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The mind-body problem in philosophy and the cognitive sciences

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Abstract Here, I examine the main philosophical solutions to the mind-body problem distinguishing between "historicist" solutions that (more or less clearly) separate philosophy from science and solutions that instead result from a double "cognitive turn", and see "continuity" between philosophy of mind and the cognitive sciences. The "historicist" solutions include ontological dualism (together with "skepticism" and "new mysterianism"), epistemological dualism, subjective idealism, and absolute idealism. In this group, transcendental idealism, phenomenology, and neutral monism are the solutions most open to a dialogue between philosophy and science. The "naturalistic" solutions can be divided into four groups: (1) behaviorism (psychological, logical, philosophical-analytical behaviorism); (2) materialism (identity theory, physicalism); (3) "weak naturalism" (functionalism, anomalous monism, "biological naturalism", liberal naturalism, emergentism); (4) "strong naturalism" ("cognitive neo-evolutionism", eliminativism). These offer a physicalist-eliminative solution to the mind-body problem (here called "soft physicalistic eliminativism") that allows for more continuity between philosophy of mind and the cognitive sciences.
KEYWORDS: Mind/Body-Problem; Cognitive Science; Cognitive Turn; Naturalism; Eliminativism

Riassunto *Il problema mente-corpo in filosofia e le scienze cognitive* - Vengono esaminate le principali soluzioni filosofiche al problema mente-corpo al fine di distinguere le soluzioni di origine storicistica che separano (più o meno chiaramente) filosofia e scienza da quelle che invece, nate da una duplice "svolta cognitiva", favoriscono la "continuità" tra filosofia della mente e scienze cognitive. Le soluzioni del primo gruppo sono anzitutto il dualismo ontologico (insieme allo "scetticismo" e al "neo-misterianismo"), il dualismo epistemologico, l'idealismo soggettivo e l'idealismo assoluto. L'idealismo trascendentale, la fenomenologia e il monismo neutrale sono invece soluzioni più aperte al dialogo tra filosofia e scienza. Le soluzioni del secondo gruppo, quelle "naturalistiche", vengono suddivise in quattro grandi gruppi: (1) il comportamentismo (psicologico, logico e filosofico-analitico); (2) il materialismo (teoria dell'identità e fisicalismo); (3) il "naturalismo debole" (funzionalismo, monismo anomalo, "naturalismo biologico", naturalismo liberalizzato e emergentismo); (4) il "naturalismo forte" ("neo-evoluzionismo cognitivo" ed eliminativismo). In conclusion, una soluzione di tipo fisicalistico-eliminativo (qui chiamata "eliminativismo fisicalistico moderato") al problema mente-corpo è quella che più di altre favorisce la continuità tra filosofia della mente e scienze cognitive.
PAROLE CHIAVE: Problema mente/corpo; Scienza cognitiva; Svolta cognitiva; Naturalismo; Eliminativismo

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1 Philosophy and the cognitive sciences

IN *THE MIND'S NEW SCIENCE*, Howard Gardner called philosophy, psychology, artificial intelligence, linguistics, anthropology, and neuroscience «the cognitive sciences».[1] Gardner argued that an intense and fruitful dialogue was developing between philosophy and the cognitive sciences, despite their differences.[2] This dialogue has now been going on for decades and has led to good results. For instance, new cognitive sciences such as neuroethics[3] and neuroaesthetics[4] have been developed from traditional philosophical disciplines such as ethics and aesthetics. However, some basic theoretical issues still remain unclear. First of all, it is evident that philosophy, despite often cooperative relationships with all sciences, is neither science nor history, art, literature, myth or religion. Philosophy is simply... philosophy! Philosophy does not study a part of reality, for example the human world or human history. Philosophy is rational reflection on all other forms of knowledge or intellectual activity.[5]

As regards the relationship between philosophy and the cognitive sciences, it must first be noted that the attitude of philosophers towards the scientific study of cognitive processes is distributed along a continuum between two poles established by the "historicists" and positivists in the 19th century. At one pole, are the heirs of "historicism"[6] (idealists, Marxists, existentialists, "hermeneuts" or postmodernists). They consider philosophy to be a humanistic discipline outside or even, following G.W.F. Hegel (1770-1831), superior to science. At the other pole, are the "naturalists", the heirs of positivism and supporters of "scientific naturalism"[7] today, who see philosophy as a kind of knowledge destined to either be replaced by or at least deeply connected to the sciences.

The first attitude does not allow for any real and intense collaboration between philosophers and cognitive scientists. It is typical of those philosophers, theologians, and more generally, scholars in the humanities who see the reduction of all mental phenomena (including the products of intellectual activity such as art, literature and science) to simple neuronal processes or to activities that could even be performed by a robot as an attack on the dignity and creativity of man and a rejection of the moral and cultural values that constitute human civilization.[8]

The second attitude, inaugurated in the 19th century by the positivists, is today supported by "naturalists" in the sense indicated above. It has proved to be more productive in view of fomenting collaboration between philosophers and cognitive scientists. In particular, in the 1960s, some philosophers of mind and many cognitive scientists began an intense dialogue aimed at founding, to use Gardner's words, «the mind's new science».[9] This cooperation between philosophy of mind and the cognitive sciences (particularly, artificial intelligence and cognitive psychology) brought about the "first cognitive turn".[10] The 1990s saw a "second cognitive turn", this time based on cooperation between philosophy of mind and cognitive neuroscience.[11]

Today's solutions to the mind-body problem, heirs to these "cognitive turns", have led to two kinds of "cognitive naturalism".[12] Cognitive naturalism, understood in this way, still follows the model offered by W.v.O. Quine's "naturalized epistemology", an ontological and epistemological framework of a philosophical kind within which the various cognitive sciences can "naturalize" different aspects of mental activity by explaining them in a rigorously scientific-empirical way.[13]

Both these basic conceptions on the nature of mind – the former anti-reductionist and anti-naturalistic, the latter reductionist and naturalistic – are reflected in the orientations still prevalent nowadays with regard to solutions given to the so called "mind-body problem".[14] In order to clarify the relationship between philosophy and the cognitive sciences it is worthwhile providing a brief systematic review of the solutions philosophers have given to the mind-body problem from antiquity to the present day[15] and the way in which these solutions have been accepted or criticized by cognitive scientists.

In other words, this review has a double purpose: on the one hand, to offer a survey of the main solutions that have been given and are still given today to the mind-body problem; on the other hand, to highlight how the last of these solutions, that is, eliminitavism (or better, "soft physicalistic eliminativism") is the most convincing solution and the most suitable ontological-epistemological framework for promoting interdisciplinary and multidisciplinary studies between the various cognitive sciences.

2 Ontological dualism, skepticism and new mysterianism

According to ontological *dualism*,[16] the soul and the body are two substances or two independent and incompatible properties. Ontological dualism, although not so called, was clearly formulated by R. Descartes in the 17th century. The mind (whose concept replaces the concept of soul in Descartes) is *res cogitans* [thinking thing] and therefore it is thinking and not extended. The body is *res extensa* [extended thing][17]and therefore it is instead extended and not thinking.[18]

The Cartesian dualism can also be called *interactionism* because it admits causal mind-body interaction. It has met with enormous success in modern philosophy, in the 20th century it was accepted by important philosophers and neuroscien-

tists such as K.R. Popper and J. Eccles[19] and is still supported by several philosophers today.[20] However, nowadays interactionism enjoys very little success both among cognitive scientists (in particular, neuroscientists)[21] and among naturalistic philosophers of mind[22] because it is difficult to reconcile it with contemporary physics. A causal interaction between the mind and the body, when considered a causal interaction between something physical and something not physical, would violate the principle of energy conservation and therefore would violate the principle of the Causal Closure of the Physical World according to which only physical events can cause other physical events.[23] A mental event external to the physical world would belong to a dimension of reality extraneous to physical reality. Therefore, if a mental event of this kind were the cause of brain processes it would inject a certain amount of energy into the physical world and thereby violate the principle of energy conservation. Moreover, not even the theory of relativity can avoid this consequence since it too accepts the principle of conservation of mass-energy.[24]

Quantum mechanics instead has offered support to those who want to justify interactionism. In fact, at least according to the Copenhagen Interpretation, quantum mechanics maintains that there is no observer-independent physical reality. Those who accept this interpretation are free to believe that the intervention of an observer determines those aspects of experimentally observable physical reality that the probabilistic equations of quantum mechanics leave undetermined.[25] This has brought about a lively discussion[26] for or against «a quantum mechanical argument for mind-body dualism».[27] However, although its promoters are serious and sometimes distinguished scientists, this hypothesis remains highly controversial.[28]

In any case, the argument against interactionism based on the violation of the Causal Closure of the Physical World does not apply to the other two kinds of ontological dualism: epiphenomenalism and "parallelism". *Epiphenomenalism*[29] argues that certain brain processes in addition to causing motor responses or other physical events also produce states of consciousness through a kind of causation called "mental causation" distinct from physical causation. According to the supporters of epiphenomenalism, these states are causally inert and cannot retroact on the brain that produced them. Their state of inertia implies that hypothesizing their existence is completely useless from a scientific point of view. Therefore, epiphenomenalism can be criticized in the light of Ockham's Razor: "entities should not be multiplied beyond necessity".

Parallelism was hypothesized in different forms by B. Spinoza and G.W. Leibniz in the 17th century. Parallelism argues that there is no causal interaction between minds and bodies but that this does not prevent mental events from being perfectly synchronized with what happens in the body (particularly in the brain). The theological-speculative justifications for mind-body parallelism given by Spinoza and Leibniz are devoid of solid evidence. Even if the prominent neuroscientist A.R. Damasio recently championed Spinoza's views,[30] they are generally considered of little interest by today's cognitive scientists. However, in the 19th and 20th centuries, an empirical reformulation of Spinoza's hypothesized parallelism of thought and extension met with considerable success under the name of "neutral monism".[31]

Furthermore, the basic thesis of ontological dualism in all its forms, namely the ontological irreducibility of mental phenomena to physical phenomena, is still indirectly acknowledged by two groups of philosophers and neuroscientists. Although philosophers in the first group (let's call them supporters of *skepticism* in the philosophy of mind) do not maintain mind-body dualism, they nevertheless argue (as did, for example, T. Nagel) that states of consciousness are subjective and therefore cannot be investigated in a scientific and objective way.[32] But the results of the empirical investigations of behaviorists, physicalists, and naturalists militate against this thesis.[33]

Philosophers in the second group (first and foremost, C. McGinn)[34] together with some neuroscientists (such as A. Benini)[35] have instead supported the so-called *new mysterianism* (a denomination they do not themselves accept). According to the "new mysterians", there is certainly something in brain activities that could explain the emergence of consciousness but unfortunately the human mind is not capable of grasping this explanation. New mysterianism therefore appears to result from a renunciation of the advances made by the cognitive sciences in the last thirty years.

3 Epistemological dualism and liberal naturalism

Ontologically distinguishing the soul (or the mind) from the body implies that knowing such different "objects" would require sufficiently different methodologies. This is the fundamental thesis of *epistemological dualism*,[36] a thesis based on the distinction between *Geistes- und Naturwissenschaften* (human sciences and natural sciences) proposed by W. Dilthey in opposition to positivism in 1881.[37] This distinction is still present in the contemporary philosophical debate. Philosophers such as H. Putnam[38] and J.R. McDowell[39] have implicitly exploited W.v.O. Quine's "naturalized epistemology"[40] to support a thesis contrary to Quine's naturalism.[41] They have stated that different sciences (or more generally different disciplines, including philosophy) have different and independent "ontological commitments" that are the basis for independent

world views which while at least partly incompatible are all equally legitimate.[42]

Putnam in particular admitted that a «mentalistic» description of the mind could account for the «qualitative character of sensations»,[43] claiming this would not be possible within the reductionist approaches of the natural sciences. Therefore, in regard to the mind-body problem, unlike interactionism, Putnam's epistemological dualism did not violate the Causal Closure of the Physical World because his mentalistic description of conscious states was independent of their naturalistic description and therefore did not violate any laws of nature. However, Putnam's epistemological dualism (or pluralism) led to cognitive relativism; his epistemological dualism (or pluralism) sacrificed the central thesis of "scientific realism"[44] that science must try to provide a true description of the real world that is unique and ontologically independent of the way in which it is described. While this thesis has been and continues to be the center of a heated dispute between realist and anti-realist philosophers,[45] it remains, at least implicitly, accepted by the majority of scientists.

The epistemological pluralism proposed in M. De Caro and D. Macarthur's *liberal naturalism*[46] owes much to Putnam but takes a more moderate stance on cognitive relativism. It aspires to a form of naturalism, albeit a form of naturalism that differs from scientific naturalism. It can be classified as a form of "weak naturalism"[47] which rejects Quine's «continuity» between science and philosophy. However, it instead requires «compatibility» between philosophical and scientific theories: mentalistic descriptions of psychological states and human actions must not violate any laws of nature.[48] Can De Caro and Macarthur keep this commitment to the principle of energy conservation while and still maintain that conscious states can produce effects on voluntary behavior despite being irreducible to brain processes that should respect all laws of nature? This seems doubtful.

4 Idealism and neutral monism

Among the monistic solutions to the mind-body problem that oppose dualism, the most akin to dualism itself is *idealism*[49] because of its anti-naturalistic and anti-reductionist character. Idealism was already present in antiquity under the form of Plotinus' neoplatonic "immaterialism" and in the modern age as G.W. Leibniz's "Monadology" but first developed thanks to classical empiricism, which claimed it was nonsense to speak of an external reality independent of the representation it is given. This empiricist approach to the external world has given rise to three distinct kinds of idealism: subjective idealism, transcendental idealism and phenomenology, and absolute idealism.

Subjective idealism, in the version presented by G. Berkeley in the 18th century, argues that bodies as autonomous substances distinct from minds (or better, from "spirits") do not exist. Bodies exist only insofar as they are the inner objects of mental acts.[50] Something similar to subjective idealism has reappeared today among interpretations of quantum mechanics as a form of "anti-realism" similar to that one already examined and criticized which attempted to recover ontological dualism through microphysics.[51] But despite this partial retrieval of actuality through quantum mechanics, subjective idealism remains a highly speculative and non-scientific conception of mind.

Absolute idealism, instead of considering bodies as the contents of perceptions and thoughts, considers nature to be a manifestation of spirit. Especially in Hegel's version, absolute idealism met with enormous success during the 19th century and the first half of the 20th century but it, too, is a speculative theory on a par with subjective idealism that lacks any empirical-scientific basis.

Transcendental idealism, the solution given by I. Kant to the mind-body problem at the end of the 18thcentury, fared and still fares better among psychologists and cognitive scientists than subjective idealism or absolute idealism. However, Kant's philosophy is still a form of idealism because according to Kant the external reality that we perceive through the senses or know through science (in particular through I. Newton's physics) is not reality in-itself but reality as it appears to us. We do not know the "thing-in-itself" but only the "phenomenon".[52] More in detail, Kant thought that our "Gemüt" ("animus", "mens"), unlike Berkeley's "spirit", does not determine the content of sensitive intuitions and empirical concepts. Through the "pure intuitions" of space and time and the "pure concepts of intellect" (that is, the "categories"), it determines only their forms.[53]

At the beginning of the 20th century, "Gestalt psychology" (C. von Ehrenfels, etc.) took the idea that empirical data are transformed into a coherent image of the world only if they are organized according to a priori forms provided by the human mind from Kant's transcendental idealism.[54] Furthermore, at the beginning of the 20th century a kind of epistemology similar in part to Kant's epistemology was proposed by E. Husserl, the founder of phenomenology.[55]

Phenomenology, a current of thought that is still central in contemporary philosophy, nowadays arouses new interest among many cognitive scientists.[56] Moreover many phenomenologists have opened themselves up to a dialogue with cognitive psychology and cognitive neuroscience.[57] However, although the results of this dialogue are very interesting, Husserl's staunch anti-naturalism[58] is still an obstacle to the compatibility of phenomenology with a scientific approach to the study of mind (or better to the study of mind/brain).

Neutral monism[59] is a kind of monism opposed to dualism but like idealism it also differs from materialism.[60] In the 17th century, this solution of the mind-body problem was proposed by B. Spinoza to justify "mind-body parallelism".[61] Neutral monism and its variant – known as "double aspect theory" – were transformed into an empirical hypothesis in accordance with modern science by G.T. Fechner, R. Ardigò, E. Mach and W. James in the 19th century. In 1921, neutral monism had its best-known formulation in B. Russell's *The Analysis of Mind.* According to Russell, minds and bodies are theoretical constructs obtained by combining the same sense data in two different ways.[62] However, if minds and bodies are theoretical constructs obtained by combining the same sense data (therefore psychical data) in two different ways, Russell's monism ceases to be neutral and instead leans towards subjective idealism.

The same criticism cannot be directed at the version of empiricist neutral monism proposed more recently by D. Chalmers. He uses quantum mechanics[63] to support his "naturalistic dualism of properties" and to hypothesize that the states of phenomenal consciousness and their neuronal correlates are two sides of the same coin and that their perfect correspondence is guaranteed by a psycho-physical law that according to Chalmers is an essential part of the fundamental laws of nature.[64] Therefore Chalmers' monism is truly neutral and exhibits no inclination towards idealism. However, it too runs into the central criticism of neutral monism in general: there is little point in saying that mind and body are two sides of the same coin if one is not able to say in empirically well-founded terms what the coin is! Neutral monists run the risk of explaining "obscurum per obscurius" (that is, they risk providing an explanation that is even more obscure than the thing it purports to explain).

5 Psychological behaviorism, logical behaviorism, philosophical-analytical behaviorism

All the solutions to the mind-body problem examined so far have their roots in the history of philosophy from antiquity to the middle of the 19th century. *Psychological behaviorism*[65] (together with psychoanalysis)[66] is an exception. It finds its roots in a scientific turning point on the conception of mind that emerged among psychologists in the second half of the 19th century and then rose to prominence in the first half of the 20th century as Darwin's *The descent of man*[67] pushed us to consider *Homo sapiens* as just another animal species among others and the study of man as falling within the natural sciences.

Contrary to all previous philosophical solutions to the mind-body problem, behavioral psychologists maintained and still maintain (insofar as they are still present) that one must renounce all belief in the existence of presumed internal mental causes of manifest behavior and instead explain such behavior in scientific terms. To come to understand human behavior in scientific terms it is necessary to use empirical generalizations based on the model: "(observable) distal stimulus → (observable) motor response".[68] According to psychological behaviorists, it is misleading to consider the mind as a mediator between sensory stimuli and voluntary actions as do introspective psychologists; on the contrary, it must be seen as a "black box" strictly placed between parentheses.

Psychological behaviorism experienced immense popularity in the first half of the 20th century (first, in the United States) but subsequently entered a profound crisis, although it has not completely disappeared. The first insurmountable objection to psychological behaviorism was raised by N. Chomsky in 1959. He pointed out that Skinner's interpretation of language as «verbal behavior»[69] (that is, as a set of conditioned reflexes learned after birth) fails because Skinner did not take into account the fact that human beings could neither speak nor understand those who speak to them in early childhood and thus could not learn to do so in such a short time if they were not able to unconsciously follow the rules of an innate universal grammar that forms the basis of all possible natural languages.[70]

Since the 1960s, criticisms directed at psychological behaviorism by the nascent cognitive sciences have moved in the same direction. According to cognitive scientists, there are no directly observable regularities between sensory stimuli and motor responses that can explain human behavior without recourse to hypothesized internal mental states that can act as intermediaries. In short, one needs to open the "black box" and study its functioning if one wants to understand human behavior.[71]

However, these criticisms of psychological behaviorism do not directly affect philosophical forms of behaviorism, that is, the logical behaviorism[72] proposed by logical empiricists and the philosophical-analytical behaviorism[73] proposed by the supporters of ordinary language philosophy. These philosophical forms of behaviorism reject dualism like psychological behaviorism but unlike psychological behaviorism do not deny the existence of mental states or mental events, even considering them relevant when explaining for voluntary actions. Philosophical kinds of behaviorism apply a "linguistic turn"[74] (a turn typical of analytic philosophy with its consequent rejection of metaphysics) to the philosophy of mind and suggest that psychological concepts, far from referring to "ghostly entities", refer to publicly observable behavioral dispositions of flesh and bone agents. However, the way in which logical behaviorism and philosophical-analytical behaviorism

have introduced the concept of behavioral disposition into their respective conceptions of the mind is quite different.

According to the "*logical behaviorism*"[75] of the first logical empiricists in the 1930s, for example the version given by R. Carnap in 1932,[76] mental states are reducible to behavioral dispositions only in an indirect way. According to Carnap, if Mr. *A* is excited, his state of excitement is identical to a state of his central nervous system. However, since brain states are not directly observable,[77] it is convenient to identify Mr. *A*'s brain state with a behavioral disposition to excitability which in turn can be implicitly defined by observable effects on Mr. *A*'s behavior: his hands shake and he responds aggressively to whatever is said to him, etc.[78] Therefore, Carnap's logical behaviorism is a sort of "physicalist behaviorism"[79] according to which mental states are brain processes (the physicalist aspect of Carnap's definition of mental states). However, brain processes can only be described indirectly as behavioral dispositions by observing the behavior they determine (the behavioral aspect of Carnap's definition).

Supporters of *philosophical-analytical behaviorism* offer a definition of mental states that resembles Carnap's definition in terms of its behavioral but not its physicalist aspect. This is particularly true of Ryle's conception of the mind[80] (although he refused to call it a kind of behaviorism). While Ryle proposes a non-physicalist conception of mind, he shares Carnap's thesis that mental states are knowable only if they are redescribed as behavioral dispositions.

For example – as Ryle has himself clarified – if you ask me why the person sitting next to me at the table passed me the salt and I reply that she did it out of courtesy, my explanation is dispositional and not causal. Her courtesy is not an occult mental cause that would have mysteriously caused a certain movement of her hand. Her courtesy is her tendency to be a kind person, that is, a person who under certain circumstances behaves in a certain way. More generally, the reason or motive for which one acts (or the intention with which one acts) is not a mental cause of the action but a behavioral disposition of the agent.[81] However, Ryle's behaviorism runs the risk of falling into a vicious circle. Saying that my neighbor passed me the salt out of courtesy is equivalent, in Ryle's dispositional explanation, to saying that she behaved politely because she is a polite person. Therefore, if this is the first time I have ever seen her in my life, then the only proof I have of her being a polite person is that on this occasion she behaved politely!

As H. Putnam made clear, if I say for example that a person groans because of the pain she is experiencing, do I mean that, since pain can be defined as a disposition to groan, that person groans because she has the disposition to groan? Or do I not rather mean that an internal state in her body is causing her to groan?[82] Mentalism,[83] that is, the theory according to which there are always unobservable internal causes of observable behavior is undeniable.[84] Therefore philosophical-analytical behaviorists make a serious mistake when, in order to reject dualism, they reject mentalism as well. In fact, one can be a mentalist without being a dualist: it is sufficient to be a materialist!

6 Materialism: The mind-brain identity theory and physicalism

Both *the mind-brain identity theory*[85] and *physicalism*[86] escape Putnam's objection to behaviorism because both these solutions to the mind-body problem admit the existence of unobservable mental causes for manifest behavior without falling back on dualism. Their proponents think that mental causes of behavior, even if they exist as required by mentalism, need not be "ghostly entities" extraneous to the physical world as dualists maintain. They are simply brain processes. Therefore, one can be a mentalist without being a dualist if one at least implicitly accepts the basic thesis of *materialism*: everything that is real is physical.[87] According to materialism, mental phenomena are real and, by causing bodily movements, they have effects in the physical world. However, in materialism, unlike dualistic interactionism, mental phenomena can cause voluntary actions without violating the principle of Causal Closure of the Physical World because they are themselves physical processes.

More specifically, according to the first version of mind-brain identity theory proposed by U.T. Place in 1954[88] and 1956,[89] "cognitive concepts" such as "knowing" and "believing" and "volitional" concepts such as "wanting" and "intending" refer to behavioral dispositions, as Ryle thought, but this is not the case for mental events such as being conscious or having sensations. This is because mental events, unlike mental states, are not behavioral dispositions but the inner bodily causes of behavior, that is, they are brain processes.[90]

As Place reiterated in a later essay, «materialism as applied to mental events is a reasonable scientific hypothesis, which cannot be ruled out of court by a priori philosophical argument».[91] In conclusion, Place and other supporters of both mind-brain identity (in particular J.J.C. Smart and D.K. Lewis)[92] and the similar "materialism of the central state" theory (D. Armstrong),[93] led the philosophy of mind from philosophical-analytical behaviorism to materialism.

A similar path was also taken by those logical empiricists who, in the 1930s, extended O. Neurath's physicalism to the philosophy of mind, claiming it was possible to translate the statements of any science into the language of physics.[94]

These developments led H. Feigl to write, in

1934, that thanks to physicalism it was possible to definitively provide a purely logical-linguistic solution to the "psycho-physical problem".[95] Nevertheless, by 1958, Feigl had revised his thinking, publishing an essay entitled *The "Mental" and the "Physical"*, where he recognized that, precisely because the mind-body problem was a scientific not metaphysical problem, it must also be an authentically ontological, not merely logical-linguistic problem.[96] Feigl, who sympathized with Place on this point, clarified in a 1967 *Postscript* to his 1958 essay that «mind-body problems cannot simply be made to disappear by purely linguistic maneuvers».[97]

The road to scientific naturalism in the philosophy of mind was open. However, even in this second formulation, physicalism found it difficult to account for the emergence of phenomenal consciousness from brain activity or more generally to reconcile the "manifest image" of the world with its "scientific image".[98]

7 Weak naturalism: Functionalism, emergentism and other hybrid solutions

Feigl's formulation of physicalism as an ontological-scientific theory was part of a more general trend towards the naturalization of epistemology promoted above all by Quine in the 1950s and 1960s. According to Quine, every scientific theory has its own "ontological commitments". Therefore, in the name of "scientific realism",[99] Quine thought it was the joint task of philosophers and scientists to "naturalize" research fields usually reserved for philosophical speculation by proposing adequate scientific theories.[100]

However, neither behavioral psychology nor the brain studies available in the early 1950s were sufficient to give philosophy of mind a decisive turn towards the naturalization of the mental. This turning point took place thanks to the birth and first affirmation of the cognitive sciences in the second half of the 1950s, the 1960s and 1970s.[101] Among the emerging cognitive sciences, those that made the greatest contribution to the philosophy of mind were artificial intelligence (AI)[102] and cognitive psychology.[103] First of all, the cooperation of philosophy of mind with artificial intelligence gave birth to the "mind-computer analogy" and functionalism,[104] a solution to the mind-body problem that was dominant among philosophers of mind and cognitive scientists from the 1960s to the 1980s[105] and still counts numerous authoritative defenders.[106]

Functionalism has been divided into multiple versions but all of them more or less directly share the key idea proposed by H. Putnam (who later became a critic of himself) in the essay *Minds and machines* published in 1960:[107] The human mind is the functional organization of brain activity that processes information contained in sensory inputs and transforms them into motor outputs. According to functionalists, finding a solution to the mind-body problem that avoids the opposite errors of dualism and physicalism requires an intermediate level of analysis between folk-psychology and cognitive neuroscience. At this intermediate level it is possible to consider mental states as functional states that are implemented by but not identical to brain processes.

The key point is that implementation does not mean identity. As clarified in the theory of "multiple realizability",[108] which marks the detachment of functionalism from physicalism, the same information processing function can be performed by different brain processes (in different animals, in different human beings or in the same person at different times) just as the same arithmetic operation can be performed both by an electronic calculator or by a mechanical calculator although the physical processes that perform it are completely different in the two cases. Because of this "multiple realizability", functionalists argue that theorists, like physicalists, who identify mental states and mental events with brain processes, must admit that any mental state or mental event can be identified with multiple brain processes. However, this is obviously absurd because in that case a mental state or a mental event would be different from itself! To avoid this contradiction, functionalists argue that a mental state or a mental event is not identical to the different brain processes that implement it in different cases ("token physicalism")[109] but instead to the information processing function common to all these processes.

Functionalism has met with great success and has produced a large number of scientific studies on various types of mental phenomena. However, firstly functionalism leaves in parentheses the problem of the emergence of consciousness and self-consciousness, since it defines the mental as a kind of information processing that can be performed within certain limits even by machines.[110] Secondly, functionalism is a "third way" between dualism and physicalism and therefore creates a sort of epistemological dualism separating cognitive psychologists' study of the mind from neuroscientists' study of the brain. For this reason, functionalism can be considered the main form of "weak naturalism", a kind of naturalism judged insufficient by all supporters of "strong naturalism".[111]

Similar considerations apply to De Caro and Macarthur's "liberal naturalism",[112] J.R. Searle's "biological naturalism",[113] D. Davidson's "anomalous monism",[114] "emergentism"[115] and "non-reductive physicalism".[116] They are all "*hybrid solutions*" that claim to be both naturalistic and non-reductionist.

Among these hybrid solutions *emergentism*[117] deserves separate consideration. It is a traditional solution to the mind-body problem which has enjoyed some success in the philosophy of mind today be-

cause it seems to reconcile a naturalistic conception of the mind with ontological non-reductionism. But in reality, this conciliation only results from an ambiguous definition of the concept of emergent properties. In fact, emergent properties can be understood in three ways:[118]

- Firstly, they can be understood as systemic properties emerging from the local properties of the elements of a physical system (think of the heat of a gas as the average kinetic energy resulting from the movements of its molecules). If consciousness is a holistic property of this kind and, at least in principle, we know the bridging principles that explain its emergence from neuronal activity, then emergentism is a kind of physicalism.

- Secondly, if you believe that the bridging principles that link consciousness to the physico-chemical processes of individual neurons are not sufficiently understood, then you can more prudently consider mental properties as virtual properties that are implemented by brain dynamics that still remain largely unknown. In this case, emergentism is a kind of functionalism.

- Thirdly, it can be thought that consciousness does emerge from brain activity but after its emergence has an ontological autonomy that allows it to causally retroact on brain activity. In this case, emergentism becomes a kind of ontological dualism and meets the same criticisms. In particular, it violates the *Causal Closure of the Physical World*.[119]

The trick that gives emergentism a certain success lies in confusing this third case with the first case or the second case. This creates the illusion that emergentism can reconcile the non-reductionism of dualism with the strong naturalism of physicalism or, at least, the weak naturalism of functionalism. The same criticism can be addressed to non-reductive physicalism which differs from emergentism more in detail than in substance.

8 Strong naturalism: Cognitive neo-evolutionism and eliminative materialism

Since the 1980s, four novel events in the cognitive sciences and the theory of biological evolution have promoted the "second cognitive turn in the philosophy of mind" mentioned above in the direction of *strong naturalism*.

Firstly, psychologists, mathematicians and computer scientists at the University of San Diego (CA) were able to use digital computers to simulate virtual machines capable of processing information in a parallel and distributed way,[120] thereby founding "connectionism".[121] These virtual machines are artificial neural networks that simulate brain function and, in turn, offer neurologists a simplified mathematical model to reconstruct and explain brain activity.

Secondly, neuroscientists imitated biologists' reconstruction of the human genome and developed a research program aimed at the reconstruction of the "connectome", that is, a comprehensive map of neural connections in the human brain.[122]

Thirdly, important neuroscientists have dealt with topics once reserved to philosophical speculation such as consciousness, the Self, or free will, giving rise to "cognitive neuroscience".[123] This has brought about a lively discussion between philosophers and humanists in general, who object to reducing spiritual capacities to brain processes.[124]

Fourthly, evolutionists have introduced interesting innovations in neo-Darwinian studies on the origins of social life, language, and culture in human beings.[125]

Among philosophers of mind, some have used these new theories offered by computer scientists, neuroscientists, and neo-Darwinian biologists to promote strong naturalism: the philosophy of mind must be closely linked to the cognitive sciences. The two most important new solutions to the mind-body problem that have arisen in this context are D.C. Dennett's "cognitive neo-evolutionism"[126] and eliminative materialism (or eliminativism),[127] particularly the version presented by Paul M. Churchland and his wife Patricia.[128]

In the 1970s and 1980s, Dennett, starting from an approach pioneered by his mentor Ryle,[129] offered a solution to the mind-body problem, later called "homuncular functionalism" by W.G. Lycan.[130] Dennett's solution is based on the notion that a virtual system can process information in an intelligent way if it is implemented by more stupid virtual subsystems that operate by trial and error. These subsystems are implemented by even more stupid subsystems and so on, until this tower of virtual systems is implemented by a physical system that works automatically according to the laws of nature.[131]

In the 1990s, Dennett refined his conception of the mental and applied the connectionist model of artificial neural networks to the human brain, that is, he argued that the human brain, like artificial neural networks, is a parallel self-programming machine that lacks any central processor (in digital computers the C.P.U.). In this way, Dennett has come to argue in particular that there is no Self, in the sense of a homunculus (material or immaterial) on the "inside" who turns his attention to some of our inner states thereby making them conscious to himself (and therefore to us) ("The Myth of the Cartesian Theater"). In reality, each of us is just a bundle of mental states that, like "demons", compete with each other to find access to the motor system. Those

states that, in coalition with others, win the competition and control our behavior consolidate their victory by inventing an *ex post* "narrative" that justifies the behavior.[132] This narrative represents the emergence of a phenomenal state of consciousness, while the Self, as the main character in this narrative, is its fictional "Center of Narrative Gravity".[133]

Subsequently, Dennett has consolidated his image of the human mind in the light of Dawkins' neo-Darwinism and has developed a complex conception aimed at reconstructing its phylogeny.[134] This conception can be called "cognitive neo-evolutionism". According to Dennett, the biological evolution that took place from prokaryotes to *Homo sapiens* by natural selection can be divided into four fundamental stages:

- "Darwinian creatures" survive only if they have got the right answer in their genes when they are faced with the challenges of external environment. If they do not have it, they die and in the long run their species becomes extinct.

- Some of these Darwinian creatures have become "Skinnerian creatures" by natural selection. Skinnerian creatures are equipped with a fairly large repertoire of possible motor responses to solve the problems that the environment poses to them and are able to learn by trial and error what the most effective responses are, but they run the risk of dying before they have found the right responses even if such responses are present in their repertoire.

- Some of these Skinnerian creatures have become, again by natural selection, "Popperian creatures". Popperian creatures are able to build an internal model of the external environment and to test in a safe way in advance the effectiveness of the motor responses available to them without running the risks that Skinnerian creatures face.

- Finally (at least, for now) a Popperian creature, *Homo sapiens*, has become, again by natural selection, a "Gregorian creature" capable of enriching her internal model of the external environment by drawing on the massive information deposited there by other human beings (contemporaries or ancestors).[135]

Dennett's conception of the mind enjoys wide diffusion and great prestige nowadays, but it is sometimes criticized because it is too anthropocentric and assigns an excessive role to language in the evolution of *Homo sapiens*.[136] Furthermore, according to other naturalists it seems to lack sufficient empirical support from a neuroscientific point of view.[137]

The other most important strong naturalism solution to the mind-body problem, namely *eliminative materialism*, focuses on the ontogeny of the mind and its functioning in adult human beings. Eliminative materialism owes its name to Paul Churchland, who considers folk psychology concepts to be pre-scientific and advises they be eliminated and replaced with scientific concepts drawn from neuroscience.[138] Physicalists think that the mental states of folk psychology are reducible to brain processes; functionalists think that they are reducible to functional states. However, according to Paul Churchland both reductions are problematic. The only way to make psychology scientific, transforming it into psycho-neurology, is to replace the old pre-scientific concepts of folk-psychology with new scientific concepts. Something similar was done in chemistry when the concept of phlogiston was abandoned in favor of the concept of oxygen.[139]

More in detail, Paul Churchland has shown how all mental states (perceptions, memories and so on) can be reduced to higher order properties of brain dynamics that can be represented by "vector coding" (or "vector processing"), that is, by means of mathematical matrices that transform the neuronal patterns of sensory input into the neuronal patterns of motor output in a certain vector space according to the model offered by artificial neural networks. In this way, Paul Churchland has shown in his book *The Engine of Reason* how artificial neural networks can simulate perceptions ("taste coding", "color coding", "smell coding"), recognize faces ("face coding") or patterns of any kind,[140]simulate long-term memory and short-term memory,[141] and acquire the ability to correctly read words written in English.[142] Moreover, comparing brain functioning to that of artificial neural networks provides a first glimpse of how the human brain implements phenomenal consciousness through the activity of the intralaminar nucleus of the thalamus.[143]

Eliminative materialism has met with many objections.[144] Firstly, that it refers to a cognitive psycho-neurology of the future which is mere wishful thinking so far and, secondly, that the elimination of phenomenal consciousness is nonsense. After all, if I am awake, I necessarily feel awake!

However, both objections are invalid. Firstly, it is not true that the cognitive psycho-neurology proposed by the Churchlands is mere wishful thinking. As clarified above, in *The engine of reason* already in 1995 Paul Churchland provided many concrete examples of how various mental phenomena can be interpreted as properties of brain dynamics and can be simulated, at least in part, through artificial neural networks. In the last forty years, Patricia Churchland has founded and developed a new science, "neurophilosophy", and has written several books that show how many themes addressed in epistemology, ethics, psy-

chology, as well as those that consider the genetic bases of human societies can be approached "brain-wise", that is, from the point of view of cognitive neuroscience.[145]

Secondly, the widely shared accusation that the Churchlands believe phenomenal consciousness does not exist and we humans are zombies is completely unfounded. As the Churchlands have made clear, they do not deny the fact that «there is a nontrivial difference between being asleep and being awake».[146] They want to eliminate only the philosophical-Cartesian concept of consciousness and replace it with the description of many neurological "mechanisms". The facts that lead to the philosophical-Cartesian concept of consciousness are real, it is just that the concept groups and describes them inappropriately.[147] With respect to consciousness, the Churchlands are fundamentally physicalists, not eliminativists!

9 Towards a "soft physicalistic eliminativism"

However, as the Churchlands themselves have recognized, this casts a shadow on the adequacy of the expression "eliminative materialism".[148] Name aside, it is possible to make slight corrections and further develop their eliminativism in order to formulate a solution to the mind-body problem that can be called "*soft physicalistic eliminativism*". It is based on the following points:[149]

- Folk psychology, cognitive psychology, and cognitive neuroscience formulate their theories in three distinct "discourse universes" which have three distinct types of ontological commitments: mental states, psycho-functional states and neurological states.

- To avoid falling into cognitive relativism and epistemological dualism[150] virtual reality must be attributed to mental states only to the extent that they are reduced to psycho-functional states implemented by physico-chemical processes (these are the only "things" that enjoy effective reality as recognized by physicalists).

- Psycho-functional states are a partial and idealized redescription of mental states in the language of scientific psychology. They are virtual functional states completely implemented by brain processes. The aspects of mental states eliminated in a psycho-functional redescription are not neurologically implemented and therefore are not real, they are *ficta* (this is a kind of "soft physicalistic eliminativism"). However sometimes (not always!) *ficta* cannot be eliminated from the scientific description of the mind because, although they are not real, human agents spontaneously do believe that they are real! These erroneous beliefs about the existence of some *ficta* are neurologically implemented; therefore, they are real in a physicalistic sense and can be functionally effective. For example, let us assume, by hypothesis, that we human beings do not enjoy free will.[151] Even in this case, it is a part of our psychic normality to feel that we are free agents, and this fallacious feeling of "free agency" is real because it is neurologically implemented and supports our mental health.[152]

- In accordance with physicalism, each psycho-functional state can be defined in such a way as to be identical to a higher order property of brain dynamics if these dynamics are described in an appropriate abstract way (e.g. by tables, graphs or various kinds of vector coding).[153] Each of these higher order properties is a holistic property of the brain that can emerge from the activity of different neuronal groups (in accordance with the theory of multiple realizability). Therefore in this way the theory of multiple realizability becomes compatible with eliminative materialism and mind-brain identity theory: each mental state of folk psychology, once purified of its *ficta* and reduced to a psycho-functional state of cognitive psychology, becomes identical to a single higher level property of brain dynamics; this single property can in turn be implemented by different neuronal processes on different occasions or in different persons.

In conclusion, the interdisciplinary ontology of the mental sketched above which corrects physicalism in the light of eliminativism and "homuncular functionalism" appears to be the philosophical solution to the mind-body problem that, more than others, maintains continuity with the cognitive sciences in general and cognitive neuroscience in particular.

It may perhaps be objected that this solution to the mind-body problem presupposes, in the wake of Quine's naturalized epistemology,[154] a continuity between philosophy and science without offering any a priori philosophical argument in its favor. Now, this is undoubtedly true. But I can reply that if one accepts the continuity between philosophy and science one must also accept that no philosophical argument can a priori decide any dispute that arises on scientific grounds (to think otherwise would mean having more or less explicitly accepted the transcendental idealism of Kant and Husserl).[155] Therefore not even the validity of the very principle of continuity between philosophy and science can be established through an a priori philosophical argument. Even this continuity, applied to the particular case of the search for a fruitful collaborative relationship between the philoso-

phers of mind and cognitive scientists, can prove to be gradually and pragmatically feasible with success only thanks to the search for something like N. Goodman's "reflective equilibrium".[156] This equilibrium requires that philosophers of mind suggest an ontological-epistemological framework capable of favoring interdisciplinary research in the field of "the science of mind" while the cognitive scientists evaluate whether this philosophical suggestion is of any use to them. It is with the intention of fostering a reflexive equilibrium of this kind that I have argued here for the superiority of an eliminativistic-physicalistic solution to the mind-body problem.

Notes

[1] H. GARDNER, *The mind's new science: A history of the cognitive revolution*, p. 7 (moreover, see p. 37 for the relations between the six cognitive sciences). According to some interpreters, their process of unification into a single science has already been completed (cf., e.g., A. STEPHAN, S. WALTER (Hrsg.), *Handbuch Kognitionswissenschaft*), according to others not yet (cf., e.g., C.P. SOBEL, *Cognitive sciences: An interdisciplinary approach*).
[2] H. GARDNER, *The mind's new science*, chapter 4.
[3] A. ROSKIES, *Neuroethics*; E. RACINE, *Pragmatic neuroethics*; P.S. CHURCHLAND, *Braintrust*; P.S. CHURCHLAND, *Conscience*; G. CORBELLINI, E. SIRGIOVANNI, *Tutta colpa del cervello*.
[4] J. ROBSON, G. CURRIE, *Aesthetics and cognitive science*.
[5] T. NAGEL, *What does it all mean?*, p. 4.
[6] P.D. HAMILTON, *Historicism*; P. ROSSI, *Lo storicismo tedesco contemporaneo*.
[7] D. PAPINEAU, *Naturalism*.
[8] Cf., e.g., the theologian Hans Küng, *Der Anfang aller Dinge*.
[9] Cf. H. GARDNER, *The mind's new science*.
[10] S. NANNINI, *The second cognitive turn in the philosophy of mind*, pp. 2-4
[11] *Ibid.*, pp. 4-5.
[12] Cf. S. NANNINI, H.J. SANDKÜHLER (eds.), *Cognitive naturalism in the philosophy of mind*; S. NANNINI, *Naturalismo cognitivo*; S. NANNINI, *Mente e cervello*.
[13] Cf. *infra*, §§7-8.
[14] Cf. M. ROWLANDS, *The mind-body problem*.
[15] For a wider historical introduction to the philosophy of mind cf., e.g., S. NANNINI, *L'anima e il corpo*.
[16] H. ROBINSON, *Dualism*.
[17] Descartes thought that the vacuum does not exist and confused space and matter under the name of extension.
[18] Cf. R. DESCARTES, *Meditations on first philosophy*.
[19] K.R. POPPER, J.C. ECCLES, *The self and its brain*; K.R. POPPER, *Knowledge and the body-mind problem*.
[20] Cf., e.g., E.J. LOWE, *An introduction to the philosophy of mind*; R. SWINBURNE, *From mental/physical identity to substance dualism*; A. LAVAZZA (a cura di), *L'uomo a due dimensioni. Il dualismo mente-corpo oggi*.
[21] Cf. first of all G. EDELMAN, *Wider than the sky*, chapter 7; G. ROTH, N. STRÜBER, *Wie das Gehirn die Seele macht*.
[22] Cf., e.g., P.S. CHURCHLAND, *Touching a nerve*, pp. 44-53; D.C. DENNETT, *From bacteria to Bach and back*, pp. 20-23.
[23] D. SPURRETT, D. PAPINEAU, *A note on the completeness of "physics"*.
[24] A. EINSTEIN, *Relativity: The special and general theory*, p. 54 ff.
[25] Cf. first of all J. VON NEUMANN, *Mathematical foundations of quantum mechanics*; E.P. WIGNER, *Remarks on the mind-body question*.
[26] Cf. about this discussion H. ROBINSON, *Dualism*, §3.1
[27] J.A. BARRETT, *A quantum mechanical argument for mind-body dualism*. Cf. also H.P. STAPP (ed.), *Mind, matter and quantum mechanics*; M. JIBU, K. YASUE, *Quantum brain dynamics and consciousness: An introduction*.
[28] Cf., e.g., S. YU, D. NIKOLIĆ, *Quantum mechanics needs no consciousness*.
[29] W. ROBINSON, *Epiphenomenalism*.
[30] Damasio maintains that Spinoza was a «proto-biologist» and accepted a materialistic solution to the mind-body problem (cf. A.R. DAMASIO, *Looking for Spinoza*). However, this is not true. Spinoza was a speculative neutral monist influenced by neoplatonism (cf. S. NANNINI, *Alla riscoperta di Spinoza*).
[31] Cf. *infra*, §4.
[32] T. NAGEL, *What is it like to be a bat?*.
[33] Cf. *infra,* §§5-8.
[34] Cf. C. MCGINN, *The character of mind*; C. MCGINN, *The Problem of Consciousness*; C. MCGINN, *The mysterious flame. Conscious minds in a material world*.
[35] Cf. A. BENINI, *Che cosa sono io? Il cervello alla ricerca di se stesso*.
[36] Cf. R.W. SELLARS, *Epistemological dualism vs. metaphysical dualism*.
[37] Cf. W. DILTHEY, *Introduction to the human sciences*.
[38] H. PUTNAM, *Reason, truth and history*, p. 79.
[39] Cf. J.H. MCDOWELL, *Mind and world*.
[40] W.V.O. QUINE, *Ontological relativity and other essays*; W. V. O. QUINE, *Theories and things*, p. 21.
[41] On Quine's naturalism cf. *infra*, §7.
[42] H. PUTNAM, *The content and appeal of "naturalism"*; J. MCDOWELL, *Naturalism in the philosophy of mind*.
[43] H. PUTNAM, *Reason, truth and history*, p. 79.
[44] A. CHAKRAVARTTY, *Scientific realism*.
[45] A. MILLER, *Realism*.
[46] M. DE CARO, D. MACARTHUR (eds.), *Naturalism in question*.
[47] Cf. *infra*, §7.
[48] M. DE CARO, D. MACARTHUR, *Naturalismo scientifico e naturalismo liberalizzato,* p. XV.
[49] P. GUYER, R.P. HORSTMANN, *Idealism*.
[50] G. BERKELEY, *A treatise concerning the principles of human knowledge*.
[51] Cf. *supra*, § 2.
[52] I. KANT, *Preface to the second edition* (1787), in I. KANT, *Critique of pure reason*, pp. 106-124.
[53] Cf. the first two parts of I. KANT, *Critique of pure reason*.
[54] B. SMITH, *Gestalt theory. An essay in philosophy*.
[55] Cf. E. HUSSERL, *Logical investigations*; E. HUSSERL, *Ideas pertaining a pure phenomenology and a phenomenological philosophy*, 3 voll.
[56] Cf., e.g., A. SETH, *Being you. A new science of consciousness*.
[57] The first link between phenomenology and naturalism in the philosophy of mind can be found in W.S. SELLARS, *Empiricism and the philosophy of mind*. For further developments cf., e.g., J. PETITOT, F.J. VARELA, B. PACHOUD, J.-M. ROY (eds.), *Naturalizing phenomenology: Issues in contemporary phenomenology and cognitive science*; S. GALLAGHER, D. ZAHAVI, *The phenomenological mind*.

[58] E. HUSSERL, *Logical investigations*, p. 2.
[59] L. STUBENBERG, *Neutral monism*.
[60] Cf. *infra*, § 6.
[61] Cf. *supra*, § 2.
[62] B. RUSSELL, *The analysis of mind*, pp. 103-105.
[63] Cf. *supra*, § 2.
[64] D. CHALMERS, *The conscious mind*; D. CHALMERS, *The character of consciousness*.
[65] G. GEORGE, *Behaviorism*.
[66] Psychoanalysis, like psychological behaviorism, has also marked and still marks a profound theoretical turning point in the conception of the human mind and has recently established connections with the cognitive sciences (Cf., e.g., M. MANCIA (ed.), *Psychoanalysis and neuroscience*). However, psychoanalysis has not proposed any new fundamental solution to the mind-body problem: Freud was a materialist in his youth, while in his maturity he arrived at his own original form of functionalism with his distinction between "Es", "Ich" and "Über-Ich", (cf., e.g., S. NANNINI, *Mente e cervello*, pp. 157-167). Therefore, psychoanalysis will not be discussed here.
[67] C. DARWIN, *The descent of man, and selection in relation to sex*.
[68] Cf. among the most important behaviorist psychologists: J.B. WATSON, *Behaviorism*; B.F. SKINNER, *Science and human behavior*.
[69] B.F. SKINNER, *Verbal behavior*.
[70] N. CHOMSKY, *Review of Skinner's "Verbal Behavior"*.
[71] G. GEORGE, *Behaviorism*, § 7.
[72] M. BEANEY, *Analysis*.
[73] M. BEANEY, *Analysis,* § 6.8.
[74] R. RORTY (ed.), *Linguistic turn*.
[75] C.G. HEMPEL, *The logical analysis of psychology*, p. 20 - my italics.
[76] R. CARNAP, *Psychologie in physikalischer Sprache*.
[77] Obviously in the 1930s there was no possibility to obtain brain images.
[78] R. CARNAP, *Psychologie in physikalischer Sprache*, pp. 112-117 and pp. 136-132.
[79] Cf. *infra*, § 6 about physicalism.
[80] G. RYLE, *The concept of mind*.
[81] *Ibid*., chapter IV, § 8.
[82] H. PUTNAM, *Mind, language, and reality*, chapter 16.
[83] The contrast made in the philosophy of mind between mentalism and behaviorism (the existence or non-existence of internal mental causes of behavior) is similar to the contrast between internalism and externalism made in the philosophy of language. Cf. S. DELLANTONIO, L. PASTORE, *Internal perception: The role of bodily information in concepts and word mastery*; S. DELLANTONIO, *La dimensione interna del significato. Esternismo, internismo e competenza semantica*.
[84] Cf., e.g., S. NANNINI, *The second cognitive turn*, pp. 1-2. More details in S. NANNINI, *Cause e ragioni*, pp. 124-128.
[85] J.J.C. SMART, *The mind/brain identity theory*.
[86] C. STOLJAR, *Physicalism*.
[87] J.J.C. SMART, *Materialism*.
[88] U.T. PLACE, *The concept of heed*.
[89] U.T. PLACE, *Is consciousness a brain process?*.
[90] U.T. PLACE, *Is consciousness a brain process?*, p. 45.
[91] U.T. PLACE, *Thirty years on – Is consciousness still a brain process?*, p. 211; cf. also U.T. PLACE, *From mystical experience to biological consciousness. A pilgrim's progress?*.
[92] J.J.C. SMART, *Sensations and brain processes*; D.K. LEWIS, *An argument for the identity theory*.
[93] D.M. ARMSTRONG, *A materialist theory of mind*.
[94] Cf. on logical empiricists' early version of physicalism O. NEURATH, *Physikalismus*; R. CARNAP, *Die physikalische Sprache als Universalsprache der Wissenschaft*.
[95] Cf. H. FEIGL, *Logical analysis of the psychophysical problem*.
[96] Cf. H. FEIGL, *The "Mental" and the "Physical"*; H. FEIGL, *Physicalism*.
[97] Cf. H. FEIGL, *Postscript after ten years*.
[98] About the distinction between "manifest image" and "scientific image" cf. W.S. SELLARS, *Empiricism and the philosophy of mind*.
[99] Cf. *supra*, § 3.
[100] Cf. W.V.O. QUINE, *Ontological relativity and other essays*; W.V.O. QUINE, *Word and object*.
[101] Cf. W. BECHTEL, *Philosophy of science. An overview for cognitive sciences*, Erlbaum, Hillsdale (NJ); H. GARDNER, *The mind's new science*.
[102] The AI literature is endless. Cf., e.g., on the relationship between AI and philosophy M. BODEN (ed.), *The philosophy of artificial intelligence*.
[103] The literature on cognitive psychology is endless as well. Cf., e.g., on its birth and development U. NEISSER, *Cognitive psychology*; L.W. BARSALOU, *Cognitive psychology*.
[104] J. LEVIN, *Functionalism*.
[105] Cf., among the founders of functionalism, H. PUTNAM, *Minds and machines*; J.A. FODOR, *The language of thought*; Z.W. PYLYSHIN, *Meaning and cognitive structure*.
[106] Cf., e.g., S. PINKER, *How the mind works*. However Cf. also the sharp criticism of J.A. FODOR, *Mind doesn't work that way: The scope and limits of computational psychology*.
[107] H. PUTNAM, *Minds and machines*.
[108] J. BICKLE, *Multiple realizability*.
[109] C. STOLJAR, *Physicalism*, § 2.2.1.
[110] Cf., first of all with regard to this criticism of functionalism, H.L. DREYFUS; N. BLOCK, *Troubles with functionalism*; J.R. SEARLE, *Minds, brains and programs*.
[111] Cf. *infra*, § 8.
[112] Cf. *supra*, § 3.
[113] Cf. first of all J.R. SEARLE, *The rediscovery of the mind*; J.R. SEARLE, *Mind. A brief introduction*.
[114] Cf. D. DAVIDSON, *Essays on actions and events*; S. YALOWITZ, *Anomalous monism*.
[115] Cf. T. O'CONNOR, *Emergent properties*; A. STEPHAN, *Emergenz: von der Unvorhersagbarkeit zur Selbstorganisation*.
[116] Cf. A. BECKERMANN, H. FLOHR, J. KIM (eds.), *Emergence or reduction? Essays on the prospects of nonreductive physicalism*.
[117] Cf. T. O'CONNOR, *Emergent properties*.
[118] Cf., e.g., S. NANNINI, *L'anima e il corpo*, pp. XXI-XXIV.
[119] Cf. *supra*, § 2.
[120] D.E. RUMELHART, J.L. MCCLELLAND (eds.), *Parallel distributed processing: exploration in the microstructure of cognition*.
[121] C. BUCKNER, J.W. GARSON, *Connectionism*.
[122] More in detail: «To understand the functioning of a network, one must know its elements and their interconnections. The purpose of this article is to discuss research strategies aimed at a comprehensive structural description of the network of elements and connections forming the

human brain. We propose to call this dataset the human "connectome", and we argue that it is fundamentally important in cognitive neuroscience and neuropsychology. The connectome will significantly increase our understanding of how functional brain states emerge from their underlying structural substrate, and will provide new mechanistic insights into how brain function is affected if this structural substrate is disrupted» (O. SPORNS, G. TONONI, R. KÖTTER, *The human connectome*).

[123] Cf. first of all F. CRICK, *The astonishing hypothesis*; J.E. LEDOUX, *Emotional brain*; G.M. EDELMAN, *The remembered present*; G.M. EDELMAN, *Wider than the sky*; G.M. EDELMAN, G. TONONI, *A universe of consciousness*; A.R. DAMASIO, *Descartes' error: Emotion, reason, and the human bain*; A.R. DAMASIO, *The feeling of what happens*; A.R. DAMASIO, *Self comes to mind*; A. DAMASIO, *Feeling and knowing*; S. DEHAENE, *Consciousness and the brain*; B. LIBET, *Mind time*.

[124] Cf. *supra*, § 1.

[125] Cf. first of all R. Dawkins, *The selfish gene*; S.J. GOULD, *The mismeasure of man*.

[126] B. DAHLBOM (ed.), *Dennett and his critics: Demystifying mind*; D. ROSS, A. BROOK, D.L. THOMPSON (eds.), *Dennett's philosophy: A comprehensive assessment*.

[127] P.M. CHURCHLAND, *Eliminative materialism and the propositional attitudes*. Cf. also W. RAMSEY, *Eliminative materialism*.

[128] R.N. MCCAULEY (ed.), *The Churchlands and their critics*; W. HIRSTEIN, *On the Churchlands*.

[129] Cf. his doctoral dissertation: D.C. DENNETT, *Content and consciousness*.

[130] W.G. LYCAN, *Homuncular functionalism and other teleological theories*, p. 59.

[131] Cf. first of all D.C. DENNETT, *Intentional systems*; D.C. DENNETT, *Brainstorms: Philosophical essays on mind and psychology*; D.C. DENNETT, *Intentional stance*.

[132] D.C. DENNETT, *Consciousness explained*, chapter 8, § 2.

[133] *Ibid*., chapter 13, § 3.

[134] Cf. first of all D.C. DENNETT, *Darwin's dangerous idea*; D.C. DENNETT, *Kinds of minds*; D.C. DENNETT, *Brainchildren*; D.C. DENNETT, *Freedom evolves*; D.C. DENNETT, *Breaking the spell: Religion as a natural phenomenon*; D.C. DENNETT, *From bacteria to Bach and back*.

[135] Cf. D.C. DENNETT, *Kinds of minds*, chapter 4.

[136] Cf., e.g., P.M. CHURCHLAND, *The engine of reason, the seat of the soul: A philosophical journey into the brain*, pp. 64-69.

[137] P.S. CHURCHLAND, V.S. RAMACHANDRAN, *Filling in: Why Dennett is wrong*.

[138] Cf. P.M. CHURCHLAND, *Eliminative materialism*; P.M. CHURCHLAND, *Matter and consciousness*, pp. 43-49.

[139] P. M. CHURCHLAND, *Matter and consciousness*, p. 44.

[140] P.M. CHURCHLAND, *The engine of reason*, pp. 21-54.

[141] *Ibid.,* pp. 97-121.

[142] *Ibid.*, pp. 137-150.

[143] *Ibid.*, cit., pp. 215.

[144] Cf. first of all R.N. MCCAULEY (ed.),*The Churchlands and their critics*.

[145] Cf. P.S. CHURCHLAND, *Brain-wise: Studies in neurophilosophy*. Cf. also P.S. CHURCHLAND, *Neurophilosophy*; P.S. CHURCHLAND, T.J. SEJNOWSKI, *The computational brain*; P.M. CHURCHLAND, P.S. CHURCHLAND, *On the contrary: Critical essays, 1987-1997*; P.S. CHURCHLAND, *Braintrust*; P.S. CHURCHLAND, *Touching a nerve*; P.S. CHURCHLAND, *Conscience*.

[146] P.M. CHURCHLAND, P.S. CHURCHLAND, *Do we propose to eliminate consciousness?*, p. 298.

[147] Cf. P.S. CHURCHLAND, *Consciousness: The transmutation of a concept*, pp. 80-95; P.S. CHURCHLAND, *Neurophilosophy*, p. 321.

[148] P.M. CHURCHLAND, P.S. CHURCHLAND, *Do we propose to eliminate consciousness?*, p. 298.

[149] Cf. S. NANNINI, *The mind-body problem in the philosophy of mind and cognitive neuroscience*.

[150] Cf. *supra*, § 3.

[151] Cf. D.M. WEGNER, *The illusion of conscious will*.

[152] Cf. S. NANNINI, *Naturalismo cognitivo*, pp. 135-158.

[153] Cf. E.L. SCHWARTZ, *Computational neuroscience*, MIT Press, Cambridge (MA).

[154] Cf. *supra*, § 1.

[155] Cf. *supra*, § 4.

[156] Cf. N. DANIELS, *Reflective equilibrium*.

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