This is the prefinal author's version of an entry in
James D. Wright (editor-in-chief), *International Encyclopedia of the Social & Behavioral Sciences*, 2nd edition,
Vol 16. Oxford: Elsevier. pp. 325–333.

Naturalism

Abstract *[96 words]*

1. Naturalism in general: One stance, two branches, three positions

As a stance, naturalism presents a united front. To adhere to naturalism, one must, first, believe or be willing to bet that nothing exists outside of nature and grant that conjecture a central position among one's theoretical commitments; second, have the courage to rebel against received views; third, to have at least a conjecture regarding how to pursue the goal of showing that nature exhausts reality. Naturalists are rebels because at all times, in one or another realm of thought, the received view promotes some form of dualism, one branch of which escapes nature—as if the struggle to establish the unity of reality were never definitively won.

Of course, both nature and reality are contentious concepts, and to equate the two is merely the starting point of a reflection which branches out in many directions. Still, one thought that is common to all forms of naturalism is this: only by looking at nature, at what surrounds us and stretches under our eyes, can one ascertain what actually exists. It is a metaphor, and the central difficulty emerges as one tries to cash out the visual element. Nature is not antecedently given: it is gradually revealed to the inquiring subject. The naturalist seems faced with a dilemma. Either she claims to know what inquiry is, or she doesn't. If she does, she has a conceptual grasp on nature, as that which inquiry gradually reveals, but she has already forsaken naturalism: inquiry isn't 'visible' in any extended sense, so her knowledge must stem from, or belong to another realm. If she doesn't, she has no conceptual grasp on nature, because whatever nature is, it includes both visible or more broadly perceptively salient things, but not all such things, as well as a wealth of non perceptively salient things, and only inquiry can sort all existing things from the rest. But without an epistemic grasp on nature, it is hard to see what sense can be made of the claim that nature is all that exists.

There is a way out of the dilemma, championed by Quine (1969). The naturalist doesn't start from scratch: she has a pretty secure hold on parts of nature, and she is acquainted with some procedures of inquiry. The way to go then is to lean on the means of inquiry one already possesses and trusts in order to broaden one's knowledge of nature, and to lean on one's broadened understanding of nature to augment one's understanding and means of inquiry. Success of this bootstrapping strategy is not guaranteed. In fact, it may be argued that it rests on a postulate of continuity: what we don't yet know of nature must in some way resemble what we do know, as it is our present means of inquiry that are to reveal it, and by the same token, the new means of inquiry must in some sense be continuous with those we already have, as they must belong to nature as we understand it at present. The argument, whatever its worth, bears on the chances of success, not on the soundness of the strategy. Besides, the continuity postulate sits well with naturalism, which favors unity and connectedness over all forms of essential duality. And it clashes with some received views: of nature as composed of semi-independent orders, and (more starkly) as inquiry evolving by leaps, under the combined effect of criticism, whereby a method of inquiry abruptly appears as unacceptable, dragging in its fall entire patches of previously held beliefs about nature, and of creative thought, bringing into being novel means of inquiry that in turn disclose unsuspected areas of nature.

Whatever trust one has in the bootstrapping strategy, it seems not to address the matter of existence. If it succeeds, it will have established the identity of nature with the knowable, not reality *in toto*. Granting that nature is part of what exists, the reverse inclusion doesn't follow: there might be a realm both non-natural and non-knowable. To the naturalist, the distinction between that situation and the situation where there is no such a realm is idle, and she is not alone in choosing to

brush the issue aside: so do many of her non-naturalist opponents. The disagreement between them is restricted to the realm of the knowable. The non-naturalist, usually on the side of tradition, sees it as clearly split into two domains (the pair differs according to times and contexts, see below), while the naturalist claims that appearances notwithstanding they are one and the same.

It is customary to distinguish ontological from methodological naturalism: the former (sometimes called metaphysical naturalism) is a claim on what (actually) exists, as above, the latter (also sometimes called epistemic naturalism) a claim concerning the (legitimate) way of getting to know reality. As we have just seen, the issues of reality and of inquiry are intertwined; yet it is possible to consider them separately. The possibility arises once a starting point for the bootstrapping process has been chosen, as needs to be done to start the ball rolling. And this is where a major parting of the ways occurs. The crucial question is: Where do we seek guidance as we start off? There are two plausible answers: commonsense or everyday experience, on the one hand, science on the other. Each of these operate as a heuristic. Neither uniquely determines a research program, a theory or a doctrine. Rather, they orient our thinking in one or the other direction.

When the starting point is the natural stance towards the world and the human experience, consisting in mankind's shared perceptual faculties, cognitive resources, linguistic and other practices, the heuristic is what might be called ordinary naturalism. An early representative is Thomas Reid, who based his well-known commonsense naturalism, opposed to Hume's, on a conception of commonsense as epistemically privileged. But as a general orientation this kind of naturalism need not be dependent on a Reidian view of commonsense, and focus instead on practice and/or language. It accommodates a wide variety of philosophers, often but not systematically linked to pragmatism or ordinary-language philosophy, from Goethe and Nietzsche to Wittgenstein and W. Sellars, and exemplified today by such authors as Huw Price, John McDowell, Robert Brandom, perhaps Thomas Nagel, and others (see Caro & Macarthur 2004).

What those thinkers have in common are their reservations with respect to the other main branch of naturalism, dominant today. More cannot be said in the present entry. The focus from now on will be that other branch, scientific naturalism. Not that ordinary naturalism lacks relevance for the sciences of man. But its main contributions are critical and foundational: it is in part a rebellion against the excesses of a higher-order dichotomy, one that pits natural science against other forms of understanding. Research programs pursued today are overwhelmingly on the side of scientific naturalism, and a large part of contemporary debates concern the value and scope of these proposals.

Scientific naturalism is the heuristic that recommends that the bootstrapping process start with the current natural science as method of inquiry, and natural-scientific knowledge as knowledge base. Ontological (scientific) naturalism claims that all that exists is that whose existence is granted by the natural sciences; and methodological (scientific) naturalism claims that natural science Is the sole reliable method of inquiry regarding the realm of existing things (for a classic and detailed exposition, see Papineau, 1993).

As remarked earlier, the ontological and methodological claims may seem to be two sides of the same coin, and indeed that is how they are viewed by many of their proponents, be it of the 'ordinary' or scientific persuasion. But as announced, they can be pursued separately, once the starting point of the bootstrap has been fixed. So for example, someone might be convinced that

natural science provides the only access to genuine knowledge without taking a stand on what exists and how that might be determined. And someone may be wedded to the thought that natural science is the arbiter of existence, but be indifferent to the means of access to truth (except of course regarding existence). Indeed, indifference may turn into rejection: the first thinker might actually affirm the existence of a realm unverified and unverifiable by natural science (and thus not susceptible of genuine knowledge), or simply deny that the issue makes sense; and similarly, the second thinker might recognize sources of genuine knowledge other than natural science. Parallel possibilities arise for ordinary naturalists.

The 'ordinary' naturalist and the scientific naturalist need not disagree on all counts. The former is willing to accept natural science and its pronouncements regarding some phenomenon as long as they don't clash too sharply with the common view. The latter, in such cases, will accept the common view as an approximation of the correct view procured by science; and even in the case of a serious clash, she will try to account for the existence and persistence of the common view. But she will not hesitate to reject it in favor of the current scientific view. The commonsense naturalist, absent a decisive argument against the common view, will treat the scientific naturalist's insistence on granting epistemic priority to the scientific view *also in a contested case* as a *reductio*, showing that natural science has exceeded its scope and that scientific naturalism has turned into scientism.

Among the contested cases are the usual suspects: mind, thought, meaning, consciousness, self, abstract objects, norms, culture, practices, language, history… These are generally regarded as the bones of contention between naturalists and anti-naturalists. It might be thought then that ordinary naturalists, reticent as they are to unquestionably accept the authority of natural science, are actually anti-naturalists. This need not be the case. Ordinary naturalists mean to preserve naturalism against what they see as the scientific naturalists' mistake of, so to speak, putting all of one's eggs in the scientific basket; while anti-naturalists see the whole enterprise as deeply misguided. To be sure, it is often a fine line separating the two groups. The situation is clarified somewhat with the introduction of a new category, one which includes ordinary naturalists next to thinkers who, like them, share a naturalist commitment and believe that the scientific naturalist overstates science's case, but do not necessarily espouse a well-articulated brand of ordinary naturalism. At this point the various heuristics and orientations must solidify into more precise doctrines, on pain of confusion. The present state of the field is then best characterized as structured around three clusters of positions: 'liberal' or 'broad' naturalism, scientific naturalism and anti-naturalism, with the first standing somewhere between the other two.

2. Scientific naturalism

Scientific naturalism ('scientific' will henceforth be omitted), in a nutshell, relies on science, and science alone, to provide a correct fundamental understanding of reality. Science is to be understood as the set of disciplines modeled after the natural sciences as we know them. Physics plays a dual role here: it is the paradigm of natural science, it also serves, in some versions of the doctrine, as the basic science in a reductive sense. However the life sciences, chemistry and other so-called special sciences such as geology or meteorology are regarded as legitimate providers, whether or not physics is thought to be able in principle to reconstruct their findings. In practice, a vast majority of naturalistic programs would not get off the ground were it not acceptable, from the

naturalist's standpoint, to take biology as an alternative model, next to physics. In fact, the main, though not the only reason why the issue of naturalism is notably different today than it was at the beginning of the 20th century is the rise of biology: on the one hand, it now stands on equal footing with physics as a respectable science, and on the other it is much more hospitable to a natural science of man.

As indicated above, there are two sides to naturalism. Ontological naturalism concerns the 'furniture' —the constituents— of the world. Methodological naturalism concerns the legitimate ways of bringing to light the make-up of reality.

It might appear that ontological naturalism simply follows from methodological naturalism: after all, whether something is or is not part of the world is one question among many that can be asked regarding reality. But it is a very special kind of question, one which requires an answer before science can start working on the answer: science needs to know what to examine, or where to look, in order to get going. As it progresses, it revises its initial ontological commitments and in the fullness of time delivers a (fallible) pronouncement. But that result seems to depend on the starting point, the choice of which calls for a separate examination. This is one reason why ontological naturalism is a semi-autonomous debate, and one which, in contradistinction with methodological naturalism, concerns mostly philosophers.

The path leading from the historical starting point of ontological naturalism to the ontological commitments of contemporary natural science is complex, and cannot be sketched here. At this point in history, according to the best-developed version of ontological naturalism, physicalism, the reconstructed starting point is this: existing entities are those located in space and time that can exert a causal influence on, or as some authors put it make a causal difference for (other) existing entities. As for the end result, the main proposal is that physics delivers the ultimate ontological judgments. In other words, there exist only entities expressly warranted by physics or made up of such entities. The main argument in favor of this starting point is the causal closure of the physical world: as our understanding of the material world has progressed, the likelihood of a case where part of the physical world would be affected by a non-physical factor has become vanishingly small (Papineau, 1993). Moreover, if our epistemic capacity itself is natural, resulting from processes that we can account for in naturalistic terms, then in particular we can only get acquainted with entities that can have a causal impact on our cognitive apparatus. Again, there is a circle, but a virtuous one according to the naturalist: as our understanding of mind and brain progresses, the natural-causal picture of cognition becomes clearer and more persuasive, and that in turn strengthens the naturalistic premise and its conclusion.

How then do prima facie non-physical things fit in the physicalist's world? The answer varies according, first, to the kind of thing under consideration, and second, to the kind of naturalism one espouses. Things, on the one hand, can be entities, properties or facts; and on the other, they may belong to various realms: supernatural (in a sense whose paradigm are deities, spirits, occult forces or principles…), mental, abstract, normative, social… Entities can variously be eliminated altogether (naturalists, also of the liberal persuasion, are unanimous in eliminating supernatural entities for example; some, but not all, scientific naturalists eliminate entities attested by folk psychology, such as beliefs or values), or else be shown to be identical to natural entities (for example, a mental state—believing that 7 is a prime number— might be shown to be identical to a state of the brain, or

a family of such states; Wall Street culture in the 2010's might be shown to be identical to an evolving network including mental representations in members of a population and public representations including texts, images, tools, practices). Properties might be shown to be natural properties, either basic properties (on the model of water being identical to the natural kind of molecular composition H2O) or disjunctions of such properties (on the model of a corkscrew being identical to one of a number of mechanical devices); alternatively, they may be shown to *supervene* on natural properties, in such a way that two entities with the exact same natural properties cannot differ with respect to the property under consideration: just as it stands to reason that two identical faces cannot differ in their degree of beauty, the proposal is that if one state of the brain, say, underlies resentment, another state of the brain identical, neuron for neuron so to speak, to the first cannot but underlie resentment (while resentment, on the other hand, might have non-identical realizations as brain states). Finally facts can be either identified, empirically, with natural facts (a ghostly apparition, for example, might be identified with a certain visual effect produced by the interaction of a natural scene and the witness, or the experience of anger with a rush of adrenalin, or again a reasoning episode with a brain process amounting to some manipulation of material symbols); or they can be seen as non-facts, either destined for the dustbin of science (the destruction of Troy did not result from Olympian rivalries); people don't succeed because they were born under a lucky star; things don't burn by losing their phlogiston), or reinterpreted (as when the putative moral fact that killing is wrong is regarded as expressing a repugnance towards killing).

Physicalism raises several objections, four of which will be mentioned. (1) Some argue that it is not true to the facts: some entities, despite being assemblies of physical entities obeying physical laws, exhibit 'emergent' properties, and thus deserve a place of their own in the natural ontology. The fallback is a non-physicalist, or pluralistic naturalism, which postulates a disjunctive ontology usually comprising the ontologies of the physical and life sciences. But why stop there, it then may be asked? Why not include the ontology of the sciences of man, and take on board their load of prima facie 'suspect' entities, thus all but depriving naturalism of its substance? (2) Physicalism is charged with indeterminacy, on two grounds. (2a) Hempel's dilemma (Hempel 1980) concerns the physics we take as our ontological guide. If we mean today's physics, we run the risk of having to change our ontology next time physics undergoes a revolution; this is a particularly worrisome prospect for those interested in the mind-body problem: all our present attempts to integrate the mind into today's physical ontology could turn out to be worthless, if for example quantum mechanics and cosmology were absorbed tomorrow into a totally novel theory of everything. If on the other hand we mean to refer to the ontology of physics as it will turn out in the fullness of time, then we are referring to nothing at all: who knows what that ontology will even remotely look like? One response to Hempel's dilemma is to throw in doubt the likelihood of such a revolution, and to take the bet that the present attempts to 'physicalize' the mind will not be overthrown by some fanciful sea change in physics (Bokulish 2011). Another response goes by the name of *via negativa:* the basic intuition driving physicalism it that non-physical entities have no place in the world as we know it (this is what two or three millennia of experiencing and experimenting seem to have taught us). We know what the main categories of prima facie non-physical entities are: the supernatural, the spiritual, the mental, the abstract, the normative, the social… So let us rephrase physicalism as stating that the world consists solely of the non-mental, non-supernatural etc., and that this latter domain is causally closed (Montero & Papineau 2005). It is not clear that this move strengthens the case of physicalism, which seems to boil down to a conviction, based on the history of natural

science, that there is no need for mental (or supernatural, or…) stuff to account for the workings of the natural world, and that seems to beg the question. (2b) Physicalism seems to rest on an unanalyzed notion of causality, while there is at present little consensus on how causality is to be understood, and how it fits in the picture of fundamental physics, which is often said to be acausal. (3) Finally, the supervenience strategy for fastening 'suspect' entities onto the natural world, while avoiding the pitfalls of reductionism, is too weak a foundation for a full-blooded naturalism, one that would put the 'suspect' entities on the same footing as the regular ones, making them in particular susceptible to the same kind of direct control.

Methodological naturalism stands on firmer ground. First, it is relatively well-defined: although there is no agreed-upon set of criteria for methods acceptable in the natural sciences, there is little dispute about concrete cases: scientists and philosophers alike are generally in agreement regarding a given natural-scientific procedure–when they see one they know one. Second, it escapes the analog of Hempel's dilemma. On the one hand, methods condoned by the natural sciences are an open-ended, evolving collection, so that there is no danger of the claim dissolving whenever a new method (such as sophisticated software applied to colossal quantities of automatically generated data) comes into force. Nor does this open-endedness make the claim vague: natural-scientific methods form a well-structured set whose elements bear a strong family resemblance, and which moreover strongly support one another; no new member is admitted without having been thoroughly tested. Third, in strong contrast with ontological naturalism, methodological naturalism is, so to speak, self-referentially closed: it claims that only natural-scientific methods should be used, and it applies that demand to itself, insofar as the decision whether or not to accept a candidate method is left entirely to natural science, with no help from outside sources except perhaps philosophy, which naturalists accept only insofar as it is continuous with natural science. Fourth, is does not give any specific discipline pride of place: physics plays no privileged role, so that methodological naturalism need not impose on inquiry the unreasonable demand of conforming to physics. Finally, the demand it does make is rather clear: naturalism is *opposed* to methodologies frequently and sometimes exclusively used today in many branches of these disciplines. Only methodologies that are clearly similar to, or continuous with those used in the natural sciences are deemed acceptable. This is not to deny that the sciences of man have their proprietary domain, and to call for the elimination of their entities and phenomena in favor of neurons, cells, molecules or bosons. The demand rather is that no special treatment be granted to those entities and phenomena except as motivated for precise reasons and to a limited extent. The mere fact that they are attached to human beings or to human populations does not qualify them for special treatment. Cells and organisms are different from stones and cascades, yet to the extent that they give rise, in science, to domain-specific methods and concepts, that is not the outcome of an initial decision from which the inquiry proceeds; on the contrary, it is a consequence of that inquiry, operating under the ground rules of natural science. The same goes, according to naturalism, for human beings, minds, cultures, societies: they start out as generic entities, and as the inquiry progressively identifies some of their specific features, the necessary adjustments are made, without in any way relaxing the standards of natural science. This requirement is known as the 'unity of science', which is not (contrary to popular views) a call for reduction to physics (although some authors have indeed hoped to accomplish this ideal via a reduction of all science, regardless of subject matter, to physics) or to biology (a more popular orientation today). Naturalism, seen in this light, is simply the rejection of a specific duality, that between the natural sciences and the sciences of man, very much ingrained

to this day in mainstream academic culture, despite the best efforts of naturalists over the last half-century.

3. In what ways does scientific naturalism make a difference?

That (scientific) naturalism should make a large difference is intuitively obvious. Yet there are both a variety of ways in which it does, and ways in which it doesn't. Naturalism makes a difference on at least five distinct issues, only one of which is directly relevant to the present volume.

The first is the existence of supernatural entities, the most prominent of which in our culture is God: naturalism sides with atheism, and this makes a difference for theists. Yet even theists, when they put on their scientific goggles, fall back on a special kind of methodological naturalism, one which recommends the scientific stance in the daily conduct of one's scientific life: the scientist who believes in God brackets her religious beliefs when she acts as a scientist. This extends to a vast majority of philosophers, as Barry Stroud has emphasized, regardless of the fact that nonbelievers are far from constituting a vast majority among philosophers. It has long been clear that God could well have chosen to proceed precisely by those means that science can identify, and that, until recently, the (in)existence of God made a difference at most in areas where science happens to be silent—a situation which is undergoing rapid, though not necessarily lasting changes, with some radical naturalists' attempts to refute theism (Harris 2004, Dawkins 2006, Dennett 2006).

The second is the quest for the ultimate reality: what are the fundamental components of the world? This is of concern to a small contingent of philosophers and physicists. Naturalism, which claims exclusive authority for natural science on this issue, and attempts to draw conclusions from the present state of fundamental physics, makes little or no difference in most other contexts, whether academic or not.

The third is the role of science in knowledge. Naturalists (of the scientific branch of course) claim an epistemic privilege for science. The weak form of the claim is that wherever science has a say, what is says has final authority, superseding all other beliefs on the same topic. The strong form is that science has 'universal coverage': anything that can be known at all can only be known by science. The weak form is relevant in contexts where rationalism is challenged: it is not an issue *within* the rationalist camp, which includes all scientists and most philosophers. The strong form is solely of philosophical import: many things are at present unknown by science, so the claim is that we are left right now in a situation of ignorance, which cuts no ice for those who, unlike philosophers, are not preoccupied by the issue of what counts as genuine knowledge. Both the weak and the strong form of the claim leave us with the more pressing demand of drawing the right distinctions within the extensive set of things unknown to science, that the naturalist labels non-knowledge: those of which we have a certain kind of grasp, those which we can conceive but are uncertain about, those which we cannot conceive with any clarity, or at all, those about which we are wrong, etc.

The fourth is the nature of philosophy: here naturalism takes the form of the 'continuity thesis', according to which philosophy is not essentially distinct from the natural sciences: it shares their goal, which is to acquire an understanding of the world, it aims or should aim at taking on board the lessons of science, both its results and its methods, and it should not avail itself of anything like a

philosophical method differing in essence from the scientific method. Insofar as philosophy remains distinct from any given science, it is due, in the naturalist's perspective, to the kind of question that it asks: too general, or too imprecise at the present stage, to be taken on by any research program in one of the established sciences.

Closely linked to this view of philosophy is the naturalistic turn in epistemology. In a seminal article, Quine (1969) defended the view that knowledge is a natural process, the output of human cognitive activities, which transform sensory stimulations into a certain kind of theoretical output. The externalist conception of knowledge sharpens this insight by attributing the difference between mere belief and genuine knowledge to the reliability of the natural processes leading to the formation of a given thought (Ramsey, 1931; Goldman, 1967).

Naturalism in this sense (sometimes also called methodological), is of direct concern only to philosophers, although it does bear on the relations that philosophy can or should establish with other theoretical and practical enterprises, including the sciences of man.

The sciences of man are the fifth issue in which naturalism makes a difference, and indeed, it is the one that we shall now be concerned with. It inspires two distinct, though related projects. The first is to 'naturalize' the mind: to show that the mind and all things mental are natural (Armstrong, 1968; Dennett, 1969; Fodor, 1975; Dretske, 1995). The second is to produce a naturalistic social science (Mill, 1943, Rosenberg, 2008).

On the negative, 'rebellious' side, naturalism takes the form, as was said earlier, of a rejection of the well-entrenched dichotomy between two kinds of science. This raises an immediate perplexity, akin to the one we encountered in relation to what constitutes genuine knowledge: naturalism rules out of bounds a large amount of research conducted in the sciences of man. If we assent to naturalism, for whatever reasons, we are left with the problem of disposing of the body of rejected research, both methods and results. Three main strategies can be deployed: wholesale elimination, wholesale reconstruction, or sorting and correction. Wholesale elimination is sometimes explicitly proposed: whether mainstream research is taken to be mistaken in its methodology—*verstehen* or interpretivism, hermeneutics, historicism...— or in its basic assumptions—cultural relativism, social constructionism, omnipotence of the mind (its alleged capacity to develop any set of thoughts whatsoever) …—, its output is consigned for the most part to the dustbin of history. But more often elimination proceeds tacitly : the results of mainstream research are essentially put to the side, and the ground is cleared for starting afresh, by picking the low-hanging fruit, accessible from the present stage of development of the natural sciences of sociality, and proceeding stepwise from there. Wholesale reconstruction rests on the thought that social scientists have unwittingly been going down the naturalist's path, while consciously following some official non-naturalist methodology. The aim is to redeploy all or most of the corpus of social science in a proper naturalistic framework, where it would blend seamlessly with results obtained directly from a naturalistic base. Finally, a naturalist social scientist may feel that throwing away the fruits of decades or centuries of work by mostly excellent minds is unreasonable, yet have no idea of how to reconstruct the entire field from first principles: she would then retain certain results that she has independent reasons to find at least approximately true or plausible, and attempt to correct and complete them with the help of natural science. This in fact is what is beginning to happen at the interface of the cognitive and social sciences (a good example is Elster 2007).

Still, the main task of the naturalist, whether philosopher or social scientist, is to develop a naturalistic research program in the sciences of man, or in other words, move from proclamation, conviction or a priori arguments to existence proof: to show how and that a naturalistic account can be given of entities, processes, phenomena that have heretofore been regarded as out of reach of a naturalistic science. This is the stage where the naturalistic stance turns into a form of anchored naturalism, one that aims at making a scientific difference.

4. Naturalizing the mind: Cognition, brain, evolution

The single most important reason why the discussion of scientific naturalism does not proceed today as it did in previous epochs is that biology has both matured into a full-fledged natural science and become hospitable to the human realm. Or so it was claimed earlier (§2). It is important at this point to qualify this statement: without the rise of the formal sciences, biology would arguably not have developed into a bona fide natural science, and it would unquestionably not have become hospitable to the human realm.

The formal sciences are understood here to cover logic, in the broadest sense of the word, information and computer science, control and signal theory, theoretical linguistics and extend today to probability and statistics, dynamical systems, and mathematical modeling techniques in general. The unity and scope of this vast area is a topic beyond the reach of the present entry. The decisive point is the development of logic and information theory in the late 1930s, which led in short succession to the computer model of the mind, to generative linguistics and to the information-theoretical approach in molecular biology and genetics. A few years earlier, statistics developed in such a way as to revolutionize and revive evolutionary theory. By the early 1960s cognitive science was born (though not yet baptized); initially understood as a computational theory of mental capacities, it rapidly expanded in several directions: first, it incorporated developmental psychology, so that the ontogenesis and the mature state of human capacities were seen as connected; second, the scope of cognitive science extended beyond the initial repertoire of learning, memory, reasoning, language, motor control, and absorbed emotions, consciousness, self, social skills; third, non-normal cognition and non-human cognition became integral parts of the study of cognition; fourth, partly as a consequence of the last point, neuroscience joined the federation, so that cognitive science cristallized in the mid-1970s into a multi-level, multi-disciplinary integrative approach of the 'mind/brain'.

Two further additions were made to this structure beginning in the 1990s. First, the mutual dependence of the cognitive and social sciences became evident; second, evolutionary theory, which for many years was seen as no more than a lateral aspect of the problem situation, came to the fore, to the extent where an 'evolutionary social cognitive neuroscience' is seen by some as the inevitable result, in the coming years, of an ongoing process of multiple convergences. The present situation, though fluid, is more accurately described as a multi-pronged naturalization program of the human realm.

When the focus is on the individual, member of the *Homo sapiens* species, three avenues are open for investigation. First, the human individual has a complex of mental or cognitive capacities that can be characterized at the functional level of information processing; this is the mission of such

fields as developmental psychology, psycholinguistics, experimental psychology; the computational models produced and tested may in principle have counterparts in artificial systems developed in artificial intelligence and robotics. Second, these capacities are undergirded by the brain: not only would there be no mind if there were no brain, but the complex structure of the mind depends on, and in fact faithfully reflect the complex structure and workings of the brain, as the mind is nothing over and above an integrated system of functions of the brain. An account of the latter amounts to a naturalization of the former. Third, these capacities are by and large functional in the biological sense, and are thus the outcome of biological evolution. Three distinct paths are thus thought to naturalize the mind, providing in the long run, respectively, (1) an abstract mechanical account of the information processing system; (2) a concrete biological account of the material system embodying the system; (3) an evolutionary account of the cognitive organ, described either at the functional, information-processing level (the evolved mind) or at the neural level (the evolved brain).

Are these programs bound to converge? The naturalist certainly thinks so. After all, the human body (and organisms in general) can be studied at the abstract functional level (models of the bodily functions can be constructed), at the anatomical, physiological and metabolic level, and as a product of evolution by natural selection, and we do expect that these perspectives, as they are filled in, gradually blend into one unique, multidimensional picture. Indeed, this is the horizon in which many cognitive scientists frame their efforts. However there is a major difference: in the case of the human body, naturalization is not, or is no longer, an issue, and because we are antecedently assured of its natural status, these various investigations are not meant to prove it, and by the same token we expect that they will converge in the long run. The case of the mind is different: each of the research programs is meant as a partial vindication of the claim that it is natural, and their convergence, if and when it is achieved, would likely be regarded as settling the issue, and also as showing how the respective ways in which the mind is 'naturalized' fit with one another. In the present stage of progress, no clear-cut conclusions are forthcoming: although our understanding has made impressive progress on many fronts, such that what may be called the 'natural profiles' of the mind are gradually coming into focus, the ultimate goal, *viz.* proving beyond reasonable doubt that the mind is natural through and through in the operational sense of being fully accessible by natural science, remains elusive.

Indeed, how much of the mind is targeted by the naturalization program—what should be included in its final, completed 'natural profile'— is not entirely clear. Strict naturalism sees the mind as a natural system, and relies on natural science to account for both its invariant structure (allowing for development from birth to adulthood) and its particular processes. A (standard) physical system has invariant features and follows certain trajectories under various environmental conditions, and both the features and the trajectories are under the jurisdiction of physics. Science however does stop short of singular happenings: a leaf falling from a particular tree at a particular time, thoroughly physical an event as it is, does not qualify for treatment by physics. Where to draw the line at which the mission of science ends is a vexed question even for physics (Cartwright 1983). To a first approximation, the physics of a system stops where the contribution of the environment to the interaction overwhelms, in terms of complexity, that of the system: it includes types of trajectories under a variety of fairly simple environmental conditions, but not specific trajectories in highly complex situations.

When it comes to the mind, we would not expect science to account for the details of every episode of everyone's mental life, but only for the regularities that all such episodes exhibit, and for the shared functional architecture of the systems that produce them. A large part of the task is to define the basic concepts in terms of which to describe both. One proposal stemming from the formal sciences is to regard the mind as a set of information-processing functions operating on inner representations; in this framework, the aim of cognitive science is to characterize the types of mental states and the types of transformations on those states. Both states and processes raise a number of perplexities.

One essentially unsolved problem of particular importance is to provide a naturalistic account of the intentionality of mental states, that in virtue of which they represent (real or fictional) states of affairs—in brief, the challenge is to provide a naturalistic account of meaning (Millikan, 1984; Drestke, 1995). Another unresolved issue is that of consciousness, with many rival contenders vying with limited success for recognition as a naturalistic account (Block et al, 1996). A third conundrum is raised by the status of reasons in actions and behavior: reasons are prima facie distinct from causes, insofar as they obey incommensurable laws, yet enter in the commonsense explanations of action; naturalism demands that actions, and behavior generally, be explained in causal terms; so either, conceptual analysis notwithstanding, my reason for X-ing causes my X-ing, or it doesn't, despite the fact that absent my reason for X-ing, my X-ing is no longer an action but a mere movement (Davidson, 1980). Meaning and reasons both involve normativity: the mind seems to have a fundamental grasp of normativity, and to keep track of particular norms while orchestrating behavior that does or does not conform to the relevant norms. Making naturalistic sense of normativity appears to some philosophers as the most daunting task (Wedgewood, 2007; De Caro & Macarthur, 2010).

Important as they are to philosophers, these issues are less central for cognitive and social scientists, who are more anxious to find a principled way of drawing a boundary, within the dynamics of the mind, between what is due to the system and what to the environment. The nature/nurture debate, though transformed by what we have learned about development and plasticity, remains a bone of contention between naturalists and various strands of anti-naturalists: if the mental dynamics owes a large part of its specific features to contingent or stable features of the history of interactions of the individual with her, mostly social, environment, then naturalizing the mind is an enterprise of limited scope, or so it seems (but see below). Nobody today doubts that there are natural constraints on what the mind can achieve, *i.e.* constraints on the mental dynamics; but the naturalists insists, and her opponents deny, that these constraints are of great import.

Most cognitive scientists involved in hands-on research, eager to avoid controversies which they see as fruitless, are in fact content with defending a modest naturalism, one which takes no stand on how far the naturalist account will eventually go, and what slack it will leave for the contingencies of the individual's life course, and/or the environmentally transmitted constraints originating in the social sphere. The real challenge lies in discovering the conceptual repertory in which to couch the natural constraints, not in attempting to second guess the extent of their reach.

5. Naturalizing the social sphere

Postulating, as has just been done, a clean separation between individual cognition and the social sphere is a gross oversimplification, and one that prejudges the issue of naturalism regarding the latter. And in fact naturalism is perhaps nowhere more salient as a challenger to established dichotomies than in the social sciences. Indeed, in some circles the mere fact that some phenomenon is under the influence of social factors implies *by stipulation* that it is not natural. This clearly assumes some particular character of *human* society, for what ants or bees do is regarded as no less natural for their being social species. Perhaps humans, also a social species, owe their natural character to both their individual and social constitutions. That is precisely what naturalism proposes; indeed, the most refined forms now under discussion aim to show that the naturalness of the human individual and the naturalness of human sociality are deeply intertwined.

Naturalism deploys three main strategies, either independently or in combination as the case may be, in its attempts to establish the natural character of the social sphere. The first is informational: society as a general phenomenon, as well as particular societies, are to a very large extent determined by the informational dynamics that they harbor. Information should be understood in a theoretical sense, shared with cognitive science, and in particular not limited to linguistic communication: many vehicles, including purely mental ones, carry and propagate meaningful tokens that in part determine both individuals' behaviors and the modification of the informational landscape. Game theory, which purports to provide a formal characterization of strategic interactions between agents, is a typical achievement of this strategy, one in fact which aspires to provide a unifying framework for the social sciences (Gintis, 2009).

The second strategy relies on cognitive science: by offering a detailed characterization of the individual mind, it narrows the set of possible social arrangements and facts. This need not presuppose a strong form of methodological individualism: a principle of individualistic transmission (Nelson, 1990), according to which any putative specifically social factor can have an impact only by impinging on individual members of the social group, is enough to make cognitive science relevant; in fact, it is irrelevant only on a strong form of social holism, claiming that the individual level of causality is screened out, and that the members of a group are indiscernible tokens that act as mere vehicles of social forces. Still, naturalism and methodological individualism of one or another shade are regular bedfellows. Cognitive science, it is argued, substitutes genuine knowledge of human mental capacities, particularly memory, learning, reasoning, decision-making, for intuitive notions or philosophers' speculations. As a result, behavior that is labeled irrational when it fails to conform to the latter, yields to explanation in the light of the former. A new field, misleadingly labeled neuroeconomics, aims at providing an account of decision-making based on cognitive neuroscience. Naturalism also harbors the hope to improve people's behaviors, in the sense of making them cohere better with their true preferences, for example by engineering the setting in which they make their choices so as to orient their natural decision processes in a more favorable direction (Thaler & Sunstein, 2009).

The third strategy rests on a general theory of evolution, with two distinct branches, biological and cultural. Biological evolution is called upon to account for the existence of cognitive mechanisms specifically geared to allow social interactions among humans to develop, stabilize, and evolve in particular ways, and which together constitute our shared 'social cognition'. Cultural evolution

accounts for the genesis of particular forms of social processes, which generally (though not always) allow human groups to acquire new capabilities and capitalize on ones acquired at an earlier stage (Tomasello, 1999), at a considerably faster rate than biological evolution would permit. Two additional phenomena have recently enriched the explanatory toolkit of evolutionary approaches. The first is group selection, a highly controversial issue: the conjecture is that Darwinian selection can operate at the group level, so that one population may acquire as a whole a gene pool allowing it to outcompete another. Long widely regarded as discredited, the conjecture is alive again (Sober & Wilson 1999). The second device is gene-culture co-evolution: a given gene pool favors the spread of certain cultural forms, that in turn favor individuals bearing certain genes, giving rise to a new gene pool (Richerson & Boyd, 2005). Niche construction, a phenomenon not limited to, but spectacularly exploited by humans, provides an illustration: the genetic endowment of a population leads it to alter its local environment in such a way that it become hospitable to variants which would otherwise be at a disadvantage. The variants thus flourish and go to fixation, leading to a genetically different population, well adapted to the niche that led to its selection (Odlin-Smee, Laland & Feldman, 2003). A niche need not be mainly material: those that matter most for humans are cultural.

Group selection and/or gene-culture co-evolution are harnessed for the resolution of several enigmas in standard biological evolution, bringing heretofore resistant phenomena within the purview of naturalism. The most important is co-operation, a central characteristic of humankind. Biological evolution in the Darwinian sense would seem to select exclusively self-regarding behaviors that destabilize in short order any cooperative system in which individuals contribute to the welfare of non-relatives without expecting the favor to be returned. Another singular feature is the ability of human populations to adjust to an immense variety of habitats, which only a certain type of evolving culture can achieve; in turn, the selection process leading to inscribing in the human genome the ability to adapt to all sorts of environments rather than to a narrow range seems to require a co-evolutionary process. These examples are representative of a new orientation, within evolutionary psychology and anthropology, that anchors the study of culture in biology while granting it semi-autonomous status (Richerson & Boyd, 2005; Sterelny, 2012, D.S. Wilson, 2002), rather than essentially reducing culture to a direct expression of our genetic endowment (Tooby and Cosmides, 1992; Pinker 2002).

Naturalism inspires a large array of research programs in the social sciences, whose ambitions range from modest to revolutionary: they aspire to complement, reconstruct or replace mainstream anti- or non-naturalistic approaches. A large part of the current efforts, and accompanying controversies, partake of methodological naturalism. A resolution of the age-old issue of *verstehen vs. erklären* seems within reach, insofar as interpretation can be understood naturalistically: the meaning of human actions and events may in fact be objective properties, which social science can bring to light without renouncing the explanatory goal of natural science. A full reconciliation would seem to depend on several moves that are resisted by many (Taylor, 1971; Geertz, 1983) the discussion of which vastly exceeds the scope of this entry. What does rather clearly stand out is the emergence of a significant body of naturalistic theory in the social sciences, which bypasses rather than confronts the interpretative tradition, by setting its own agenda and foregoing, in accordance with the lessons of biology, the demands of lawlike generality and predictability.

Fewer attempts are made to vindicate ontological naturalism. Still, the nature of social entities has come under sustained attention in the last quarter-century. Social representations, institutions, norms, joint action, collective intentionality have been the focus of several proposals: Dawkins's theory of memes, Sperber's (1996) epidemiology of representations, Searle's (1995) theory of institutions as constitutive rules, the competing account of institutions as game-theoretic equilibria, pursued in the wake of Lewis's seminal *Conventions* (1969) by Skyrms (2010), Bicchieri (2006) and others, Gilbert's (1989) notions of plural subject and attached predicates such as collective belief, shared intention, etc., competing with accounts by Bratman (2014), Searle, Tuomela (2007) and others, Goldman's (1999) program for social epistemology… Here again, philosophical and formal theorists are under increasing pressure to share the field with empirical scientists, who bring data from developmental psychology, behavioral ecology, neuroscience, experimental economics, etc. that naturalism is committed to regard as relevant. Much remains to be done, however, before a clear picture of the viable options emerges.

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Here as elsewhere, scientific naturalism in action, much like the sciences themselves, gradually refines its self-conception as it pursues the multiple theoretical, formal and empirical inquiries inspired by its initial commitments: what 'nature' refers to, what are the admissible ways in which the entire repertory of entities attested in our practices, linguistic and otherwise, is in turn to be inscribed in nature, these are the terms of both the problem and the partial solutions proffered along the way. The process and its fallouts may well be more significant than any putative final vindication.

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