



Intentionality: A philosophical-cognitive approach to mental representations

Intencionalidade: uma abordagem filosófica-cognitiva das representações mentais

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Abstract

This article critically analyses the notion of intentionality from several philosophical-cognitive points of view. The authors argue that the notion of mental representation in the wider sense and intentionality in the narrower sense remains elusive despite accommodated paradoxes, improved semantic precision and more sophisticated strategies in dealing with intentionality. We will argue that different approaches to intentionality

appear to be coherent in their inferences. However, most of them become contradictory and mutually exclusive when juxtaposed and applied to borderline questions. While the explanatory value of both philosophy of mind as well as cognitive psychology should not be underestimated, we must note that not even hard-core neuroscience has been able to pin point what is going on in our minds, let alone come up with a clear cut explanation how it works or a definition of what thought really is. To date, however, intentionality is the best of all explanatory models regarding mental representations.

Keywords: Mind. Mental representation. Intentionality.

Resumo

Este artigo analisa criticamente a noção de intencionalidade de vários pontos de vista filosófico-cognitivos. A noção de representação mental no sentido mais amplo e de intencionalidade no sentido mais restrito ficam elusivos apesar de paradoxos acomodados, de uma precisão semântica melhorada e de estratégias mais sofisticadas em tratar intencionalidade. As diversas discussões de intencionalidade aparecem coerentes nas suas inferências. Porém, a maioria delas torna-se contraditória e mutuamente excludente quando justapostas e aplicadas a questões limítrofes. Enquanto não deveríamos subestimar o valor explanatório tanto da filosofia da mente quanto da psicologia cognitiva, precisamos reconhecer que inclusive a neurociência não tem podido explicar adequadamente o que está acontecendo em nossa mente, muito menos desenvolver uma explicação clara de como ela funciona ou uma definição do que é pensamento. Até hoje, porém, intencionalidade é o melhor modelo explanatório disponível no que se refere às representações mentais.

Palavras-chave: Mente. Representação mental. Intencionalidade.

Introduction

The relation between the mental and the physical is the deepest and most recurrent classic philosophical topic in the philosophy of

mind. The problem is most famously associated with Rene Descartes, the preeminent figure of philosophy and science in the first half of the seventeenth century. Descartes combined a thorough-going mechanistic theory of nature with a dualistic theory of the nature of human beings. Although nature, including that of the human body, is material and thus completely governed by basic principles of mechanics, human beings are special in that they are composed of both material and nonmaterial stuff. To put it in more common sense terms, people have both a mind and a body. Every mental phenomenon is characterized by what the Scholastics of the Middle Ages called the intentional inexistence of an object. This medieval terminology was reintroduced by the Austrian philosopher Franz Brentano late in the 19th century.

Intentionality

The term *intentional* is used by philosophers, not as applying primarily to actions, but to mean “directed upon an object”. More colloquially, for a thing to be intentional is for it to be about something. Paradigmatically, mental states and events are intentional in this technical sense which originated with the scholastics and was reintroduced in modern times by Franz Brentano. For instance, beliefs and desires and regrets are about things, or have intentional objects: I have beliefs about Neymar Jr. (the Brazilian football player), I want a glass of wine and good education for my children, and I regret not having studied harder while in high school.

A mental state can have as intentional object an individual (William loves Kate), a state of affairs (Kate thinks that it is going to be a happy marriage) or both at once (William wishes that Kate were happier). Perception is intentional: I see William and that William is writing Kate’s name in his diary. The computational states and representations posited by cognitive psychology and other cognitive sciences are intentional also, inasmuch as in the course of computation something gets computed and something gets represented (an exception here may

be stated of neural networks, which have computational values but arguably not represent).

What is at once most distinctive at most philosophically troublesome about intentionality is its indifference to reality. An intentional object need not actually exist or obtain: the Greeks worshiped Zeus; a friend of mine believes that birds grow while flying; and even if I get the glass of wine, my desire for ubiquitous good education is likely to remain unfulfilled.

Brentano argued both (A) that this reality neutral feature of intentionality makes it the distinguishing mark of the mental, in that all and only mental things are intentional in that sense, and (B) that purely physical or material objects cannot have intentional properties — for how could any purely physical entity or state have the property of being directed upon or about a nonexistent state of affairs? (A) and (B) together imply the Cartesian dualist thesis that no mental thing is also physical. And each is controversial in its own right.

Thesis (A) is controversial because it is hardly obvious that every mental state has a possibly nonexistent intentional object; bodily sensations such as itches and tickles do not seem to, and free-floating anxiety is notorious in this regard. Also, there seem to be things other than mental states and events that aim at possibly nonexistent objects. Linguistic items such as the name Santa Claus are an obvious example; paintings and statues portray fictional characters; and one might ignorantly build a unicorn trap.

More significantly, behavior as usually described is intentional also: I reach for the glass of wine; William sends a gift to Kate; Kate throws the gift into the garbage can. (Though some philosophers, such as Chisholm (1958), and Searle (1983), argue that the aboutness of such nonmental things as linguistic entities and behavior is second-rate because it invariably derives from the more fundamental intentionality of someone's mental state).

Dualism and immaterialism about the mind are unpopular both in philosophy and in psychology — certainly cognitive psychologists do not suppose that the computational and representational states they posit are states of anything but the brain — so we have strong motives

for rejecting thesis (B) and finding a way of explaining how a purely physical organism can have intentional states. The taxonomy of such explanations is now fairly rich. It divides first between theories that ascribe intentionality to presumed particular states of the brain and those that attribute intentional states only to the whole subject.

Many theorists, especially those influenced by cognitive science, do believe that not only the intentionality of cognitive computational states but also that of everyday intentional attitudes such as beliefs and desires inhere in states of the brain. These propositional attitudes or, more generally, any state or act that can be said to be representational, represents the world as being a certain way and the content of the propositional attitude is what determines the way the world is represented. So propositions must be objects that have truth conditions that must be satisfied for a representational state with that content to correctly represent the world.

On the view that all propositional attitudes inhere in states of the brain, all intentionality is at bottom mental representation. To understand the nature of mental representation posited by cognitive scientists to account for various aspects of human and animal cognition, it is useful to first consider representation in general. Following Peirce (HARTSHORNE; WEISS; BURKS, 1931-1958), we can say that any representation has four essential aspects: (1) it is realized by a representation bearer; (2) it has content or represents one or more objects; (3) its representation relations are somehow grounded; and (4) it can be interpreted by and will function as a representation for some interpreter.

If we take one of the foundational assumptions of cognitive science to be that the mind/brain is a computational device, the mental representation bearers will be computational structures or states. The specific nature of these structures or states depends on what kind of computer the mind/brain is hypothesized to be. To date, cognitive science research has focused on two kinds: conventional, that is, symbolic, or rule-based computers and connectionist computers, that is, parallel distributed processing devices. If the mind/brain is a conventional computer then the mental representation bearers will be data

structures. Kosslyn's (1980) work on mental imagery provides an adequate illustration of such mental structures.

If the mind/brain is a connectionist computer, then the representation bearers of occurring mental states will be activation states of connectionist modes or sets of nodes. In the first case, representation is considered to be local; in the second case is considered to be distributed (MCCLELLAND; RUMELHART; HINTON, 1986). There may also be implicit representation, that is, storage of information, in the connections themselves, a form of representation appropriate for dispositional mental states.

While individual claims about what our representations are about are frequently made in the cognitive science literature, we do not know enough to theorize about the semantics of our mental representation system in the sense that linguistics provides us with the formal semantics of natural language. However, if we reflect on what our mental representations are hypothesized to explain — namely, certain features of our cognitive capacities — we can plausibly infer that the semantics of our mental representation system must have certain characteristics.

Theoretically, human cognitive capacities have the following three properties: (1) each capacity is intentional, that is, it involves states that have content or are “about” something; (2) virtually all of the capacities can be pragmatically evaluated, that is, they can be exercised with varying degrees of success; and (3) most of the capacities are productive, that is, once a person has the capacity in question, he or she is typically in a position to manifest it in a practically unlimited number of novel ways.

To account for these features, we must posit mental representations that can represent specific objects; that can represent many different kinds of objects — concrete objects, sets, properties, events, and states of affairs in this world, in possible worlds, and in fictional worlds as well as abstract objects such as universals and numbers; that can represent both an object in and of itself and an aspect of that object, that is, its extension and intension, and, finally, that can represent both either correctly or incorrectly. In addition, if we take the productivity

of our cognitive capacities seriously, we must posit representations with constituent structure and a compositional semantics (FODOR; PYLYSHYN, 1988).

Cognitive scientists are interested not only in the content of mental representations, but also in where this content comes from, that is, in what makes a mental representation of a tree have the content of being a tree. Theories of what determines content are often referred to as this-or-that kind of semantics. Note, however, that it is important to distinguish such theories of content determination (VON ECKARDT, 1993) from the kind of semantics that systematically describes the content being determined (as above referred to).

Of the five principal accounts of how mental representational content is grounded, we shall discuss the following three.

- 1) *Structural isomorphism*. A representation is understood to be some sort of model of the thing (or things) it represents (PALMER, 1978). The representation or, more precisely, the representation bearer represents aspects of the represented object by means of aspects of itself. Palmer (1978) treats both the representation bearer and the represented object as relational systems, that is, as sets of constituent objects and sets of relations defined over these objects. A representation bearer then represents a represented object under some aspect if there exists a set G of relations constituting the representation bearer and a set D of relations constituting the object such that G is isomorphic to D.
- 2) *Causal historical*. (DEVITT, 1981; STERELNY, 1990). The causal historical approach is intended to apply only to the mental analogues of designational expressions. This account holds that a token designational expression in the language of thought designates an object if there is a certain sort of causal chain connecting the representation bearer with the object. Such causal chains include perceiving the object, designating the object in natural language, and borrowing a designating expression from another person.

- 3) *Biological function*. In this account (MILLIKAN, 1984), mental representations, like animal communication signals are intentional icons, a form of representation that is articulate (has constituent structure and compositional semantics) and mediates between producer mechanisms and interpreter mechanisms. The content of any representation bearer will be determined by two things — the systematic natural associations that exist between the family of intentional icons to which the representation bearer belongs and some set of representational objects, and the biological functions of the interpreter device. More specifically, a representation bearer will represent an object if the existence of a mapping from the representation bearer family to the object family is a condition of the interpreter device successfully performing its biological functions. Take the association between bee dances and the location of nectar relative to the hive. The interpreter device for bee dances consists of the gatherer bees, among whose biological functions are those adapted to specific bee dances, for example, finding nectar a specific distance to the north of the hive in response, to say, dance number 16. The interpreter function can successfully perform its function, however, only if bee dance 16 is in fact associated with the nectar's being at that specific location.

It can be argued that for a mental entity or state to be a representation, it must not only have content, it must also be significant for the subject who has it. According to Peirce (HARTSHORNE, C.; WEISS, P.; BURKS, A., 1931-1958), a representation having such significance can produce an interpretant state or process in the subject, and this state or process is related to both the representation and the subject in such a way that, by means of the interpretant, what the representation represents can make a difference to the internal states and behavior of the subject.

This aspect of mental representation has received little explicit attention; indeed its importance and even its existence have been disputed by some. Nevertheless, many cognitive scientists hold that the

interpretant of a mental representation, for a given subject, consists of all the possible computational consequences, including both the processes and the results of these processes, contingent on the subject's actively entertaining that representation.

Cognitive scientists engaged in the process of modeling or devising empirical theories of specific cognitive capacities — or specific features of such capacities — often posit particular kinds of mental representations. For pedagogical purposes, Thagard (1990) categorizes representations into six main kinds, each of which is typically associated with certain types of computational processes: sentences or well-formed formulas of a logical system; rules; representations of concepts such as frames; scripts; analogies; and connectionist representations.

To date there is, however, no tidy taxonomy of representational kinds. Sometimes such kinds are distinguished by their computational or formal characteristics — for example, local versus distributed representation in connectionist systems. Sometimes they are distinguished in terms of what they represent — for example, phonological, lexical, syntactic, and semantic representation in linguistics and psycholinguistics. And sometimes both form and content play a role.

Paivio's (1986) dual-coding theory claims that there are two basic modes of representation — imagistic and propositional. According to Eysenck and Keane (1995), imagistic representations are modality-specific, nondiscrete, implicit, and involve loose combination rules, whereas propositional representations are amodal, discrete, explicit, and involve strong combination rules. The first contrast, modality-specific versus amodal, refers to the aspect under which the object is represented, hence to content; the other three contrasts all concern form.

Not all philosophers interested in cognitive science regard the positing of mental representations as being necessary or even unproblematic. Stich (1983) argues that if one compares a *syntactic theory of mind* (STM), which treats mental states as relations to purely syntactic mental sentences tokens and which frames generalizations in purely formal or computational terms, with representational approaches, STM will win. Representational approaches, in his view, necessarily encounter difficulties explaining the cognition of young children,

“primitive” folk, and the mentally and neutrally impaired. STM does not. Nor is it clear that cognitive science ought to aim at explaining the sorts of intentional phenomena that mental representations are typically posited to explain.

We earlier pointed out that many theorists, especially those influenced by cognitive science, believe that propositional attitudes inhere in states of the brain. We now add that these propositional attitudes also have Brentano’s feature because the internal physical states and events that realize them represent actual and possible states of affairs.

Some evidence for this is that intentional features are semantical features: Like undisputed cases of representation, beliefs are true or false; they entail or imply other beliefs; they are, it seems, composed of concepts and depend for their truth on a match between their internal structures and the way the world is; and so it is natural to regard their aboutness as a matter of mental referring or designation.

Sellars (1963) and Fodor (1981) have argued that intentional states are just physical states that have semantical properties, and the existent or non-existent states of affairs that are their objects are just representational contents.

The main difficulty for this representationalist account is that of saying exactly how a physical item’s representational content is determined; in virtue of what does a neurophysiological state represent precisely that the Democratic candidate will lose? An answer to that general question is what Fodor has called a psychosemantics; the question itself has also been called the symbol grounding problem; several attempts have been made on it (BLOCK, 1986; DEVITT, 1981; DRETSKE, 1988; FODOR, 1987, 1990; MILLIKAN, 1984).

One serious complication is that, surprisingly, ordinary propositional attitude contents do not seem to be determined by the states of their subjects’ nervous systems not even by the total state of their subjects’ entire bodies. Putnam’s (1975) Twin Earth and indexical examples are widely taken to show that, surprising as it may seem, two human beings could be molecule-for-molecule alike and still differ in their beliefs and desires, depending on various factors in their spatial and historical environment (for dissent, however – see SEARLE, 1983).

Thus we can distinguish between narrow properties, that is, those that are determined by a subject's intrinsic physical composition, and wide properties, as it were, those that are not so determined and representational contents are wide.

So it seems an adequate psychosemantics cannot limit its resources to narrow properties such as internal functional or computational roles; it must specify some scientifically accessible relations between brain and environment.

A second and perhaps more serious obstacle to the representational view of thinking is that the objects of thought need not be in the environment at all. They may be abstract; one can think about a number, or about an abstruse theological property, and as always they may be entirely unreal. An adequate psychosemantics must deal just as thoroughly with Arthur's illiterate belief that the number of the fates was six, and with a visual system's hallucinatory detection of an edge that isn't really there, as much as with a real person's seeing and wanting to eat a bagel that is right in front of here.

In view of the foregoing troubles and for other reasons as well, other philosophers have declined to ascribe intentionality to particular states of subjects, and they insist that ascriptions of commonsense intentional attitudes, at least, are not about inner states at all, much less about internal causes of behavior. Some such theories maintain just that the attitudes are states, presumably physical states, of a whole person (BAKER, 1995; LEWIS, 1995; MCDOWELL, 1994; STRAWSON., 1959).

Others are overtly instrumentalist: Philosophers influenced by Quine (1960) or by continental hermeneuticists maintain that what a subject believes or desires is entirely a matter of how that person is interpreted or translated into someone else's preferred idiom for one purpose or another, there being no antecedent or inner fact of the matter. A distinctive version of this view is that of Davidson (1970) and Dennett (1978, 1987), who hold that intentional ascriptions express nonfactual, normative calculations that help to predict behavior but not in the same way as the positing of inner mechanisms does — in particular, nor casually or, what is generally referred to as the intentional stance.

The intentional stance

The intentional stance is the strategy of interpreting the behavior of an entity (person, animal, artifact, or the like) by treating it as if it were a rational agent that governed its choice of action by a consideration of its beliefs and desires. The distinctive features of the intentional stance can best be seen by contrasting it with two more basic stances or strategies of prediction, the physical stance and the design stance.

The physical stance is simply the standard laborious method of the physical sciences, in which we use whatever we know about the laws of physics and the physical constitution of the things in question to devise our prediction. When we predict that a stone released from someone's hand will fall to the ground, we are employing the physical stance. For things that are either alive or artifacts, the physical stance is the only available strategy. Every physical thing is subject to the laws of physics and hence behaves in ways that can be explained and predicted from the physical stance. If the thing released from someone's hand is a stone or a cat, we can make the same prediction about its downward trajectory, on the same basis.

Alarm clocks, being designed objects, are also amenable to a fancier style of prediction, that is, prediction from a design stance. Suppose we categorize a novel object as an alarm clock: We can quickly reason that if we depress a few buttons in a certain way, then some hours later the alarm clock will make a loud noise. We do not need to work out the specific physical laws that explain such regularity. We simply assume that it was a particular design — the design we call an alarm clock — and that it will function properly, as designed.

Design-stance predictions are riskier than physical-stance predictions, because of the extra assumptions we have to take on board: that the particular entity is designed just in the way we suppose it to be, and that it will operate exactly according to such design, that is, that it will not malfunction. However, designed things are occasionally misdesigned, and sometimes they break.

An even riskier stance is the intentional stance, a subspecies of the design stance, in which the designed thing is an agent of sorts.

An alarm clock is so simple that this fanciful anthropomorphism is, strictly speaking unnecessary for our understanding of why it does what it does, but adoption of the intentional stance is more useful when the artifact in question is much more complicated than an alarm clock.

Consider chess-playing computers, which all succumb neatly to the same simple strategy of interpretation: just think of them as rational agents that want to win, and that know the rules and principles of chess and the position of the pieces on the board. Instantly your problem of predicting and interpreting their behavior is made vastly easier than it would be if you tried to use the physical or the design stance. At any moment in the chess game, simply look at the chess board and draw up a list of all the legal moves available to the computer when it is its turn to play. Now rank the legal moves from best to worst, and make your prediction: the computer will make the best move. You may well not be sure what the best move is, but you can almost always eliminate all but four or five candidate moves, which still gives you tremendous predictive leverage.

The intentional stance works whether or not the attributed goals are genuine or natural or, really appreciated by the so-called agent, and this tolerance is crucial to understanding how genuine goal-seeking could be established in the first place. Does the macro-molecule really want to replicate itself? The intentional stance explains what is going on, regardless of how we answer that question.

Consider a simple organism — say an amoeba — moving non-randomly across the bottom of a laboratory dish, always heading to a nutrient-rich end of the dish, or away from the toxic end. This organism is seeking the good, or shunning the bad — its own good and bad — not those of some human artifact user. Seeking one's own good is a fundamental feature of any rational agent, but are these simple organisms seeking or just *seeking*? We do not need to answer that question. The organism is a predictable intentional system in either case.

By exploiting this deep similarity between the simplest — one might as well say mindless — intentional systems and the most complex (ourselves), the intentional stance also provides a relatively neutral perspective from which to investigate the differences between our

minds and simpler minds. For instance, it has permitted the design of a host of experiments shedding light on whether other species, or young children, are capable of adopting the intentional stance — and hence are higher order intentional systems.

Although imaginative hypotheses about theory of mind modules (LESLIE, 1991) and other internal mechanisms (BARON-COHEN, 1995) to account for these competences have been advanced, the evidence for the higher-order competences themselves must be adduced and analyzed independently of these proposals, and this has been done by cognitive ethologists (BYRNE; WHITEN, 1991; DENNETT, 1983) and developmental psychologists, among others, using the intentional stance to generate the attributions that in turn generate testable predictions of behavior.

Although the earliest definition of the intentional stance (DENNETT, 1971) suggested to many that it was merely an instrumental strategy, not a theory of real or genuine belief, this common misapprehension has been extensively discussed and rebutted in subsequent accounts (DENNETT, 1987, 1991, 1996).

Thus, the view that intentional ascriptions express nonfactual, normative calculations that helps to predict behavior (but not in the same way as the positing of inner mechanisms does) but not causally so, are defended epistemologically, by reference to the sorts of evidence we use in ascribing propositional attitudes.

Perhaps suspiciously, the instrumentalist views are not usually extrapolated to the aboutness of perceptual states or of representations posited by cognitive scientists; they are restricted to commonsense beliefs and desires. They do shed the burden of psychosemantics, that is, of explaining how a particular brain state can have a particular content, but they do no better than did representationalist views in explaining how thoughts can be about abstracta or about nonexistent.

Executive function: from a cognitive neuroscience point of view

The executive functions of the brain can be defined as the complex processes by which an individual optimizes his or her performance

in a situation that requires the operation of a number of cognitive processes. A rather more poetic metaphor is that the executive functions are the brains conductor, which instructs other regions to perform, or be silenced, and generally coordinates their synchronized activities. In other words, a fully working executive function is a necessary condition for meaningful intentionality.

As such, executive functions are not tied to one particular domain but take on a role that is meta-cognitive, supervisory or controlling. Attention and consciousness, memory processes and its mental images, maps, and propositions, the organization of knowledge in the mind, language in context, problem solving, creativity, decision making and, last but not least, reasoning in general, are all tied and dependent on executive function.

Executive functions have traditionally been equated with the frontal lobes. More accurately, executive functions are associated with the prefrontal region of the frontal lobes, and it is an empirically open question as to whether all aspects of executive function can be localized to this region.

In their seminal paper, Norman and Shallice (1986) outline five types of situation in which automatic activation of behavior may be insufficient and in which executive functions may be needed to optimize performance:

- 1) Situations involving planning or decision making;
- 2) Situations involving error correction or trouble-shooting;
- 3) Situations where responses are not well learned or contain novel sequences of actions;
- 4) Situations judged to be dangerous or technically difficult;
- 5) Situations that require the overcoming of a strong habitual response or resisting temptation.

In their work, Norman and Shallice (1986) show that executive functions are needed to optimize performance when several cognitive processes need to be coordinated; is situation is novel or difficult; a situation does not require an automatic response (trouble-shooting,

problem solving). Thus, executive function is widely regarded as being supervisory or controlling.

Functional imaging studies and studies of brain damaged patients point to a key role of the prefrontal cortex in executive functions. Patients with lesions here may have difficulties in problem solving, multi-tasking and so on. These findings are particularly important if we look at the development of this particular brain region. The prefrontal cortex is most developed in human beings where it occupies almost a third of the cortical volume, whereas it is comparatively underdeveloped, as it were, in other species, including our closest relatives, the Chimpanzees, due to its evolutionary progression.

Working memory is an important aspect of executive functions and may consist of several subsystems, including maintenance (holding things in mind) and manipulation (e.g. re-ordering the content of information held in mind). We cannot expect any animal that does not have its prefrontal cortex adequately developed to be capable of such maintenance and manipulation. This holds as much for non-human animals as it does for human beings whose cognitive development has not yet been concluded, particularly, whose left and right dorsolateral, ventrolateral, and anterior prefrontal region are under construction or lesioned.

Conclusion

The notion of intentionality has occupied mind philosophers for quite some time. Paradoxes were found and accommodated, semantic precision in dealing with the posed problems has been improved, ever more divide-and conquer strategies have been employed. The topic of intentionality remains elusive. Not even hard-core neuroscience has been able to pin point what is going on in our minds, let alone come up with a clear cut explanation how it works or a definition of what thought really is.

The different approaches to intentionality appear to be coherent in their inferences. However, most of them become contradictory

and mutually exclusive when juxtaposed and applied to borderline questions. The explanatory value of both philosophy of mind as well as cognitive psychology should not be underestimated even though the veracity, and validity of the respective models, premises and conclusions is subject to further neuro scientific findings. Even here, in this relatively new field of scientific methodology, new findings shatter long standing beliefs. The authors of this article believe intentionality and the intentionality stance as described above to be the strongest among the hitherto presented approaches, however, suspend their judgment as to whether or not intentionality will hold future scientific scrutiny.

References

- BAKER, L. R. *Explaining Attitudes*. Cambridge: Cambridge University Press, 1995.
- BARON-COHEN, S. *Mindblindness: an essay on autism and theory of mind*. Cambridge: MIT Press, 1995.
- BLOCK, N. J. Advertisement for a semantics for psychology. In: FRENCH, P.; UEHLING, T. E.; WETTSTEIN, H. (Ed.). *Studies in the Philosophy of Mind*. Minneapolis: University of Minnesota Press, 1986. p. 615-678. (Midwest Studies, 10).
- BYRNE, R.; WHITEN, A. *Machiavellian intelligence: social expertise and the evolution of intellect in monkeys, apes and humans*. New York: Oxford University Press, 1991.
- CHISHOLM, R. M. Sentences about believing. In: FEIGL, H.; SCRIVEN, M.; MAXELL, G. (Ed.). *Minnesota Studies in the Philosophy of Science*. Minneapolis: University of Minnesota Press, 1958. v. 2. p. 510-520.
- DAVIDSON, D. Mental events. In: FOSTER, L.; SWANSON, J. W. (Ed.). *Experience and theory*. Amherst: University of Massachusetts Press, 1970. p. 79-101.
- DENNETT, D. *Brainstorms*. Montgomery: Bradford Books, 1978.

DENNETT, D. Intentional systems. *Journal of Philosophy*, v. 68, p. 87-106, 1971.

DENNETT, D. Intentional systems in cognitive ethology: the "panglossian paradigm" defended. *Behavioral and Brain Sciences*, v. 6, p. 343-390, 1983.

DENNETT, D. *The intentional stance*. Cambridge: Bradford Books; MIT Press, 1987.

DENNETT, D. Real Patterns. *Journal of Philosophy*, v. 87, n. 27-51, 1991.

DENNETT, D. *Kinds of minds*. New York: Basic Books, 1996.

DEVITT, M. *Designation*. New York: Columbia University Press, 1981.

DRETSKE, F. *Explaining behavior*. Cambridge: Bradford Books; MIT Press, 1988.

EYSENCK, M. W.; KEANE, M. T. *Cognitive Psychology: a student's handbook*. Hillsdale: Erlbaum, 1995.

FODOR, J. A. *Representations*. Cambridge: Bradford Books; MIT Press, 1981.

FODOR, J. A. *Psychosemantics*. Cambridge: Bradford Books; MIT Press, 1987.

FODOR, J. A. *A theory of content and other essays*. Cambridge: Bradford Books; MIT Press, 1990.

FODOR, J. A.; PYLYSHYN, Z. W. Connectionism and cognitive architecture: a critical analysis. In: PINKER, S.; MEHLER, J. (Ed.). *Connections and symbols*. Cambridge: MIT Press, 1988. p. 3-71.

HARTSHORNE, C.; WEISS, P.; BURKS, A. (Ed.). *Collected papers of Charles Sanders Peirce*. Cambridge: Harvard University Press, 1931-1958.

KOSSLYN, S. M. *Image and mind*. Cambridge: Harvard University Press, 1980.

LESLIE, A. The theory of mind impairment in autism: evidence for a modular mechanism of development? In: WHITEN, A. (Ed.). *Natural theories of mind*. Oxford: Blackwell, 1991.

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- LEWIS, D. Reduction of mind. In: GUTTENPLAN, S. (Ed.). *A companion to the philosophy of mind*. Oxford: Blackwell, 1995. p. 412-431.
- MCDOWELL, J. *Mind and world*. Cambridge: Harvard University Press, 1994.
- MCCLELLAND, J. L.; RUMELHART, D. E.; HINTON, G. E. (Ed.). *Parallel distributed processing: explorations in the microstructures of cognition*. Cambridge: MIT Press, 1986. 2 v.
- MILLIKAN, R. G. *Language, thought, and other biological categories*. Cambridge: MIT Press; Bradford Books, 1984.
- NORMAN, D. A.; SHALLICE, T. Attention to action. In: DAVIDSON, R. J.; SCHWARTZ, G. E.; SHAPIRO, D. (Ed.). *Consciousness and self regulation*. New York: Plenum Press, 1986.
- PAIVIO, A. *Mental representations: a dual coding approach*. Oxford: Oxford University Press, 1986.
- PALMER, S. E. Fundamental aspects of cognitive representation. In BOSCH, E.; LLOYD, B. (Ed.). *Cognition and categorization*. Mahwah: Erlbaum, 1978.
- PUTNAM, H. The meaning of "meaning". In: GUNDERSON, K. (Ed.). *Language, mind and knowledge*. Minneapolis: University of Minnesota Press, 1975. (Minnesota Studies in the Philosophy of Science, 7).
- QUINE, W. V. *Word and object*. Cambridge: MIT Press, 1960.
- SEARLE, J. R. *Intentionality*. Cambridge: Cambridge University Press, 1983.
- SELLARS, W. *Science, perception, and reality*. London: Routledge; Kegan Paul, 1963.
- STERELNY, K. *The representational theory of mind: an introduction*. Oxford: Blackwell, 1990.
- STICH, S. P. *From folk psychology to cognitive science*. Cambridge: MIT Press, 1983.
- STRAWSON, P. F. *Individuals*. London: Methuen and Co., 1959.

THAGARD, P. Concepts and conceptual change. *Synthese*, v. 82, n. 2, p. 255-274, 1990.

VON ECKARDT, B. *What is Cognitive Science?* Cambridge: MIT Press, 1993.

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