# The Philosophy of Science

## An Encyclopedia

Volume 2

N–Z

INDEX

Sahotra Sarkar
Jessica Pfeifer
EDITORS

EDITORIAL ASSISTANTS
Justin Garson, James Justus, and Ian Nyberg
University of Texas

Routledge
Taylor & Francis Group
New York London

looking at the relation between empirical beliefs and reality (Quine 1963; Davidson 1987). The physicalist bridge they see is neural and causal, respectively, but not epistemological in an inferential sense. These bridges nevertheless play a crucial role in our attempts to fix meaning and belief.

JORDI CAT

### References


Carnap, R. ([1928] 1967), *The Logical Structure of the World*. Berkeley and Los Angeles: University of California Press.

——— (1932a), "*Der physikalische sprache als Universalsprache der Wissenschaft*," *Erkenntnis* 2: 432–465.

——— (1932b), "*Ueber Protokollsaetze*," *Erkenntnis* 3: 215–228.

——— (1934), *The Logical Syntax of Language*. London: Kegan Paul, Trench, Trubner & Co.

Carnap, R. (1950), "*Empiricism, Semantics and Ontology*," *Revue Internationale de Philosophie* 4: 20–40.

Davidson, D. (1987), "*Empirical Content*," in E. Lepore (ed.), *Essays on Truth and Interpretation*. Oxford: Oxford University Press.

Feyerabend, P. K. (1958), "*An Attempt at a Realistic Interpretation of Experience*," *Proceedings of the Aristotelian Society* 58: 143–170.

——— (1962), "*Explanation, Reduction, and Empiricism*," in H. Feigl and G. Maxwell (eds.), *Scientific Explanation, Space, and Time*. Minneapolis: University of Minnesota Press, 28–97.

Galison, P. (1989), "*Aufbau/Bauhaus: Logical Positivism and Architectural Modernism*," *Critical Inquiry* 16: 709–752.

Hanson, R. N. (1961), *Patterns of Discovery*. Cambridge: Cambridge University Press.

Kuhn, T. S. (1962), *The Structure of Scientific Revolutions*. Chicago: Chicago University Press.

Neurath, O. (1931), "*Physikalismus*," *Scientia* 50: 297–303 (trans. in Neurath 1983).

——— (1932), "*Protokollsaetze*," *Erkenntnis* 3: 281–288.

——— (1934), "*Radikaler Physikalismus und 'wirkliche Welt,'*" *Erkenntnis* 4: 346–363.

——— (1935), "*Pseudorationalismus der Falsification*," *Erkenntnis* 5: 353–365.

——— (1983), *Philosophical Papers, 1913–1946*. Edited by M. Neurath and R. Cohen. Dordrecht, Netherlands: Reidel.

Popper, K.R. ([1935] 1959), *The Logic of Scientific Discovery*. London: Hutchinson.

Quine, Willard Van (1963), *From a Logical Point of View*. New York: Harper and Row.

Schlick, M. ([1918] 1925), *General Theory of Knowledge*. LaSalle, IL: Open Court.

Schlick, M. (1930), "*Die Wende in der Philosophie*," *Erkenntnis* 1: 4–11 (trans. in Schlick 1979).

Schlick, M. (1932), "*Positivismus und Realismus*," *Erkenntnis* 3: 1–31 (trans. in Schlick 1979).

Schlick, M. (1934), "*Ueber das Fundament der Erkenntnis*," *Erkenntnis* 4: 79–99 (trans. in Schlick 1979).

Schlick, M. (1979), *Philosophical Papers, Vol. 2 (1925–1936)*. Dordrecht, Netherlands: Reidel.


*See also* **Carnap, Rudolf; Cognitive Significance; Demarcation, Problem of; Feyerabend, Paul; Hanson, Norwood Russell; Kuhn, Thomas; Logical Empiricism; Neurath, Otto; Popper, Karl Raimund; Schlick, Moritz; Vienna Circle**

# PSEUDOSCIENCE

*See* **Cognitive Significance; Demarcation, Problem of**

# PHILOSOPHY OF PSYCHOLOGY

Traditionally, when general philosophy of science dominated the discipline, a simple division was often invoked to talk about philosophical issues specific to particular kinds of science: that between

the natural sciences and the social sciences. Over the last twenty years, philosophical studies shaped around this dichotomy have given way to those organized by more fine-grained categories, corresponding to specific disciplines, as the literatures on the philosophy of physics, biology, economics, and psychology—to take the most prominent four examples—have blossomed. In general terms, work in each of these areas has become increasingly enmeshed with that in the corresponding science itself, and so increasingly naturalistic (in at least one sense of that term).

The philosophy of psychology, like psychology itself, is concerned with mind and cognition. When psychology cut itself loose—institutionally and professionally—from philosophy in the late nineteenth and early twentieth centuries, it was the discipline that predominantly studied mind and cognition. This has changed over the last thirty years. With the development of artificial intelligence, cognitive anthropology, linguistics, and neuroscience—perhaps, together with psychology, best referred to collectively as the "cognitive sciences"—philosophers of psychology have found themselves both drawing on and contributing to scientific work in this more interdisciplinary milieu. There are two consequences of this. The first is that the field has become increasingly entwined with the philosophical aspects of cognitive science. One view is that one does greater justice to the interdisciplinary motivations behind cognitive science by placing an emphasis on the cognitive sciences, rather than on foundational assumptions that constitute a single paradigm of cognitive science (see Cognitive Science). In this view, the philosophical aspects of the cognitive sciences occupy the greater part of the philosophy of psychology (cf. Wilson 1999). The second consequence is that the more lively areas or topics of contemporary discussion in the philosophy of psychology are quite diverse, including (for example) philosophical issues in neuroscience, the nature and physical bases of consciousness, the evolution of mind, and the ontogenetic and phylogenetic development of intentional states in human agents.

Despite the first of these points, and contributing to the second, the material that philosophers of psychology discuss also covers questions about the mind and areas of psychology that even a pluralistic conception of the cognitive sciences excludes. These issues include debates over the scientific status of psychoanalysis, questions about the foundations of the taxonomy of psychopathology, and discussions of the nature of social psychology, all of which concern areas of psychology other than cognitive psychology.

What further complicates any simple characterization of work in the philosophy of psychology, and to some extent what distinguishes it from the other "philosophy of *X*" studies within the philosophy of science, is its close relationship to a traditional area of philosophy—the philosophy of mind—that has not typically viewed itself as a part of the philosophy of science at all. Thus, many of the topics that philosophers of psychology discuss that arise from their reflection on the cognitive sciences have analogues in traditional philosophy of mind. For example, concerns about the causal role of semantic- or representational-level properties in computational theories of cognition echo the more general problem of mental causation; many of the issues about the nature of cognitive architecture that separate, for example, "classic" from connectionist approaches to cognitive architecture are also reflected in the historical debates between rationalists and empiricists. Perhaps because the nature of the mind has been one of the central issues in metaphysics and epistemology throughout the history of philosophy, the connections between the philosophy of psychology and philosophy more generally are more extensive than in any other disciplinarily specialized area of the philosophy of science. What follows will attempt to convey something of the flavor of three topics within the philosophy of psychology that have dominated the field over the last twenty years: intentionality, cognitive architecture, and consciousness. It will also briefly discuss another pair of more specific topic clusters that represent novel and perhaps trend-setting topics for future research.

## Intentionality and Mental Representation

The postulation of mental representation has been central to the cognitive sciences throughout their history. Human agents do not simply or reflexively respond to their environments, but are equipped with some internal, mediating mental machinery, which is sensitive to what is in the environment but which has enough complexity to it to thwart any attempt (e.g., made by behaviorists) to exhaustively characterize it in terms of that environment (e.g., in terms of stimulus–response pairs) (see Behaviorism). Mental representations play precisely such a mediating role, both containing information about the world and combining to guide an individual's behavior in that world (see Intentionality).

The form that mental representation takes in commonsense, folk psychology is *propositional:* Agents have beliefs and desires, where each of these mental states can be thought of as an attitude to a proposition. Psychology has built on such folk psychological representations since its inception, from the Freudian extension of folk psychology from conscious to unconscious states, to work on stereotypes and schemata in social psychology, to classic artificial intelligence (AI) models of human problem solving or reasoning. Because of this link between folk and scientific psychology, propositional representation has been a focus of discussion within the philosophy of psychology. In fact, due to its prominence, many general discussions of mental representation have been cast exclusively in terms of propositional representation, or even its folk psychological guise. What follows constitutes three of the central issues in the literature and a sampling of positions that have been adopted with respect to them:

1. *How many kinds of mental representation are there?* Much of the debate over mental imagery (Pylyshyn, in press) has focused on the reality of mental images and their relationship to propositional representations. There has also been more recent discussion of the extent to which mental representations are "local" as opposed to "distributed" in their nature. The role of language in mental representation, and thus thought, has also structured a range of related debates, such as over the language of thought hypothesis and the question of the form that mental representation takes in nonlinguistic creatures, such as human infants and nonhuman animals.
2. *What determines a representation's content?* Three chief answers to this question have been entertained: conceptual role or procedural semantics, causal or informational theories, and teleological theories (see also Cognitive Science). The first of these is typically internalist in that mental content is determined entirely by intrinsic, physical properties of the agent or system. But the most pervasive views here are externalist; that is, they allow an individual's social or physical environment to be a determinant of the type of mental states the individual has, which reinforces externalist views of psychology and psychological explanation (Wilson 1995 and 2002). Both causal and teleological views allow an individual's historical, social, and physical location to partially determine what content its representations have. An alternative form of externalism that departs from the sort of realism about mental representation that has been taken for granted by the three chief views here is a conventionalism about the nature of representational content (see Horst 1996).
3. *Is mental representation dispensable within the cognitive sciences?* Stich (1983) was an early defender of the view that the cognitive sciences could be (indeed, should be) content free. Patricia S. Churchland (2002) has expressed an alternative, neuroscientifically inspired form of eliminativism about mental representation. Both of these forms of eliminativism about mental representation have pitched their critiques at the sorts of representations posited by folk psychology. Proponents of connectionist architectures and, more recently, of dynamic approaches to cognition have also often introduced their views as avoiding the postulation of mental representation. But as the descriptors 'distributed' and 'dynamic' suggest, such approaches do not necessarily imply the rejection of all forms of mental representation, and the place of mental representation within them remains a topic of continuing interest (Érdi 2000) (see Epistemology).

## Cognitive Architecture and Processing

If debates over the nature of mental representation concern *what* it is that cognition ranges over, those over cognitive architecture and processing concern *how* it is that cognition proceeds. Part and parcel of the "cognitive revolution" of the late 1950s that formed the basis for the cognitive sciences was the conceptualization of cognitive processing as a form of *computation.* This view, computationalism, has received both general and somewhat vague characterizations ("cognition is computation") as well as more specific formulations ("cognition is explicit symbol manipulation") that are tied to particular research programs, the best known of which is the *physical symbol system hypothesis*, associated with Allen Newell and Herb Simon (1981): "A physical symbol system has the necessary and sufficient means for general intelligent action" (41). Central to any account of cognitive processing is a commitment to the nature of the basic design of the cognitive system, the *cognitive architecture* of that system, and hypotheses about cognitive architecture have usually been formulated as explicit

computational models that generate behavior that approximates some aspect of (often human) cognitive behavior. In Newell and Simon's own view, production systems, which consist of chains of condition-action rules defined over data structures, form the heart of human cognitive architecture, and the types of behaviors to which their computational models were applied most extensively were problem solving and reasoning. Variations on this general view were predominant in much of AI and psychology until the 1980s, and the philosopher perhaps most firmly associated with this sort of "rules and representations" approach to cognitive architecture is Jerry Fodor (1981).

Over the past twenty years, connectionism has come to represent a general alternative to the rules and representation approach. The basic idea of connectionist architectures and the neural network models that correspond to them is that cognition involves the adjustment of weighted connections between many relatively simple processing units through a process of feedback from environmental inputs (learning). Although these basic units are often compared to neurons, the bulk of the psychological work to which philosophers appeal (e.g., in modeling the acquisition of the past tense in English) involves processing units that are on the wrong scale to be very neuron-like (see Connectionism).

The most fruitful work within the computational paradigm, broadly construed, involves models that appeal to aspects of both rules and representations and connectionist architectures. A common suggestion is that the former handles "higher" cognitive functions, such as problem solving, while the latter are applicable to "lower-level" cognition, such as pattern recognition. But more truly integrative models of cognitive architecture focus on the role that *probability* has within computational models; for example, Boltzmann machines, developed within the neural network paradigm, are essentially identical to Bayesian networks developed within traditional AI (Pearl 2000). The significance of such models is that they straddle the supposed divide between "classic" and "connectionist" architectures. Their rise within work on computational intelligence signals the next stage in cognitive modeling (see Jordan and Russell 1999).

Dynamic approaches to cognition attempt to pose a more radical challenge to these two views of cognitive architecture and their corresponding paradigms for the cognitive sciences. The chief idea of dynamicism is that cognitive systems are a form of dynamic system that exists in real time and whose movement over time is not governed by any special computational principles (Port and van Gelder 1995). On the dynamic conception of cognitive processing, internalized rules and symbols do not play any special role in cognition; rather, cognition proceeds through the settling of the cognitive system into an equilibrium state. The mathematical equations that govern such processes are not internalized within the cognizer any more than Newton's laws of motion are internalized in the objects whose behavior they govern. The dynamic approach has thus challenged both the representational and computational dimensions to standard cognitive science, and it also suggests that cognitive systems are fundamentally *embedded* or *embodied*, a point discussed further later.

The development of connectionist architectures has led many philosophers of psychology to rethink a range of issues concerning the nature of cognitive processing. Many of these concern the nature of mental representation, as noted above, but the rise of connectionism has also generated more general discussions, such as those over the nature of computation (including the relationship between computational models and computation) and the role that cognitive neuroscience has to play in addressing some of these questions about large-scale cognitive organization. Despite the fact that most of the neural network models of influence within the cognitive sciences are not neurally very realistic, connectionist architectures have redirected attention to the brain itself, particularly as noninvasive techniques of imaging, such as positron emission tomography (PET) and functional magnetic resonance imaging (fMRI), have allowed researchers to explore the activity of the brain in real time. One pair of related themes concerning cognitive architecture has been the modularity of cognitive design and the localization of mental processes. Fodor (1983), crystallizing and generalizing a view of the mind articulated within linguistics by Chomsky as part of his approach to generative grammar in linguistics, rekindled interest in a modular view of cognitive capacities of the sort introduced originally by Gall almost two hundred years earlier. According to Fodor's view, many such capacities are *domain specific* and *encapsulated:* roughly, cognition is structured so that particular mental organs are sensitive only to specific kinds of inputs and are insulated from the causal influence of the operation of other mental organs. Fodor's own view here was that such a view of the mind held only of input systems—the five senses, plus language, according to Fodor—and he cautioned against the extension of the view to "central systems." This caution has been largely ignored as developmental psychologists have

postulated Fodorean modules for the domains of physics, number, biology, and psychology, and evolutionary psychologists have endorsed what has become known as the *massive modularity* thesis, the claim that the mind is overwhelmingly modular, with the number of modules running into the hundreds if not thousands (see Evolutionary Psychology). Philosophers have had much to say about these topics, particularly about the "theory of mind" within developmental psychology and evolutionary psychology in general.

It has typically been assumed that modules are *physically localized* in the brain, roughly in the way in which other bodily organs, such as the heart or the kidney, are so localized. As Fodor (1983) himself pointed out in his brief discussion of the "fixed neural architecture" (98–99) associated with modules, one might articulate this assumption in terms of broader systems that are somewhat distributed throughout the brain. But the basic idea is that functionally individuated modules have neural hardware specifically dedicated to the function they perform. As PET and fMRI have been increasingly used in experimental investigations of cognition, data on such localization assumptions have accumulated, though it is worth mentioning that these methods themselves have often been used in ways that presuppose a basically localistic view of cognitive function (Uttal 2001). Lloyd (2000) has presented a striking, even if preliminary, meta-analysis of the data across independent studies, arguing that these data support the claim that the brain is a distributed processor and refutes the stronger, "localistic," modularity hypotheses common in the field (see also Neurobiology).

## Consciousness

Consciousness has been a buzz topic in the philosophy of psychology for the past ten years, returning to occupy center stage after a long absence, and commanding the attention both of philosophers of science (i.e., of psychology) and of traditional philosophers of mind (see Consciousness). Amongst the latter, there has been an explicit a priori strand, with a focus on the challenge that consciousness, phenomenal states, and qualia pose to views, such as physicalism and functionalism, that continue to operate as working assumptions for many within the cognitive sciences. A work that has galvanized such discussion is Chalmers' *The Conscious Mind* (1996), a book whose central conclusions echo the skepticism about physicalism associated with well-known, earlier papers by Thomas Nagel and Frank Jackson, and whose emphasis on conceivability arguments and what they putatively show about the limits to the scientific study of consciousness has fueled some interesting debate over the role of conceptual analysis within a naturalistic account of the mind. Philosophical work on consciousness has also reacted to attempts to eliminate qualia, developed representationalist views of the nature of phenomenal experience, and debated the idea that consciousness is just awareness, so that a conscious mental state is some sort of second- (or, in general, higher-) order mental state. A succinct overview of this work is provided by Levine (1997).

Within the cognitive sciences themselves during roughly the same period, consciousness also had a renaissance, with much of this literature focused on the phenomena of visual awareness and attention. There has been speculation in this literature about the function(s) and evolutionary origins of consciousness, as well as a variety of neural techniques to try to pinpoint the parts of the brain that are most directly causally responsible for conscious experience. In an influential paper, Crick and Koch (1990) advocated that the time was ripe for neural speculations about consciousness, and proposed (building on the work of von Malsburg and others) that 40-hertz oscillatory cycles in the brain, particularly in the visual cortex, were especially important to consciousness. A detailed, recent empirical account of consciousness has been offered by Rodney Cotterill (1998), which emphasizes the relationship between consciousness and movement and the importance of *timing* to consciousness. Cotterill offers an integrated psychological and neurological view of the bases for consciousness that posits a triangular neural circuit linking the posterior lobes, the premotor area of the frontal lobes, and the nucleus reticularis thalami between the thalamus and the medulla oblongata as the neural basis for conscious experience.

One obvious question concerns the relationship between such work on consciousness and that on the nonconscious, representational mental states that have been central to the cognitive sciences over the last thirty years. *Representationalism* about conscious states constitutes one sort of answer, for it holds that qualitative states just *are* representational states. Indeed, one of the motivations for representationalism is to deflate the commitments that one makes in admitting conscious mental states as well as intentional states to one's ontology. Another type of answer is provided by John Searle (1992), who has defended what he calls *the connection principle*, which says that unconscious mental states must be, in principle, accessible to consciousness (see Searle, John). This principle

has one of two implications for traditional cognitive science: Either the states it posits do not exist or those states are, contrary to what most of those investigating them believe, accessible to consciousness. Given the disparate writings on consciousness, it is no surprise that some of these have become more explicitly self-reflective. Perhaps the best-known is by Block (1995), who introduced the distinction between "phenomenal consciousness," or *p*-consciousness (the what-it's-likeness of mental experience), and "access consciousness," or *a*-consciousness (the feature of mental experience that allows its reportability). One suggestion is that mental states such as pain and sensations are *p*-conscious, while those such as occurrent thoughts are *a*-conscious; another is that the former is really the subject of the literature inspired by Nagel, by Jackson, and by Chalmers, while the latter is what cognitive scientists investigate. Block himself introduced the distinction to critique claims, especially in the psychological literature, that were often made about the function of phenomenal consciousness that relied implicitly only on data about access consciousness. Philosophers remain divided over whether Block's distinction makes sense of much of the consciousness literature or constitutes a confusion about consciousness itself (see Consciousness).

## Pain, Psychopathology, and Color

One of the concomitant products of the extended-consciousness fest has been work on topics concerning particular phenomenal states. *Color* is perhaps the most richly mined of these, beginning with C. L. Hardin's *Color for Philosophers* (1988), which significantly raised the bar regarding the level of empirical detail relevant to philosophical discussions of color. From its characterization as a secondary quality in seventeenth-century mechanical philosophy and science, color has constituted both an epistemic and an ontological puzzle: Just what is color, in the world, and does one's epistemic access to it constitute some sort of privileged knowledge? Some of the recent work on color processing in the cognitive sciences suggests that color is at least as much of an enigma in accounts of cognitive processing. For example, it now appears that there is no place or system in the central nervous system that is modularly dedicated to process color, and this has led some philosophers to rethink the evolutionary function of color perception and its role within the perceptual life of the individual (cf. Matthen 1999).

While psychopathology itself is not a new topic for philosophers, work here has taken a novel turn as a by-product of the focus on consciousness. Conscious experience sometimes deviates from its normal course. Philosophical issues abound here, whether it be in cases of blindsight in patients with severed corpus callosa, where subjects are causally influenced by phenomena of which they report no conscious awareness (Weiskrantz 1986), or in clinical breakdowns of the self, such as those involving "injected selves," or dissipated and disjoint mental lives (Graham and Stephens 1994). Clinical, medical, and cognitive psychologies have represented distinct traditions studying mental pathologies, and as they begin to share more common phenomena, data, and theoretical bases, there is an opportunity for philosophers of psychology not only to contribute to discussions of foundational questions about the nature of the self, rationality, and normative mental functioning, but also to bring together these discussions with those on each of the three topics with which this article began: mental representation, cognitive architecture, and consciousness. Pain is the third and newest of these topics within empirically attentive philosophy of psychology. The large community of researchers on pain have their home base in the medical sciences and have focused not so much on the theorization of pain as on its amelioration and treatment. Along with color, pain is the qualitative mental phenomenon most commonly invoked by philosophers discussing consciousness, and like color the empirical work on pain has exploded in recent years. There are sensory and affective dimensions to pain, where the former reflects the role of pain as a detector of bodily damage, and the latter, the phenomenal character of pain. Moreover, there turns out to be considerable interpersonal bodily variability for those experiencing pain. Conceptually, the sensory and affective dimensions of pain are distinct, and early empirical work offered support for the hypothesis that there are two separate pain systems. Dennett ([1978] 1998) used some of the complexities of the folk psychology commonsense conception of pain to argue for an eliminativist view of pain, and more recently philosophers have taken opposing views on whether pain is essentially perceptual or emotional in nature (see Aydede, Güzeldere, and Nakamura, forthcoming).

## Embodied, Embedded, and Situated Cognition

A second general area in which there has been a hive of activity is that of *embedded* cognition, also referred to as *situated* or *embodied* cognition. In

part as a reaction to the general character of traditional symbolic AI and connectionism, both of which have abstracted away from the nature of the environment in which cognition actually operates, this cluster of views emphasizes the organism/environment coupling in theorizing about cognition. While the "embeddedness movement" has sometimes represented itself as anticomputational (e.g., Brooks 1997), there has been a concerted effort within an overarching computational framework to capture the spirit of the movement, ranging from Cantwell Smith's (1996) reconceptualization of computation to Dennett's (2000) emphasis on the important role of out-of-the-head scaffolding in higher mental processes. Central to the embedded movement is the idea that cognizers are *agents* who act in the world, gathering information about the world in order to act. This agent-centered conception of cognition has become increasingly a part of mainstream artificial intelligence (e.g., Russell and Norvig 1995). Indeed, as stated at the outset, it is one of the motivating themes of folk psychology. In light of these points, this development within the philosophy of psychology is less a departure from traditional views than a return to one of the themes familiar to those in the field.

There is an obvious affinity between such approaches to cognition and the externalist views that have come to dominate philosophical reflection on intentionality and mental representation. There are a number of attempts (e.g., Clark 1997) to build some firmer bridges between the philosophical and scientific work. But there is much more to be done here.

ROBERT A. WILSON

## References


Aydede, M., G. Güzeldere, and Y. Nakamura (forthcoming), *The Puzzle of Pain: Philosophical and Scientific Essays*. Cambridge, MA: MIT Press.

Block, N. (1995), "On a Confusion About a Function of Consciousness," *Behavioral and Brain Sciences* 18: 227–247.

Brooks, R. (1997), *Cambrian Intelligence*. Cambridge, MA: MIT Press.

Chalmers, D. (1996), *The Conscious Mind*. New York: Oxford University Press.

Churchland, P. S. (2002), *Brain-Wise: Studies in Neurophilosophy*. Cambridge, MA: MIT Press.

Clark, A. (1997), *Being There*. Cambridge, MA: MIT Press.

Cotterill, R. (1998), *Enchanted Looms*. New York: Cambridge University Press.

Crick, F., and C. Koch (1990), "Towards a Neurobiological Theory of Consciousness," *Seminars in the Neurosciences* 2: 263–275.

Dennett, D. C. ([1978] 1998), "Why You Can't Make a Computer That Feels Pain," in *Brainstorms: Philosophical Essays in Mind and Psychology*. Montgomery, VT: Bradford Books, 190–232.

——— (2000), "Making Tools for Thinking," in D. Sperber (ed.), *Metarepresentations*. New York: Oxford University Press.

Érdi, P. (2000), "On the 'Dynamic Brain' Metaphor," *Brain and Mind* 1: 119–145.

Fodor, J. A. (1981), *Representations*. Sussex, UK: Harvester Press.

——— (1983), *The Modularity of Mind*. Cambridge, MA: MIT Press.

Graham, G., and L. Stephens (eds.) (1994), *Philosophical Psychopathology*. Cambridge, MA: MIT Press.

Hardin, C. L. (1988), *Color for Philosophers*. Indianapolis: Hackett Publishing.

Horst, S. (1996), *Symbols, Computation, and Intentionality*. Berkeley and Los Angeles: University of California Press.

Jordan, M., and S. Russell (1999), "Computational Intelligence," in R. A. Wilson and F. C. Keil (eds), *The MIT Encyclopedia of the Cognitive Sciences*. Cambridge, MA: MIT Press.

Levine, J. (1997), "Recent Work on Consciousness," *American Philosophical Quarterly* 34: 379–404.

Lloyd, D. (2000), "Terra Cognita: From Functional Neuroimaging to the Map of the Mind," *Brain and Mind* 1: 93–116.

Matthen, M. (1999), "The Disunity of Color," *Philosophical Review* 108: 47–84.

Newell, A., and Simon, H. (1981), "Computer Science as an Empiral Inquiry: Symbols and Search," in J. Haugeland (ed), *Mind Design: Philosophy, Psychology, Artificial Intelligence*. Cambridge, MA: MIT Press, 35–66.

Pearl, J. (2000), *Causality: Models, Reasoning, and Inference*. New York: Cambridge University Press.

Port, R., and T. van Gelder (eds.) (1995), *Mind as Motion*. Cambridge, MA: MIT Press.

Pylyshyn, Z. (in press), *Seeing and Visualizing: It's Not What You Think: An Essay on Vision and Imagination*. Cambridge, MA: MIT Press.

Russell, S., and P. Norvig (1995), *Artificial Intelligence: A Modern Approach*. Englewood Cliffs, NJ: Prentice Hall.

Searle, J. (1992), *The Rediscovery of the Mind*. Cambridge, MA: MIT Press.

Smith, B. C. (1996), *On the Origin of Objects*. Cambridge, MA: MIT Press.

Stich, S. (1983), *From Folk Psychology to Cognitive Science*. Cambridge, MA: MIT Press.

Uttal, W. (2001), *The New Phrenology*. Cambridge, MA: MIT Press.

Weiskrantz, L. (1986), *Blindsight*. Oxford: Oxford University Press.

Wilson, R. A. (1995), *Cartesian Psychology and Physical Minds*. New York: Cambridge University Press.

——— (1999), "Philosophy," in R. A. Wilson and F. C. Keil (eds.), *The MIT Encyclopedia of the Cognitive Sciences*. Cambridge, MA: MIT Press.

——— (2002), "Individualism," in S. Stich and T. A. Warfield (eds.), *Blackwell Guide to Philosophy of Mind*. New York: Blackwell.


*See also* **Artificial Intelligence; Biology, Philosophy of; Cognitive Science; Connectionism; Consciousness; Evolutionary Psychology; Intentionality; Neurobiology; Reductionism; Social Sciences, Philosophy of**