished from processes that occur within brains (Bennett & Hacker, 2003). Here it is important to recognize that the term "cognitive," though highly equivocal, was associated in cognitive psychology's early days and most broadly with the *activities* of sense-making and meaning making (e.g., Anderson & Ausubel, 1965).

What might a demarcation strategy focusing on activity look like? Harré (2002) provides an example by defining the domain of cognitive science as the "range of human activities—remembering,

[3] In his denial of the parity principle, Menary (2007) would seem to be removed from this criticism.

deciding, reasoning, classifying, planning, and so on—that have traditionally been thought to belong to a group of mental processes, generally falling under the label "cognition"" (p. 5). To this list of activities we might add others, including innovating, creating, constructing, and representing (Osbeck & Good, 2005; Good, 2007). As a set these activities are carried out in relation to the performance of tasks, thereby introducing an inescapably normative element: "Tasks can be performed well or ill, carefully or carelessly, correctly or incorrectly, with many intermediate possibilities" (Harré, 2002, pp. 5–6). Note that this still leaves us with the problem of determining a principled basis for grouping certain forms of activity under the banner of "cognitive" if activities of other kinds are also normatively constrained. The point here is largely to point out that alternative strategies for demarcation of the cognitive might be found and there are important philosophical implications attendant on each strategy.

It is most important that in demarcating "the cognitive" by kind of *activity* undertaken, the intersection of "the cognitive" not only with "the epistemic" (as noted above), but more broadly with "the rational," comes into clearer view, because of the very long tradition of ascribing rationality principally to the reflective activities of intentional persons. It is precisely in this area of overlap with the rational that the wider philosophical significance of "the cognitive" is most evident, for it enables us to link questions concerning "the cognitive" not only to questions concerning "the ethical" and "the real," but to the capacities that enable the practice of science itself, such as determining the relevance of observations. There is of course no settled answer on what it is for something to be rational, and this is not by any means intended as a claim that "rational activity" is a rarified function removed from our embodiment and enculturation. Nor is it to deny the pervasiveness of "irrational" cognition. However, in contrast to the answer provided by Adams and Aizawa, my assertion here is that consideration of "the rational," or more specifically, activity directed toward particular kinds of reasoning tasks and holding to the standards by which it is judged to be rational or irrational must at least play a *part* in the principled answer we would give to the question of what demarcates the cognitive. If rationality is to be understood in terms of activity that at least includes a normative dimension, this demarcation is best accomplished with ontology of practice rather than of process, and thus is furthered by the developments I have identified as belonging to a "new" cognitive science.

Final Comments

This paper has attempted to survey several recent lines of departure from "cognitivism" or "orthodox representationalism" evidenced by the interdisciplinary field of cognitive science, and to suggest important questions and implications arising in relation to these approaches. The overarching purpose of reviewing new directions in cognitive science and the critical response to these directions is to underscore that there is hope for psychologists long disgruntled with representationalism, internalism, and ecologically invalid methodologies to revive the study of thinking, reasoning, problem solving, innovating, imagining, and representing, and to incorporate new empirical findings emerging from cognitive science. Given the domain in which cognitive and rational activity might be said to overlap, the ongoing study of "the cognitive" will remain essential to any comprehensive theoretical and philosophical psychology, however critical one's stance toward dominant assumptions and methods employed to understand it.

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