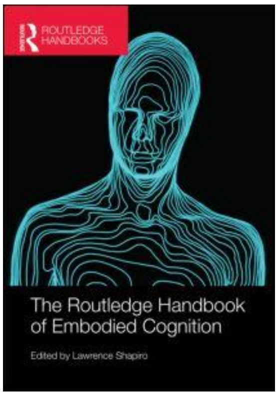

The Routledge Handbook of Embodied Cognition

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PART VI

Meta-topics

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COGNITION

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Introduction

The study of cognition was widespread in experimental psychology after behaviorism's decline and was a reason for the decline. A specific notion of cognition was central to the rise of the interdisciplinary program of cognitive science. The perceptual psychologist James J. Gibson thought that postulation of cognitive processes should be avoided. Cognition, as knowledge, has long been studied in philosophy. Nowadays, cognitive psychology and cognitive science come in various flavors, including classical, connectionist, dynamic, ecological, embodied, embedded, enactive, and extended. These flavors differ in their conceptions of cognition and on the roles of the body and the environment in cognitive processes.

But what is cognition? What makes a process cognitive? These questions have been answered differently by various investigators and theoretical traditions. Even so, there are some commonalities, allowing us to specify a few contrasting answers to these questions. The main commonalities involve the notion that cognition is information processing that explains intelligent behavior. The differences concern whether early perceptual processes are cognitive, whether representations are needed to explain cognition, what makes something a representation, and whether cognitive processes are limited to the nervous system and brain or include other bodily structures or the environment itself.

After unearthing some root notions of cognition in the development of cognitive psychology and cognitive science, this chapter considers the commonalities and differences just scouted, examines Wheeler's (2005) reference to Descartes' works in describing "Cartesian" cognitive theory, finds the real target of situated approaches in classical symbolic cognitive science, and suggests that instead of revisiting that target attention should turn to characterizing the varieties of intelligent (adaptive, appropriate, flexible) behavior.

Some root notions of cognition

Bernard Baars (1985), in his excellent study of the "cognitive revolution," describes cognitive psychology as a metatheory that supplanted the previous behavioristic metatheory. Behaviorism was many splendored. It came in Watsonian, Hullian, Tolmanian, and Skinnerian varieties. All agreed that behavior provides the evidence and object of explanation for psychology, and all but

Tolman excluded mentalistic terms in describing and explaining that behavior. Tolman allowed intentionality, Gestalt principles of perceptual organization, and representational cognitive maps (Hatfield, 2003).

By the 1950s, Hullian learning theory, which was deeply theoretical (positing non-mentalistic inner states), was in retreat; and Skinner's "hollow organism" behaviorism, which shunned internal states in psychological explanation, was ascendant. Against both Hull and Skinner, some psychologists – sometimes in league with computer scientists and linguists, and sometimes extending ongoing work (from earlier in the century, including that of Gestalt psychology) in perception, attention, and memory – began to posit internal states described in terms of information processing or information flow. In Baars's (1985) account, these psychologists used behavioral data to infer unobservable internal constructs, such as "purposes," "ideas," "memory," "attention," and "meaning" (pp. 7, 144). Psychologists came to speak of "representations" that organisms have of themselves and their world, and they construed the transformation of such representations as "information processing" (p. 7). Such internal representations were only reluctantly described as "conscious" or as subject to introspection (pp. 169, 414).[1] Starting from Baars's portrayal, we can distinguish several conceptions of cognition in the literature.

Cognitive mechanisms and information processing

In 1967, Ulric Neisser published a signal work entitled *Cognitive Psychology*. It included two major parts, on visual and auditory cognition, and a brief part on higher mental processes. Neisser offered two glosses on the term "cognitive psychology," indicating a broader and a narrower conception of cognition. In a broad sense, cognitive psychology studies the "cognitive mechanisms," which include perception, pattern recognition, imagery, retention, recall, problem solving, concept formation, and thinking (Neisser, 1967, pp. 4, 10, 11). In a narrow sense, Neisser promoted a certain conception of cognition as "the flow of information in the organism," including many transformations and reconstructions of that information (pp. vii, 208). In his view, "Whatever we know about reality is mediated, not only by the organs of sense but by complex systems which interpret and reinterpret sensory information" (p. 3). His cognitive psychology largely focused on visual and auditory information processing. He described such processing as yielding not only behavior but also "those private experiences of seeing, hearing, imagining, and thinking to which verbal descriptions never do full justice" (p. 3). His book refers to behavioral data but also describes perceptual experiences. Although not labeling these as "conscious," he clearly included conscious experience among the discussables.

By contrast with theories to come, I should note that Neisser was aware of comparisons between human cognition and digital computers and found comparing human processes with computer programs to be useful but limited; he expressed deep skepticism of AI (artificial intelligence) models, such as that of Newell, Shaw, and Simon (1958), and, by his own account, largely put them aside (Neisser, 1967, p. 9). Neisser's cognitive psychology invoked psychological processes of construction and synthesis, which were characterized in task-specific terms. His heroes included especially Bartlett (1932, 1958), who worked on memory, but also Broadbent (1958), who worked on attentional constraints in auditory perception, and Bruner, who worked on concept formation (Bruner, Goodnow, and Austin, 1956).

Neisser's approach (1967, pp. 304–5) did not focus on explaining the behavior of human beings freely acting "in the wild" (i.e. outside the laboratory). Rather, he aimed to discover information-processing mechanisms by inferring their characteristics from the available data. This information-processing approach to psychology, which sees its subject matter as the information-processing mechanisms underlying perception, attention, recognition, categorization, memory, learning, problem solving, thinking, and speech, became entrenched. Often, information processing was itself the root notion (Lindsay and Norman, 1972; Massaro, 1989), and "cognition" (a term these authors used sparingly) was distinguished from perception as pertaining to the processes in recognition, problem solving, and memory. This runs counter to Neisser's conception of cognitive psychology as concerned with all information processing, including perception. Neisser's conception lives on, as seen in Dawson (1998) and Eysenck and Keane (2000), but with a difference: the conception of information processing is now allied to computation.

Cognition as symbol processing

Comparisons with computers as information handling devices were not uncommon in the 1950s and 1960s. With the formulation of Fodor's (1975) language-of-thought hypothesis, the computer analogy became the foundation of a new, interdisciplinary enterprise soon to be called "cognitive science" (e.g. Collins, 1977). Fodor's approach was to extract a common set of computational assumptions from recent work in cognitive psychology and psycholinguistics. His main examples were rational choice, concept learning, perceptual belief, and language learning. In his terms, such theories involved computations defined over symbolic representations. (Actually, he would have considered "symbolic representation" to be redundant, since he unceremoniously treated the terms as interchangeable; Fodor, 1975, p. 55.)

Fodor grounded his notion of symbol through a comparison with the machine language in a standard digital computer. Humans are "built to use" their native language of thought (Fodor, 1975, p. 66). Empirically, we know we have the right computational theories when inputs and outputs line up with stimuli and with responses as described in subjects' propositional attitudes (pp. 74–75). The posited internal formulae should line up with a subject's beliefs or other intentional states. A cognitive theory "tries to characterize the ways in which the propositional attitudes of an organism are contingent upon its data processes, where 'data processes' are sequences of operations upon formulae of the internal language" (p. 77). Standard or "classical" cognitive science was born.

John Haugeland soon clarified the object and the structure of explanation of "cognitivism" (1978) or "cognitive science" (1981). As he put it: "The basic idea of cognitive science is that *intelligent beings are semantic engines* – in other words, automatic formal systems with interpretations under which they consistently make sense" (Haugeland, 1981, p. 31). Haugeland here endorses symbolic computationalism, imputing a formal system under an interpretation to cognitive systems. The formal system, like that in a computer, can be characterized wholly in syntactic terms. In a theory of cognition, the theorist assigns an interpretation to the computational states of the posited system which "makes sense of" the organism's behavior in relation to its situation (pp. 28–33). That is, the theorist proposes that states of the system intrinsically have certain meanings or contents.[2] Haugeland also expresses a conception of cognition that has become widespread: cognition is what supports intelligent behavior.

Computation and representation without symbol systems

In the early days of classicism, David Marr (1982) proposed a useful way of thinking about perceptual and cognitive processes. He distinguished three levels of analysis: computational, algorithmic, and implementational. The "computational" level essentially was a task analysis: it specifies what task the given perceptual or cognitive system is supposed to fulfill in the organism. The algorithmic level proposes concrete processing operations that, in models of vision (Marr's target), would operate on optical inputs and transform them into a representation of the distal scene. Finally, the implementational level is the hardware realization of the processing operations. His approach also charted the employment in the visual system of environmental regularities, such as that surfaces are comparatively smooth.

Marr (1982, p. 343) thought of the algorithms and their implementation in classical, symbolist terms. But he need not have done so. His three-level analysis allowed others to propose alternative schemes for thinking about algorithms and implementation. Theories of vision had long postulated operations to combine information. While some theorists, such as Irvin Rock (1975), conceived of these operations as inferential (and carried out in a language-like, albeit insulated, system of representations; Rock, 1983, p. 13), other theorists recognized that such operations might combine perceptual information, conceived in analog terms (e.g. as continuously varying magnitudes), without the benefit of cognitive and conceptual processes such as inference (Hatfield, 1988; see also Hatfield and Epstein, 1985, and Epstein, 1973). Processes that combine optical information for visual angle with a registered value for distance to yield size perception fit this bill, but so might mechanisms for recovering Gibsonian higher-order stimulus variables.

In 1984, Kosslyn and Hatfield proposed a connectionist interpretation as especially suited to perceptual processing, explicitly reinterpreting Marr's algorithms as non-symbolic but representational, with a neural-net or connectionist implementation. Such processing models might invoke rules of information-combination and notions of representations of proximal and distal states, without thinking of the rules as explicitly represented (as in symbolic models) or of the representations as syntactic (they might be analog). In a later terminology, the processing rules might be *instantiated* without being explicitly represented (Hatfield, 1991a, 1991b). Kosslyn and Hatfield also observed that Marr's "assumptions" about environmental regularities could be construed not as explicitly stated rules but as "engineering assumptions," by which they meant that "it is as if the system were engineered in such a way that it will work in environments where certain conditions are met" (Kosslyn and Hatfield, 1984, p. 1040).[3]

Connectionist models come in a variety of forms, associated with sometimes opposing conceptions of representation, such as local versus distributed representations (for an overview, see Bechtel and Abrahamsen, 1991). In models of early perceptual achievements, such as the creation of visual representations of shaped surfaces at a distance, connectionist networks can provide a happy medium for modeling rule-instantiating analog perceptual processes. The connectionist approach also has been applied to complex cognitive tasks such as language processing, using dynamical models that allow continuously varying magnitudes to serve as (subsymbolic) representations (Smolensky, 1988).[4] Connectionism is not a specific approach but offers a family of model-types that enable various ways of thinking about perception and cognition without going symbolic from the start. Although such models are not essentially situated, it makes sense in thinking about connectionist processes to see them as adjusted to environmental regularities (Hatfield, 1988, 1990). Not having the symbolic metaphor to fall back on, such models may (or should) appeal to environmentally conditioned task analyses in grounding their notions of what is computed and what representations are needed.

Cognition as what supports intelligent behavior

The cognitive revolution entrenched the notion that cognitive processes are responsible for effective behavior. This idea is expressed by Bechtel and colleagues: "Cognitive science is the multidisciplinary scientific study of cognition and its role in intelligent agency. It examines what cognition is, what it does, and how it works" (Bechtel, Abrahamsen, and Graham, 1998, p. 3). As they make clear, this definition is broad enough to cover various conceptions of how cognition works: classical, connectionist, and situated (pp. 91–92). Some of these approaches, under the umbrella of situated cognition, challenge the notion of cognition as information processing in the head. But such challengers retain a steady conception of what cognition does, which is "to enable agents to interact intelligently with their environments" (p. 92).

Recourse to the notion of "intelligent agency" (or the earlier "intelligent beings") invites reflection on the notion of intelligence. The term plays a prominent role in discussion but is not found in the index or table of contents (except as "Artificial Intelligence" and "Unconscious Intelligence," Bechtel and Graham, 1998, p. vi). The chapter on "Unconscious Intelligence" characterizes unconscious processes as "smart" or "intelligent" if they are "sophisticated, flexible, and adaptive" (Allen and Reber, 1998, p. 314). This description may exclude reflexes and also instincts (on many conceptions). Otherwise, it is open-ended, presumably including early visual processes that underlie the perceptual constancies and other sensory processes that are world directed, as well as action guidance, concept formation, emotion (at least cognitive theories of the emotions), problem solving, and reasoning.

When Haugeland (1981) spoke of cognitive processes as providing an account of intelligence, these processes were conceived as occurring between stimulus and response. Cognitive theories replaced behavioristic intervening variables with mentalistic ones. Those were at first symbolically conceived, but connectionism soon provided an alternative that also accommodated notions of representation and information processing. In the usual paradigms, cognition occurs between stimulus and response and does not consider the effects of responses on stimulation or take account of bodily organization, and only in some cases (including Marr) is put in relation to environmental regularities. As it happens, the push toward embodiment and environmental embeddedness originally came from a theorist who was anti-cognitivist.

Gibson and his impact: the importance of the environment

While the information-processing psychologists of the 1950s, 1960s, and 1970s were filling in between the sense organs and behavior (focusing on internal processes), Gibson was arguing that organisms are active in perceiving (1950), that sensory systems evolved to take into account environmental regularities (1966), and in favor of an ecological psychology in which the environment is described in organism-relative terms, yielding an "ecological physics" (1979). Gibson held that traditional theories of visual perception overlooked significant aspects of sensory information, including adequate information in the light to specify the distal environment. Consequently, he found no need to posit cognitive operations to supplement sensory information. He held that physiological mechanisms pick up information by "resonating" to it (Gibson, 1966, pp. 4–5), but he did not fill out the resonance analogy. Even if his view is not completely right (about either the information or the lack of need for psychological processes to recover it; Hatfield, 1988, 1990; Neisser, 1976), Gibson's work directed attention to the tie between perception and action and the fact that an organism's own activity in relation to the environment generates stimulus information (e.g. bodily motion in a direction creates optic flow that specifies that direction).

Gibson's outlook spurred a substantial research tradition, including many who shared his anti-cognitivist outlook. Within this tradition, Turvey and his colleagues developed a dynamical systems approach to picking up Gibsonian information, which rejects any appeal to representations or traditional information processing. Nonetheless, they did offer a view of cognition. According to Turvey and Carello, "The term 'cognition' is taken, very generally, to refer to the coordination of any organism (as an epistemic agent) and its environment (as the support for its acts). The task of cognitive theory is to explain this epistemic, intentional coordination of organism and environment" (1981, p. 313). Rejecting internal representations and unsecured attributions of intelligence, they emphasized Gibsonian realism, his commitment to organism–environment informational relations, an ecological scale of analysis, and appeal to dynamic physical systems to portray internal processes (thereby elaborating the resonance analogy). "Intentional" relations to the environment are reduced to informational relations between environment and organism. In a more recent overview, these authors conclude: "Consistent with a strategic approach to perception and action that minimizes (and, for all practical purposes, precludes) mental representations and computations, we have identified some dynamical themes that have been exploited in ecological research in haptic perception and coordinated movement" (Turvey and Carello, 1995, p. 396). The specific examples include visual-tactual coordination in learning to juggle and to use control levers. In this more recent survey, they avoid the term "cognition" altogether.

Gibson also influenced mainstream cognitivists to alter their conceptions so as to take account of embodiment, environmental embeddedness, and organismic action. In 1976, Neisser published a second book sounding these themes. He conceived perception as a cycle that incorporates action and in which cognitive schemata direct exploration of the environment and the sampling of present objects, which in turn alters the schemata as a result of the information acquired (Neisser, 1976, pp. 20–24). He thought of the processes by which the schemata direct exploration and incorporate information as cognitive. His definition of cognition was a bit general: "Cognition is the activity of knowing: the acquisition, organization, and use of knowledge" (p. 1). But his intent was clear: he wished to join a Gibsonian outlook with mentalistic notions from the information-processing tradition (p. 24). Marr, with his emphasis on ecologically valid environmental assumptions, was also deeply indebted to Gibson's approach (Marr, 1982, pp. 29–31).

Fast-forwarding, theoretical outlooks that fall under the umbrella of situated cognition (dynamic, ecological, embodied, embedded, enactive, and extended) have proliferated. Among these, Gibsonian inspiration is often but not everywhere acknowledged. The notion of cognition remains that of the new mainstream: cognition supports intelligent behavior (Clark 2010, p. 92). Michael Wheeler (2005), from the extended cognition camp, has been especially explicit on the breadth that he desires in interpreting the notion of intelligence. He sees cognitive processing as yielding "displays of intelligence" that involve "behaving appropriately (e.g., adaptively, in a context-sensitive fashion) with respect to some (usually) external target state of affairs" (p. 3). The notions of "intelligence" and "cognition" are here used in a "deliberately broad and nonanthropocentric manner," to include not only human capacities for reflective thought and conceptualization but also "cases in which an agent coordinates sensing and movement, in real time, so as to generate fluid and flexible responses to incoming stimuli" (ibid.). Animal cognition is included (e.g. tracking mates, avoiding predators). Action is intelligent, including navigating the terrain as an animal moves along. Cognition includes both "knowing that" and "knowing how" (p. 4). The processes that support intelligent behavior are conceived as dynamical systems, and only sometimes involve internal representations (see also van Gelder and Port, 1995, pp. 11–12).[5]

The core notion of cognition started as information processing and was then modified by differing models of how information is processed, including classical and connectionist visions. As work proceeded, the notion of cognition as supporting intelligent behavior gained currency.[6] How it does so has been variously conceived. The past decade has seen rapid growth in conceptions of situated cognition.

Commonalities and differences in the notion of cognition

If one wanted a notion of the cognitive that could cover all the above usages, including Turvey and Carello (1981) and other non-representational dynamical systems approaches (e.g. Kelso, 1995; Chemero, 2009), it would have to be defined at the *molar* level, as a type of behavior of the whole organism. Cognitive behavior would be adaptive, appropriate, and flexible in relation to environmental and organismic circumstances.

There is something to be said for seeking to identify the forms of behavior that are cognitive at the molar level. However, it is more idiomatic to call such behavior "intelligent" than "cognitive." This aspect of linguistic usage favors the notion that cognition is mental and that the mind is more than its behavioral expression. All the same, molar-level analyses of what makes behaviors intelligent or flexibly adaptive would be useful. This might have something of the feel of Ryle's (1949) analysis of clever behavior, but without the added rider that there can be no intraorganismic explanation of the cleverness. With such a molar description in place, one might choose to use the term "cognitive" to describe the processes that explain intelligent behavior. It might then be best to restrict that term to those processes that involve mentalistic notions such as representation or mental content and that have a place in "cognitive mechanisms" such as those listed earlier (pp. 362–63).[7] In this case, all of the above usages except that of Turvey and Carello (1981) and other non-representational dynamicists would be included.

Within this still quite large group, there are differences in what counts as cognition. Especially in the decades from the 1960s through the 1980s, a significant number of theorists distinguished perception from cognition. This occurred at two different levels of analysis. First, at the molar level, the perceptual theorist Rock distinguished "sensory processes" that constitute perception from "cognitive processes" (1975, p. 24). He assigned to the first group the formation of a perceptual object through the perception of shape, size, distance, direction, orientation, and rest or motion. The second category begins "where perception ends," with "the perceived object," and includes "recognition, recall, association, attention, abstraction, concept formation, understanding and meaningful learning, problem solving, and thinking" (ibid.). In this scheme, the cognitive and the conceptual go together. This sort of usage matches that of Lindsay and Norman (1972) and Massaro (1989), as previously noted.

Among those distinguishing perception from cognition, the second level of analysis concerns the character of the underlying processes that yield molar perception and cognition. Rock (1983), while maintaining a distinction between perceptual (in vision, picture-like) and cognitive (recognitional) achievements, proposed that perception is mediated internally by inferential operations that might easily be labeled "cognitive." For instance, he suggested that perceptual processes involve language-like, propositional descriptions that enter into deductive inferences (pp. 13, 240). Elizabeth Spelke (1988) argued the other way, that the processes underlying perception are essentially non-conceptual. For that reason, she assigns molar-level object perception to cognitive or conceptual processes, as when she says that "the apprehension of objects is a cognitive act, brought about by a mechanism that begins to operate at the point where perception ends" and brings concepts to bear (p. 199). I made the same alignment of "cognitive" with "conceptual" in Hatfield (1988), so that by "non-cognitive" processes I meant non-conceptual algorithms involving non-conceptual perceptual representations. This more restricted usage has faded, and the term of "cognition" is now frequently applied even to early vision.[8]

Other theoretical differences arise in considering situated cognition. As amply illustrated in this volume, the embodied cognition camp assigns the body a significant role in cognitive achievements. They sometimes claim to replace the machinery of representations with non-representational dynamic processing. That the structure of the body is important in the cycle of perception and action would not be denied by a theorist such as Neisser (1976). But he weds the outlook with information-processing accounts. Those who do otherwise (non-representationalists) cannot be arguing simply from the fact of embodiment; rather, they must give other reasons for rejecting representations. The extended cognition thesis also comes in representationalist (e.g. Clark and Chalmers, 1998) and non-representationalist forms (discussed in Wheeler, 2005; see Chemero, 2009). Again, the extended cognition hypothesis, according to which the world itself can enter into cognitive processes that guide effective behavior, is not intrinsically non-representational. The need for representations surely hinges on whether, in order to explain intelligent (adaptive, appropriate, flexible) behavior in its many manifestations, representations bring explanatory advantages some or all of the time (see also Shapiro, 2011, ch. 5).[9]

Anti-Cartesian cognitive science

In the literature of cognitive science, there is much talk of rejecting a Cartesian picture of the mind in favor of some other view, representationalist or not. This can mean many things, including rejecting Cartesian dualism (Bechtel *et al.*, 1998, p. 62), or rejecting the view that rational manipulation of internal representations, ignoring body and environment, suffices for effective behavior (Rowlands, 1999, pp. 4–5; van Gelder, 1995, pp. 380–81). For the most part, anti-Cartesians avoid engaging Descartes' own writings. Wheeler (2005) is an exception. He engages Descartes directly. Because this proponent of extended cognition considered it important to show that Descartes held the to-be-rejected views, correcting this mistaken impression is worthwhile. Leaving substance dualism aside and focusing on intelligent or situationally appropriate behavior, I present Descartes as an advocate of embodied behavioral effectiveness and extended memory.

Wheeler (2005, chs. 2–3) seeks to establish that Descartes subscribed to five theses that form part of a contemporary "Cartesian psychology." The five are: (1) mind is representational, (2) intelligent action occurs through sense-represent-plan-move cycles, (3) perception is essentially inferential, (4) most intelligent human action comes from general-purpose reasoning mechanisms, and (5) the environment provides only problems, sensory inputs, and a stage for pre-planned actions (Wheeler, 2005, ch. 3). Here, I challenge (2)–(5).

There is no doubt that Descartes held that mind is representational. Further, he would contend that true intelligence is mental. But he denied that all situationally appropriate behavior arises from the mind and that the mind simply uses the body to carry out actions. On the contrary, he held that many behaviors result from physiological processes: "a very large number of the motions occurring in us do not depend on mind," including "actions such as walking, singing, and the like, when these occur without the mind attending to them" (Descartes, 1984, p. 161). Bodily mechanisms are attuned to environmental circumstances: "When people take a fall, and stick out their hands so as to protect their head, it is not reason that instructs them to do this; it is simply that the sight of the impending fall reaches the brain and sends the animal spirits into the nerves in the manner necessary to produce this movement even without any volition" (ibid.).[10] Descartes advanced a theory of the passions or emotions according to which, at the sight of a frightful animal, brain processes alone cause the body to turn and flee. These same processes simultaneously cause the feeling of fear. The function of this feeling is "to encourage the soul to want to flee"; the passions more generally have the function of "disposing the soul to want the things" that the body is already engaged in (Descartes, 1985, p. 343). Note that there is no "sense-represent-plan-move cycle" here. Rather, there is: bodily process, which causes movement and an emotion that inclines the soul or mind (without rational deliberation or "general reasoning") to want to carry on the movement (see Hatfield, 2007). In these cases, the behavioral agent (i.e. the human subject) is not the mind alone, but the body plus mind, and the mind's function need not be deliberative.

Descartes did not regard all perception as inferential; he developed a sophisticated physiological model of distance perception, according to which an experience of distance is directly caused in the mind by brain mechanisms (see Hatfield, 1992, pp. 356–57).[11] Perhaps the most surprising passage to cite here concerns embodied and extended memory. In a letter explaining his views on memory, Descartes of course affirms that the brain is involved in memory. But so is the body: "I think that all the nerves and muscles can be so utilized [for memory], so that a lute player, for instance, has a part of his memory in his hands" (Descartes, 1991, p. 146). And there is "extended" memory: "what people call 'local memory' is outside us: for instance, when we have read a book, not all the impressions which can remind us of its contents are in our brain. Many of them are on the paper of the copy which we have read" (ibid.). Presumably, some of the book's content enters brain memory; the printed pages constitute a more extensive memory record. Descartes does not hold that the page is part of the mind, but it is part of the phenomenon of memory.

One could pile on examples to show how Cartesian psychology and theory of mind has been caricatured in recent times, abetting a deep postmodern animosity toward Descartes.[12] That is not the present point. Rather, we should believe that this version of Cartesian psychology as targeted by adherents of situated cognition was invented for a reason, to portray an opponent. But, leaving substance dualism aside, the real opponent is not Descartes. So what is it?

Conclusion: the real target? And whence now?

The real target of many of those who emphasize situatedness and environmental embedding is the classical symbolist conception, or that together with those connectionist models that eschew environmental relations. The static "rules and representations" that are usually the target of rebellion are explicitly represented rules conjoined with symbolic representations.[13] A fine target. But there have been alternatives to that paradigm all along. An attack that merely shows that some behaviors are successfully modeled without invoking symbolic computation is not news. Effort should instead be spent in articulating what the alternative frameworks are actually saying.

Concerning representation, we have met two alternative frameworks. One allows representations to vary continuously and one seeks to avoid representations altogether. A third variant uses representations sometimes but not others (e.g. Wheeler, 2005). All three seek to include the body and the environment.

The non-representationalist frameworks may explain behaviors such as toddler walking and perseverative reaching behavior in infants (Smith and Thelen, 2003). Dyed-in-the-wool symbolists would model these behaviors symbolically. But others, including Descartes, might explain them through non-mentalistic physiological processes. Other behaviors, such as tracking and catching prey, or using a mass transit system, may invite other sorts of modeling, perhaps requiring or at least inviting internal representations.

Let us accept Wheeler's (2005) plea that cognitive psychology and cognitive science, construed broadly, should aim to explain a wide range of intelligent (adaptive, appropriate, flexible) behaviors. If intelligent behavior, broadly construed, is the object of explanation – perhaps augmented by human perceptual and other types of experience[14] – then there needs to be consideration of the varieties of behavior (and experiences). This may lead to the notion of a variety of intelligences.

Evolution is frequently omitted from situated discussion (but see Gibson, 1966, ch. 9; Rowlands, 1999, chs. 4, 11; Wilson, 2004).[15] The literature on the evolution of mind might help in thinking about the varieties of behavior and intelligence. In the evolution of the hominid line, group hunting, tool making, and habitat improvement arose at various points. What cognitive mechanisms allowed for these behaviors to arise? Some theorists posit the evolution of several different types of modular intelligence (e.g. Mithen, 1996, 2013). Others emphasize a smaller set of adaptations, perhaps starting from auto-cued motor sequences used for making tools and then for dancing (e.g. Donald, 1991, 2013). Even if not all actions are planned, skilled action may involve representational routines to guide its manifestation. Engaging in helping behavior may require intention-reading (Warneken, 2013). Other animals show other ranges of skills, requiring specific types of competencies (e.g. Seyfarth and Cheney, 2013).

There is no such thing as intelligent behavior in general. What may be needed now is a survey of behavioral and cognitive skills and other tendencies, with an eye toward the explanatory resources that can account for them. Representations, including non-conceptual and conceptual, action-guiding and recognitional, individual and intention-sharing or cooperation-affording, are sure to be in the mix. They need not be symbolic or come formulated in explicit rules. Connectionist and dynamical systems may use them. They may vary continuously or be discrete. But they are here to stay.

Notes

1 For a complementary account of the renewal of cognitive approaches, which discusses yet other portrayals, see Hatfield, 2002. See also Bechtel, Abrahamsen, and Graham, 1998.

2 The "assignment" of intentional content is not merely instrumental but imputes "original intentionality" to the system (Haugeland, 1981, p. 33). Haugeland specifies that such assignments must make sense of the agent's behavior "relative to the environment." While the conditions on an adding machine are simple formal truth, in assigning content to behaving organisms "other conditions" are important, including context, that is, considering outputs "in relation to one another and in relation to the situation in which they are produced" (pp. 32–33). Fodor (1975, ch. 2, esp. pp. 71–73) also recognizes environmental constraints in interpreting propositional attitudes (hence internal formulae), but less clearly or forcefully so. Only subsequently did Fodor (1980) propose that cognitive science should be concerned only with the formal operations mediating between input and output and not relations to the environment. Methodological solipsism (or so-called "narrow content") was not a founding or essential feature of symbolic computationalism. On the contrast between behavior narrowly construed and the objects of investigation in mainstream cognitive psychology of the 1970s and 1980s, see Shapiro, 1994. Shapiro shows that many discussions in philosophy of psychology treated behavior as mere physically described movement, by contrast with environmentally related descriptions of behavior by ethologists, behaviorists, and cognitive psychologists.

3 On the interpretation of Marr's theory in debates over wide and narrow content, see Shapiro, 1993.

4 On affinities between connectionism with a dynamical systems approach and the field theories of Gestalt psychology, see Hatfield and Epstein, 1985, pp. 179–83.

5 Adherents of dynamical systems approaches sometimes acknowledge an affinity with Gestalt field theories (e.g. Kelso, 1995). On Gestalt dynamical theory, see Hatfield and Epstein, 1985, pp. 179–83, and Epstein and Hatfield, 1994, pp. 175–77.

6 Other, broader specifications of cognitive science, which define it as "a cross-disciplinary enterprise devoted to exploring and understanding the nature of the mind" (Frankish and Ramsey, 2012, p. 1), apparently equate *mind* with *cognition*, either unacceptably narrowing the former term or expanding the latter.

7 There have been attempts to specify a "mark of the cognitive." Adams and Aizawa (2008) propose that part of the mark is underived content, belonging to a system intrinsically. This accords with my notion of mentalistic representation and mental content. Perceptual and cognitive psychologists normally assume underived content. To this, Adams and Aizawa (2008, ch. 4) add that, for a system to be cognitive, certain sorts of processes must take place, which they indicate through example. Rowlands (2010, pp. 110–11) offers a criterion involving information processing and representations that belong

to subjects (in support of extended perception and cognition). In a different spirit, some (see Thompson 2007, pp. 122–27) extend the "cognitive" to include all effective activities for self-maintenance in relation to the environment (so that every living thing on Earth is cognitive).

8 It may still be useful to distinguish non-conceptual perceptual processes from conceptual ones. One might even consider non-conceptual perceptual content, of which size and shape at a distance are typical instances (Dretske, 1981, ch. 6), to be "cognitive" in that they stably represent the spatial environment (the latter is not Dretske's usage). Such usage would prize apart the conceptual and the cognitive. (Thanks to Louise Daoust for this suggestion.)

9 Wilson (2004) renders individuals as the bearers of *psychological* states but regards *cognitive* states as locationally wide (extending into the environment) and treats Gibsonian optical arrays as parts of locationally wide computational systems (Wilson, 2004, ch. 7, esp. p. 171). His distinction between psychological and cognitive states needs fuller articulation, as does the sense in which the optic array is cognitive (as opposed to being an environmental condition that sensory systems exploit, including those deemed to engage in information processing).

10 "Animal spirits" are purely material processes that serve neural functions in Descartes' scheme.

11 Descartes also described mechanisms for size and distance perception involving inference (Hatfield, 1992, pp. 351–56).

12 The caricatures often arise from reading Descartes' *Meditations* as if every statement, including those made under radical doubt, should be taken at face value (see Fodor, 1980, pp. 64–65). When Descartes speaks of being only a mind, he is taken literally, despite his subsequent conclusion that the human being consists of mind and body (1984, pp. 24, 61). His skepticism toward the senses is allowed to stand, despite his reconception of sensory function as embodied; the primary function of the senses is bodily preservation in relation to environmental circumstances (Descartes, 1984, pp. 56–61).

13 An even smaller target, frequently invoked, is the subclass of classical (symbolist) models espousing methodological solipsism or narrow content. Fodor (1980) advanced methodological solipsism in despair of fixing representational content by environmental relations: accordingly, cognitive science should study only internal symbolic computations. Stich (1983) embraced the despair; under renewed Gibsonian inspiration, few would now.

14 Human perceptual experience and other forms of consciousness are included in contemporary research, both as objects of explanation and sources of data. Phenomenal experience certainly is included in vision science (Palmer, 1999). The situated cognition literature is mixed anent its interest in such data.

15 Among environmentally attuned representationalist views, evolutionary considerations have been invoked in teleosemantics, e.g. Dretske, 1986.

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