

What Mindedness Is

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Recent advances in theoretical cognitive science can be fruitfully characterized as part of the ongoing attempt to come to grips with the very idea of *homo sapiens*—an entity at once biological and intelligent—and among the more striking developments has been the emergence of a philosophical anthropology that, *contra* Descartes and his thinking thing, instead puts doing at the center of human being.¹ This shift to a more “enactive”² understanding of human nature is owed proximally to the work of Heidegger and Merleau-Ponty, but also has clear precursors in such figures as William James and Hegel—and more specifically Marx and Marxist interpreters of Hegel such as Kojève. Naturally, Darwin must be considered as central as any philosopher, and many of the recent developments also echo the Aristotelian sense that being-at-work is the primary way of being anything at all.

¹ This shift is described in rich and illuminating detail in Anthony Chemero *Radical Embodied Cognitive Science* MIT Press, 2009. See also Gallagher, *How the Body Shapes the Mind*, Oxford University Press, 2005; Wheeler, *Reconstructing the Cognitive World: The Next Step*, MIT Press, 2005; and my own “Embodied cognition: A field guide” *Artificial Intelligence* 149(1): 91-130, 2003.

² The term comes from Francisco Varela, Evan Thomson & Eleanor Rosch *The Embodied Mind: Cognitive Science and Human Experience*, MIT Press, 1990. For more recent treatments see Evan Thompson, *Mind in Life: Biology, Phenomenology, and the Sciences of Mind*, Harvard University Press, 2007 and Froese & Ziemke, “Enactive Artificial Intelligence: Investigating the systemic organization of life and mind”, *Artificial Intelligence* 173(3-4): 466-500, 2009.

The ongoing engagement with these ideas and figures has put (back) into play two competing visions of human being and its place in nature: one is a conventionally Modern scientific view, quintessentially represented by certain schools of neuroscience, that treats the body primarily as a reactive mechanism whose main purpose is to house and feed (sensations and sustenance to) the brain.³ The other is more influenced by ecology and evolutionary biology, and takes human being to be rooted in and by agency and practical activity. Although these two positions in fact suggest fairly complete visions of the nature of human life (not just biological, but ethical, social, emotional and political—something to which the inclusion of Marx and Aristotle in the list of intellectual forebears already alludes) I would like to focus here just on the competing views of mindedness itself: what it is, where it is, and how it might be possible.

As has been indicated already, the central tension concerns the relation of agency and practical activity to mindedness, and it therefore concerns precisely the role of the body in (and for) mind. Whereas on the traditional Cartesian view the body is understood as the source of afferent stimulus and the target of efferent output—is, therefore, neither more nor less than a set of sensory receptors and physical effectors, peripheral devices playing subordinate roles to the brain-as-CPU (where representation and calculation occur, on this view the central hallmarks of intelligence)—on the enactive view, the body and its activity play not a peripheral, but a central role in the processes of mind. In fact, the activity of an organism in relation to its environment can be considered not just the most salient expression of mindedness (its location, if you will), but also in some sense its *constitution*.

Pretending for a moment that mindedness is composed of perception and cognition (it is not; not only does this leave out such important elements of mindedness as emotion—the recently emerged conception of emotion as an embodied cognitive system is an extremely important development in the overall program of cognitive science⁴—but this distinction between perception and cognition is itself Cartesian in

³ As Chemero (2009: 177) puts it, “the problem is that neuroscientists tend to ignore the animals attached to the brains they are interested in studying.”

⁴ For a good introduction to the issue, see Antonio Damasio, *Descartes' Error: Emotion, Reason, and the Human Brain*, Avon Books, 1994. An excellent recent review is Pessoa, “On the

origin) will provide an opportunity for drawing these distinctions somewhat more finely. In considering the issue of perception, the Cartesian asks first how it is that the features and elements of the outside world can be captured and re-presented inside the organism. Note how this simple question, thus framed by the notions of inner and outer, and centrally featuring the idea of representation, points us in the direction of the familiar and intractable anxieties of Modern philosophy: how to relate the accessible, inner given to an outer reality—i.e. how to determine truth and representational accuracy⁵—and likewise how to adjudicate the relation between the well-known, easily accessible self and the social world—i.e. how to determine meaning.⁶ The assumption is that the end product of perception is an inner world that fully re-produces—that in its elements and their relations is appropriately homologous to—the outer. This approach to perception accords perfectly well with a notion of mind that is contemplative (or, perhaps better, *reflective*⁷) in character; such a mind—withdrawn, narcissistic, engaged only in its own productions—needs inner objects to behold, to alter. Thus is cognition, on this view, the manipulation of, and the calculation over, such inner objects, a notion which points us in the direction of such harmful abstractions in ethical and social thought as the “rational calculation” of individual and collective utilities.

In contrast, the enactive view treats perception first and foremost as an organism's means for negotiating its environment. This suggests at least two things: first, that perception is a tool of exploration, and second that it is intimately bound up with and primarily fitted to the service of action. Perception is not the passive reception of abstract qualities from the environment, but is itself active, often highly selective and goal-directed, designed to mine from the world all and only information of

relationship between emotion and cognition”, *Nature Reviews Neuroscience* 9: 148-158 (February 2008).

⁵ On these issues see, e.g., Hacking, *Representing and Intervening*, Cambridge University Press, 1983; Anderson, “Cognitive science and epistemic openness” *Phenomenology and the Cognitive Sciences*, 5(2): 125-154, 2006.

⁶ On these issues see, e.g., Thompson, *Mind in Life: Biology, Phenomenology, and the Sciences of Mind*, Harvard University Press, 2007; Sandel, *Liberalism and the Limits of Justice*, Cambridge University Press, 1997; O'Donovan-Anderson, “Wittgenstein and Rousseau on the context of justification” *Philosophy and Social Criticism* 22: 75-92, 1996; Schmitt, *Beyond Separateness: The Social Nature of Human Beings—Their Autonomy Knowledge and Power*, Westview Press, 1995; Taylor *Sources of the Self: The Making of Modern Identity*, Harvard University Press, 1989; Wood, *Hegel's Ethical Thought*, Cambridge University Press, 1990.

⁷ cf. Richard Rorty, *Philosophy and the Mirror of Nature*, Princeton University Press, 1981.

importance to the current (or ongoing background) purposes of the agent. The primary task of perception, then, is not the construction of inner objects, but the detection of opportunities for action, a notion that recalls the familiar phenomenological claim that the perceptual field is always an action-field, that the perceived world is always known in terms directly related to an agent's current behavioral options. To put it in terms of affordances, the perceived availability of things to certain interventions: the world is seen as a continuous series of invitations to action.⁸

As with perception so, too, with cognition. On the enactive view, cognition first emerged from, and is still rooted in, mechanisms to control the behavior, and augment the survival, of particular agents in particular environments. Given the real-time demands of rapidly changing circumstances, one would expect systems to develop that, rather than rely strictly on "inner" manipulations of abstract constructions, instead utilize and exploit the various features of the environment to drive decision making. Thus, in the simplest sort of case, the frog's vision system is highly attuned to contrast and motion, and prey-capture is a hard-wired response to the detection of small, dark, moving dots.⁹ The frog does not represent individual insects; it cannot distinguish between them or recognize one in particular. Nor does it model its whole environment and *decide* which objects are tasty. Indeed, the detection of a fly and the eating of that fly are not really separate events; eating is the sign of detection.

This illustrates two important principles of the enactive approach to cognition. First, the classification of an object or situation and the response to it are deeply related. To see as is often to act as *if*, and, more generally, what one sees is a function of what one does.¹⁰ Indeed, as we will see in more detail below, it is often untenable to

⁸ Cf. J. J. Gibson, *The Ecological Approach to Visual Perception*, Houghton Mifflin Press, 1979. The best recent treatment of affordances and their importance is Chemero *Radical Embodied Cognitive Science* MIT Press, 2009.

⁹ J. Lettvin, H. Maturana, W. McCulloch, and W. Pitts. (1959) "What the frog's eye tells the frog's brain." *Proceedings of the Institute of Radio Engineers*, 47:1940-1951. See also Horace Barlow (1999) "Feature Detectors" *The MIT Encyclopedia of the Cognitive Sciences*: R. A. Wilson and F. C. Keil, eds., pp. 311-13.

¹⁰ The implications of this idea for the concept of representation are developed in Anderson & Rosenberg, "Content and action: The guidance theory of representation", *Journal of Mind and Behavior*, 29(1-2): 55-86, 2008.

speak of a separation of visual and motor systems; seeing is not a single process, the information from which is neutrally specified and centrally available, but is often highly task-specialized, such that separate, encapsulated systems have evolved to support the distinct visual needs of different classes of action. Thus, for instance, the frog has distinct visuomotor systems for orienting itself to its prey, and for capturing it.¹¹ These systems are unified and coherent *not* due to the production of some shared representation of the world, an integrated motion picture forever showing in the Cartesian theatre, but simply in virtue of being in the same body, experiencing and acting on the same environment.

Second, the organism exploits facts about its environment to turn simple mechanisms to somewhat more sophisticated uses: black dot detection *is*, in the frog's environment, fly detection. Were the world different, the environment different, or the frog's tastes more discriminating, the mechanism would not work. Put differently: typical behavior-guiding mechanisms are built on—and in some cases out of—environmental features. And, indeed, many human perception-action mechanisms are like this, based on satisficing machinery that is good enough for the usual conditions, but easily foiled by a change in circumstance.¹²

It is of course open for someone to object that the frog example is misleading—the frog is not thinking, but only reacting; this is not an example of cognition, but merely of instinct. Whatever the force of such an argument from within a Cartesian world view, it makes little sense as a specific objection to the enactive view. For the frog doesn't eat indiscriminately; it exhibits very specific and appropriate responses to differential aspects of the environment. It eats bugs and avoids predators. It shrewdly negotiates its environment in accord with its limited set of needs and goals.

¹¹ D. J. Ingle "Two visual systems in the frog." *Science* 181: 1053-55, 1973; D. J. Ingle "Some effects of pretectum lesions on the frog's detection of stationary objects" *Behavioural Brain Research* 1: 139-63, 1980; D. J. Ingle "Organization of visuomotor behaviors in vertebrates" In D.J. Ingle, M.A. Goodale, and R.J.W. Mansfield, eds., *Analysis of Visual Behavior*, MIT Press, 1982.

¹² Famously, face recognition in general is utterly compromised when faces are turned upside-down; infamously, cross-racial facial recognition can be difficult, apparently because people privilege race-specifying cues over individuating information when recognizing faces cross-racially. These are facts that wouldn't be predicted by a thoroughgoing world-model version of face recognition. Bartlett & Searcy, "Inversion and configuration of faces" *Cognitive Psychology* 25: 281-316, 1993; Levin, "Race as a visual feature: Using visual search and perceptual discrimination tasks to understand face categories and the cross-race recognition deficit" *Journal of Experimental Psychology: General* 129: 559-74, 2000.

For the enactive view this *is* intelligence—and note the conflation, in the example, of the perceptual, cognitive, and performative elements of the phenomenon in question; this is typical of the enactive approach, but looks sloppy to the Cartesian. Indeed, given the Cartesian notion that the cognitive and perceptual can and should be distinguished, one suspects that were the frog also endowed with a limited vocabulary—along the lines of Wittgenstein's builders, so it said “fly!” when it saw a fly, and “hawk!” just before diving under cover of water to avoid the bird overhead, and perhaps whistled just so when it saw an attractive potential mate—that its intelligence would be more widely recognized and praised.¹³ Herein lies a simple prejudice, which the enactive view does not share.

Besides which, there is evidence that a significant part of the human visual system is not entirely unlike the frog's (which is the sort of fact one comes to expect when looking at these matters from an evolutionary perspective; solutions to common adaptive problems are often common across species, and conserved along lines of descent).¹⁴ For the human visual system is likewise split into (at least) two separate pathways: a “dorsal stream” (also known as the “where” pathway) that tracks the location, size and shape of objects, and a “ventral stream” (the “what” pathway) that facilitates classifying and identifying objects. The dorsal stream is a specialized perception-action system optimized for calculating and directing motor responses aimed at an object in virtue of its location, orientation, and spatial extent. This system guides such things as reaching and grasping, and the orientation of sense organs for optimal perception and perceptual tracking. Thus, the natural way to characterize what one knows in virtue of dorsal stream operation is in terms of ego-centric spatial coordinates: where something is in relation to one's self, and what might be done to get the self-object relation into a preferred state. One might say that the dorsal stream “sees” objects in an ego-centric action field; the object is thereby

¹³ Cf. Ludwig Wittgenstein, *Philosophical Investigations*, 3ed. Prentice Hall, 1999, p.3. Technically, I am conflating my animals here: rabbits, not frogs, have hawk detectors.

¹⁴ “In summary, the modular organization of visuomotor behaviour in representative species of at least one mammalian order, the rodents, appears to resemble that of much simpler vertebrates such as the frog and toad. In both groups of animals, visually elicited orienting movements, visually elicited escape, and visually guided locomotion around barriers are mediated by quite separate pathways from the retina right through to motor nuclei in the brainstem and spinal cord. This striking homology in neural architecture suggests that modularity in visuomotor control is an ancient (and presumably efficient) characteristic of vertebrate brains.” Milner & Goodale, *The Visual Brain in Action*, Oxford University Press, 1995, pp. 18-19.

experienced in these terms. Like the dorsal stream, the ventral stream is a specialized perception-action system, but in this case optimized for making classifications, generating descriptions, and other more traditionally "cognitive" activities.

As is often the case in cognitive science, some of the most striking illustrations of this separation and its importance come from studies of individuals with specific neural deficits. Thus, for instance, patient DF, who has widespread lesions in the ventral stream caused by carbon monoxide poisoning, although unable to identify objects by sight (she can neither draw nor describe them), can nevertheless reach for these objects with fluent and appropriately sized and oriented grips. Similarly, while she is unable to perceive and describe the orientation of a letter-slot, she is easily able to post a letter through it. In contrast, optic ataxics who have dorsal stream lesions are able to see and describe visual scenes without trouble (for instance the objects on a table or the letter-slot in a wall), but are unable to fluently grasp those objects, or post a letter through the slot, despite the apparent clarity of their visual experience.¹⁵

The same kind of disconnect between conscious perception and perceptually guided action can be seen for *everyone* in the case of a clever variation of the "Titchener circles" illusion. In this experiment, subjects were presented with poker chips arranged like the discs in the Titchener circles diagram, and were told to pick up the center chip on the left if the center chips appeared to be of the same size, and on the right if they appeared to be different. Although the *choice* of chip showed that the participants were subject to the relevant illusion, in reaching for the chip they used a grip perfectly suited its *actual* and not its *perceived* size.¹⁶ Subjective experience to the contrary, it appears that much of our behavior is (still) governed by specialized, even unconscious, visuomotor systems. When it comes to actually acting in the world, we are perhaps more frog-like than we care to admit.

¹⁵ For a thorough discussion of these findings see Milner & Goodale, *The Visual Brain in Action*, Oxford University Press, 1995.

¹⁶ S. Aglioti, M. Goodale, & J. F. X. DeSouza "Size contrast illusions deceive the eye but not the hand" *Current Biology* 5: 679-85, 1995. A nice discussion of some general implications of the finding is Clark, "Visual experience and motor action: Are the bonds too tight?" *Philosophical Review* 110(4), 2001

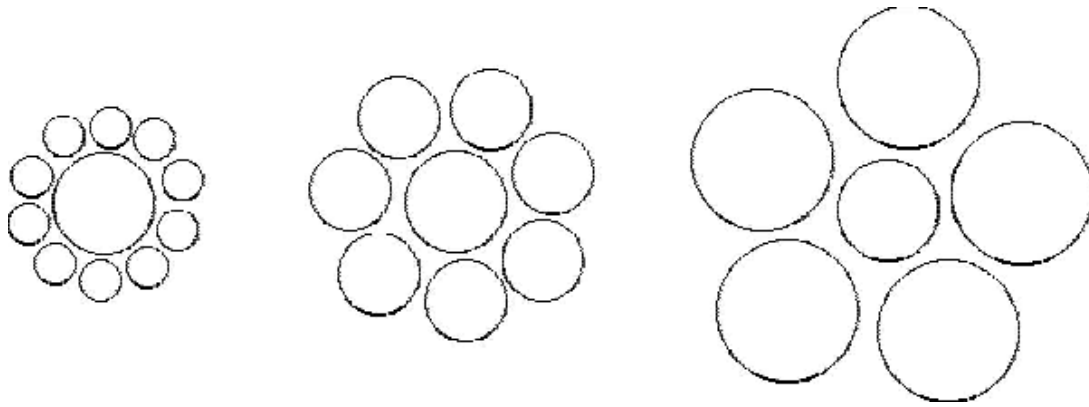


Figure 1: The Titchener circles illusion. The three center circles are the same size.

Still, one is certainly entitled to doubt whether this dorsally-mediated orientation to the environment can account for the complex tasks routinely faced by the typical parent, who shuttles the children to their various activities at the right time, in the right order, meanwhile figuring out ways to work in laundry, dry cleaning, and grocery shopping. Surely he cannot simply let the world unconsciously guide him and expect to accomplish his daily tasks; rather, he must think about, and plan in reference to, the way the world *will be*. Doesn't this require world modeling, concepts, and representations—cognition as traditionally understood? Possibly.¹⁷ But whenever in our (pre-)history symbols and representations emerged as a cognitive tool, they did so in a context—in an environment—already dominated by effective solutions to perceptual-behavioral coordination. It seems unlikely that new solutions radically broke with the old. Instead, we should ask what existing resources might have been exapted, redeployed, recycled or otherwise adapted to these new purposes.¹⁸

From this perspective what emerges as the critical (and fabulously interesting) question is: what are the relations between the lower-level, older, specialized sensory-

¹⁷ Chemero (2009) argues forcefully that the answer is “no”, that dynamic systems theory can account for cognition without recourse to computationalism and its various accoutrement. He could be right. My argument here is that even the best possible case for computationalism in cognition undermines the traditional Cartesian paradigm with which it has long been allied.

¹⁸ On the dependence of conceptual contents on action and embodiment see Anderson & Rosenberg, “Content and action: The guidance theory of representation”, *Journal of Mind and Behavior*, 29(1-2): 55-86, 2008; and Anderson, “Cognitive science and epistemic openness” *Phenomenology and the Cognitive Sciences*, 5(2): 125-154, 2006. On the general question of the re-use of existing resources for new purposes, see my “On the grounds of x-grounded cognition” In: P. Calvo and T. Gomila, eds. *The Elsevier Handbook of Cognitive Science: An Embodied Approach*, pp. 423-35, 2008; and “Massive redeployment, exaptation, and the functional integration of cognitive operations” *Synthese*, 159(3): 329-345, 2007.

motor systems and the structure, elements, and rules of operation of any more general, highly flexible, symbolic computational system we may possess? My bet, for what it's worth, is that these are significantly intertwined, with bi-directional feedback and cooperation—that, for instance, some conceptual contents can be traced to specific sensory-motor systems, and some sensory-motor systems have been adapted to utilize some of the resources of (or at least be responsive to) more general conceptual systems.¹⁹ Whatever representations emerged in such an environment would seem very likely to be themselves action-oriented, built upon faculties that govern our ability to move and act in a dynamic environment. And so the moral remains the same: the first work of cognition is to provide for action; as the organism's possibilities for action become more sophisticated, so, too, must the structures that support that activity. But the very nature of perception, of cognition—of mindedness—is not fundamentally transformed by this process.

So, even when one simply concedes that planning and model-building may be necessary to some kinds of complex cognition, the central point about its fundamental action-orientation stands. And the argument can be made stronger still, because it turns out that a lot of behavior that might seem to require planning can in fact be done without it. Consider the well-known example of Pengi²⁰, a software agent that successfully plays a video game in which a penguin must (among other things) kill bees by kicking ice cubes at them. Since this sometimes means re-arranging the cubes before kicking them, so they better align with the bees, the ability to play this game looks like exhibit A in the case for the necessity of planning systems. But Pengi doesn't do any planning, nor does it construct the detailed models that planning typically requires. Instead, it continually decides what to do in the moment based on the way the world *looks*.²¹

“Pengi constructs no plans and no models of hypothetical future worlds. . . .
[I]n place of simulation, Pengi uses *visualization*. Pengi looks to see what might happen next. It engages in visual routines which find particular spatial

¹⁹ For a discussion see my “Neural re-use as a fundamental organizational principle of the brain”.

²⁰ P. E. Agre & D. Chapman, “Pengi: An implementation of a theory of activity.” *The Proceedings of the Sixth National Conference on Artificial Intelligence (AAAI-87)* 268-272, 1987.

²¹ Thus Rodney Brooks' famous slogan: “the world is its own best model”. R. Brooks, “Elephants don't play chess” *Robotics and Autonomous Systems* 6: 3-15, 1990.

configurations that predict courses of events and so suggest actions. For example, when Pengi sees that an ice cube adjacent to the penguin is aligned with a bee, and there are no intervening ice cubes, it kicks it. . . . When it sees such an ice cube is only near rather than adjacent to the penguin, it moves the penguin in the direction of the ice cube . . ."²²

And when it sees that a cube can be kicked and end up aligned with a bee, it kicks that one. In support of all this, Pengi registers aspects of its environment in deictic, indexical-functional terms like *the-bee-I-am-chasing* and *the-projectile-cube* that help it to select appropriate actions for the circumstance. That is, entities in the world are individuated in terms of their relations to the agent and its ongoing purposes. As the authors put it: "The participatory nature of deictic representations means that Pengi deals with the environment through a constant interaction with it rather than through the construction and manipulation of models."

This returns us to a point we left behind earlier: it isn't just that perception and cognition are action-oriented, but that they are *interactive*, exploiting properties of their environment to guide and simplify cognitive tasks. Thus, to understand the character of (advanced) cognition one needs to understand not just the basic faculties that support and constrain it, but also the nature of the environment within which an organism exercises those faculties. Put somewhat differently, thinking and perceiving are activities of embodied agents in particular circumstances. These processes crucially rely on neural, corporeal, and environmental resources and are thus not easily localized "inside" or "outside" the agent. This is certainly true of Pengi, whose complex-looking behaviors are the result of the complexity of the *interaction* of simple sensorimotor routines with simple world circumstances.²³ Since this is also true of both human and frog, the massively greater sophistication of human intelligence needs to be explained in a way that does justice *both* to the enhanced (behavioral, categorical, representational, linguistic) faculties of human brains, *and* to the richer resources of the human environment (not to mention the structure and

²² Agre & Chapman, "What are plans for?" *Robotics and Autonomous Systems*, 6(1-2): 17-34, 1990.

²³ On this point see also H.A. Simon, *the Sciences of the Artificial*, MIT Press, 1970. Simon describes the apparently complex track of an ant on the beach as the result of an interaction between the ant and the nature and features of its environment.

behavioral repertoire of the human body).²⁴ For human-level cognition is marked by the use of and interaction with the environment in myriad ways: using a pencil and paper to store intermediate results in long division or large-number multiplication; arranging a hand of cards or scrabble tiles to better see relevant patterns, matches, or potential words; rotating puzzle pieces to better discern their fit; making grocery lists, labels, signs, encyclopedias, and otherwise storing information in the world to be consulted later; and using management structures, and the constraints imposed by individual roles, to accomplish complex tasks like ship navigation or building construction.²⁵

The overall picture that this suggests is of an intelligence that lies less in the individual brain, and more in the dynamic interaction of agents with and within the wider world.²⁶ Mindedness emerges as—is—the activity of making the world a home, one that reflects the nature of its occupant. Its primary sign is a kind of adaptive integration with one's environment, including especially the social and cultural worlds that are so important to human cognition. Note this is the precise opposite of mind on the Cartesian view, which shows itself fully only in disengagement and alienation.²⁷ Thus, in my judgment, discovering and detailing the particular physical characteristics and environmental integrations that shape and support the various aspects of mindedness is the central project of cognitive science. What we are (or should be) doing is attempting to understand how the activity of human mindedness emerges from—is related to, shaped by, and influences—the structures and characteristics of human biology and society. This physical grounding project encompasses enterprises ranging from specifying the particular influence of physical or neurological structures on the contents of experience; to modeling the principles

²⁴ In fact, it follows from this approach that the sophistication of the environment increases as a function of the perceptual-behavioral sophistication of the organism.

²⁵ See Clark, *Being There: Putting Brain, Body and World Together Again*, MIT Press, Cambridge, MA, 1996.; and Clancey, *Situated Cognition: On Human Knowledge and Computer Representations*, Cambridge University Press, 1997.

²⁶ See, e.g., Clark & Chalmers, "The extended mind", *Analysis* 58:10-23, 1998; Rowlands, *Body Language: Representation In Action*, MIT Press, 2006.

²⁷ Given this emphasis on integration, one might wonder about the "critical distance" from the world which is apparently central to social progress. For proponents of the enactive view, metaphors of distance are automatically suspect, and it is an important challenge for the enactive view, therefore, to articulate the possibility of criticism without alienation; still, it is an illusion to suppose that this capacity is any less mysterious on the Cartesian view, which most certainly poses its own challenges to the notion of free will.

guiding the re-use of existing neural, behavioral and environmental resources for new purposes over evolutionary and developmental time; to understanding the simple interactions with the physical environment that aid in calculation, memory, and decision-making (some of which have been mentioned already); to grappling with how we give abstract, linguistic and mathematical symbols concrete meaning, something which involves supporting integrations not just with the physical environment, but also, and perhaps especially, with the social world; all the way to the extremely difficult question of how to understand the very formation, in its social and physical context, of subjectivity and self-hood.

Enactive cognitive science therefore sits at the junction of biology, psychology, philosophy, and the various humanistic sciences, including anthropology, sociology, and economics, with the hope that a vision of mindedness which insists from the outset at *staying* at this critical intersection can help to unify—or at least make consistent—the myriad visions of human being expressed in these various fields.

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