

Can Psychological Science Be Replaced by Biological Science?

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Abstract

This paper examines and finds wanting the thesis that psychological concepts and forms of explanation will, with advances in scientific understanding, one day be supplanted by biological ones.

“...our common-sense psychological framework is a false and radically misleading conception of the causes of human behavior and the nature of cognitive activity. (It)...is not just an incomplete representation of our inner natures, it is an outright misrepresentation of our internal states and activities. Consequently, we cannot expect a truly adequate neuroscientific account of our inner lives to provide theoretic categories that match up nicely with the categories of our common sense framework. Accordingly, we must expect that the older framework will simply be eliminated, rather than be reduced, by a matured neuroscience”

--Paul Churchland, 1988, p. 43

The hypothesis that our current psychological forms of description and explanation will one day be replaced by biological ones, while not universally held, is widespread and highly influential in the scientific and philosophical communities (Churchland, 1988; Churchland & Churchland, 1994; Freud, 1959; Gold & Stoljar, 1999; Shermer, 2004). Further, if one listens to assumptions and assertions made in the media and

in general conversation, it becomes clear that this view--that “when you get really scientific about the matter, it’s all really at bottom biological”--has made substantial inroads into the thinking of the broader culture.

The purpose of this paper is to examine this hypothesis. It will be argued that, while biology has had and will undoubtedly continue to have many extremely valuable and illuminating findings, it cannot and will not *replace* psychological concepts and explanations in our understanding, scientific and otherwise, of human behavioral phenomena.

The paper will be organized in the following way. First, a sketch of the scientific outlook at issue will be drawn. Second, the enormous implications of acceptance of the biological reductionist thesis embedded in this outlook will be detailed. Third, a series of arguments will be presented to the effect that, not only is this reductionist thesis at present wholly unestablished, but it is *in principle* impossible that it could be established coherently in the future.

The Scientific Outlook at Issue: “It’s All Really Biological”

Let us begin with a brief sketch of a widely shared contemporary scientific outlook. The view has three aspects. Some of these pertain to matters of established scientific fact and procedural strategy, and are in themselves nonproblematic. Others pertain to matters of scientific admissibility and philosophy, and will be shown to be highly problematic in any number of ways.

Aspect #1: Scientific facts. All of the following propositions are long since scientifically demonstrated, and almost universally accepted within the scientific community. (1) As homo sapiens brains developed via evolution (as well as individual maturation), the bearers of these brains exhibited consciousness and, over time, ever more sophisticated mental and behavioral accomplishments (Dennett, 2003; McGinn, 1999). (2) When these brains sustain certain sorts of damage, or undergo certain sorts of chemical or other alterations, we observe resultant changes in the mental and behavioral functioning of their possessors (Bickle & Mandik, 2002). (3) Different patterns of neural activation, as recorded by means such as positron emission topography and magnetic resonance imaging,

are associated with different mental functions, both normal and pathological (Bechtel & Mundale, 1999; Bickle & Mandik, 2002; Schwartz, 2002). Finally, (4) direct stimulation of certain brain sites results in reports by the stimulated party of experiences such as memories, images, and sensations (Penfield & Perot, 1963).

Aspect #2: Scientific strategy. Historically, science has had many documented successes at explaining the properties and functions of various entities by analyzing their physical structures and processes (Bickle, 1998; Churchland & Churchland, 1994; Searle, 1984). By this general method, for example, the property of heritability has been found to be attributable to the sequencing of DNA elements in genes, the solidity of matter to the lattice configuration of atoms operating at low energy levels, and the electrical conductivity of certain materials to the ability of electrons to move freely through them.

Aspect #3: Metaphysics and scientific admissability. Finally, the overwhelming modern consensus is that dualism is long since dead, and deservedly so. On this view, while Descartes had it right when he spoke of a material substance, he was decidedly wrong when he alleged the existence of a spiritual one. Accordingly, in the minds of many scientists (and nonscientists), there is an unreflectively assumed equation between being real and being physical (Ossorio, 1998). On this view, biological phenomena such as neurons, synapses, neurotransmitters, and action potentials, being physical states of affairs, meet this requirement for reality status most admirably, and thus are eminently scientifically admissible. On this equation, however, phenomena such as motives, beliefs, intentions, and traits, lacking all physical dimensionality (mass, locatability in space, electric charge, etc.), and seeming far more intangible, elusive, and difficult to measure and quantify, are suspect with respect both to reality status and scientific admissability.

Conclusions. On these and further bases, many have concluded that psychological phenomena such as thinking, remembering, imagining, learning, and acting to bring about envisioned outcomes, if they are to be granted reality status at all, are best understood scientifically as the

causal products of bodily (and especially brain) structures and processes (Armstrong, 1999; Bickle, 1992, 1998; Churchland & Churchland, 1994; Kandel, 1998; Searle, 1984; Shermer, 2004). This being the case, there is some presumptive reason to believe that such phenomena will prove explicable through physical analysis of the biological organism that is a human being. In the minds of the more radical proponents of this view, once these biological structures and processes are well understood, we will be able to discard our current psychological concepts entirely from the scientific vocabulary as valid descriptive and explanatory categories (Churchland, 1988; Churchland & Churchland, 1994; Freud, 1959; Gold & Stoljar, 1999; Shermer, 2004). In the minds of the less radical, these concepts may be retained as that which is to be explained, but not in their explanation (Bickle, 1992, 1998; Clark, 2001; Dennett, 1991, 2003; Fodor, 1987). Thus, for example, we may always have a biology of “memory” or of “cognition,” but the explanation of these phenomena will be entirely in biologic terms.

Implications of the Present Reductive Hypothesis

The Death of Psychology

Adherence to the reductionist thesis articulated above calls into serious question the very legitimacy of psychology as a science. If such phenomena as thinking, remembering, learning, perceiving, believing, and acting to achieve envisioned purposes -- in short, the vast bulk of the subject matter of psychology -- just are, and are nothing over and above, the causal products of brain and other biologic phenomena, and are completely describable and explainable as such, it follows that psychology will in time disappear as a science. A type of reduction known as “theory reduction” (Teller, 1995) will have occurred in which an earlier theory, with its attendant construct system and modes of explanation, will have been replaced by a newer one embodying different constructs and explanations. In this scenario, psychological explanations and theories will pass into the scientific relic room with the likes of alchemy and Ptolemaic cosmology.

The Death of Science

Psychology is but one science among many. A further logical implication of the present reductionist thesis is that it would undermine, not only psychology, but the entire institution of science. Why is this so?

Science, as we have long understood it, requires and presupposes an ability to do such things as examine relevant empirical evidence, reason about its implications, and create theoretical structures that are consistent with and account for this evidence. Newton, as we commonly understand the matter (see, e.g., Berlinski, 2000), surveyed a vast body of terrestrial and celestial findings, and finding all current theories insufficient, created a new theory of universal gravitation that accommodated and unified all of these findings. Darwin examined a panoply of species, considered the possible implications, and concluded that a process of evolution must have occurred. Hubble observed the ongoing expansion of the universe, and conjectured that there must once have been a “Big Bang.”

On the more radical version of the thesis articulated above, however, any phenomena described in terms such as “examining” empirical data, “reasoning about” its possible implications, “drawing appropriate conclusions,” “formulating” theories that account for it, and even “knowing” the truth, are all riddled with invalid, prescientific, psychological “mind-talk” and can have no scientific legitimacy. In other words, our whole historic conception of scientific activity is undermined, and a subterranean biological process of wholly unknown (and unknowable) epistemic status proffered in its place.

Broader Cultural Implications

The effective annihilation of the science of psychology and of science itself are of course already enormously significant consequences. However, the matter does not end with them. The third highly significant implication of acceptance of the present reductionist thesis is that what we now take to be *persons* must be reconceived as nothing more than a certain type of organic, deterministic mechanism --as, in E.O. Wilson’s phrase, a “marvelous robot...wired (neuronally) with awesome precision” (1999, p.

53). If explanations in terms of synaptic events, hippocampal structures, neurotransmitters, and so forth, come to be regarded as the *only* scientifically admissible explanations of human behavioral phenomena, the very concept of a “person” --i.e., of an individual who paradigmatically selects and implements from among a set of understood behavioral options--must correspondingly disappear (see Ossorio, 1982, for a delineation of the conceptual requirements for saying of any candidate X--X could be a dolphin, an ape, a computer, or an extraterrestrial--that X is a person).

With the disappearance of the concept of a person must come a corresponding disappearance of the conceptual apparatuses of our current seminal social institutions (e.g., the family, the judicial system, religion, and the educational system) and of many other disciplines aside from the scientific ones (e.g., ethics, law, and history). While entire books and articles have been written on this topic (see, e.g., Holmes, 1991), let me attempt here only to make this point in a very shorthand way. If we dismiss the categories of “choosing,” “intending,” “acting for a reason,” “acting deliberately,” and so forth, as designating legitimate, scientifically acceptable states of affairs, then consider the following statements. From law: “Murder in the first degree, implying the *planned, premeditated act* of killing another, ought to be punished more severely than manslaughter.” From ethics and religion: “The concepts of moral ‘right’ and ‘wrong’ (as well as the latter’s religious counterpart, ‘sin’), conceptually imply the ability of an individual to *choose from among understood behavioral options*; a completely determined movement on the part of a person, such as falling when one is tripped, is ineligible for such attributions.” From history: “The primary *reason* that Truman *decided* to drop the atomic bomb was to force the enemy to surrender.” And finally, from everyday life in academia: “The professor (who, by the way, was a biological reductionist) was infuriated at his chairperson because he *believed* the latter had *deliberately* discriminated against him in his tenure recommendation.”

If we accept the reductive views articulated above, all of these propositions, logically presupposing and necessitating the concept of a person and its logical sequelae, become inherently defective attempts to account

for what can only legitimately be accounted for biologically. Further, all of those around us--our spouses, children, friends, coworkers, and others--must be reconceived as “marvelous robots,” to be regarded and treated accordingly. I think it very difficult to imagine the general consequences on our total worlds if psychological constructs and forms of explanation were ever to pass entirely from the scene in favor of biological constructs and explanations. (Incidentally, I do not know of a single biological reductionist who does not practice a sort of Orwellian “double-think” of the sort suggested in my final example above. In the classroom, there are no choices, thoughts, or intentions; there are only “action potentials” and the like. Outside the classroom, in the vital affairs of their lives -- their marriages, families, professional relationships, economic dealings, and more -- they utilize the concept of a person and psychological constructs no differently than others do.)

But What If It's True?

In concluding this section, let me raise a final and different kind of “so what” question. It might be argued that, if the biological reductionist view articulated above some day represents the most cogent, evidentially established scientific position on this issue, then all talk of “what difference it makes” will be beside the point. We shall just have to live with whatever difference it makes, just as the adherents of certain religious viewpoints have had to live with Copernican cosmology and Darwinian evolutionary theory, and just as the adherents of certain scientific outlooks have had to live with such paradigm-shattering findings as those involving action at a distance without benefit of physical medium and the indeterminacies of sub-atomic particles.

The key question thus becomes: Are there strong reasons to conclude that the present reductionist view of psychological phenomena *is* in fact, or is highly likely to become, the most cogent, evidentially established scientific position? Or are there powerful considerations that render it a highly problematic and dubious position? In the following three sections of this paper, respectively, I shall (a) issue a relevant reminder having to do with the current scientific state of affairs in biology and psychology;

(b) argue that psychology's construct system is *in principle* not replaceable with biology's; and (c) demonstrate, building upon the previous point, that psychology's explanatory forms are similarly non-replaceable.

Reductionist Thesis Not Currently Established

Let us begin simply by noting the current state of affairs. Despite the many advances witnessed in biology, our psychological construct system remains. We have not, either as scientists or as everyday describers of behavior, dispensed with categories such as cognition, memory, learning, motivation, reason, intentional action, and so forth. For the most part, in fact, biologists *both accept and use* these categories. Thus, for example, they speak of “the biological basis of *memory*,” “the neural substrates of *cognition*,” “the neurochemistry of *depression*,” and so forth. Indeed, even the Churchlands, the most outspoken critics of what they consider prescientific “folk psychological” categories, have been unable to avoid such concepts as “perception,” “cognition,” “conceptual change,” “moral knowledge,” and even “theory of the world” as categories of explananda in their work (Bickle & Mandik, 2002).

Not only do we continue to employ psychological concepts to describe and to designate categories of empirical phenomena, but we also, and equally clearly, continue to *explain* human behavior in terms of these concepts. The cognitive model of psychopathology, for example, remains alive, well, supported by much empirical evidence, and widely and effectively used (Beck & Weishaar, 2005). Acting as scientists and clinicians, we continue to employ forms of explanation such as those in terms of schema activation (e.g., “She was depressed because the divorce brought to the fore her old, core belief that she was personally unloveable and would never have a successful relationship”), and expectation of reinforcement (e.g., “He used cocaine again, expecting that it would produce the same euphoric feelings that it had in the past”). Acting as everyday explainers of behavior, we make claims such as, “He moved his queen there in order to put his opponent in check,” “she voted Democratic because she believed the Democrats would work harder to advance the

cause of civil rights,” and “he became angry because he saw the remark as an insult and not as a joke.”

All of this is in no way meant to deny the validity of apt biological explanations of mental and other behavioral phenomena. We also see them both in scientific accounts (“Alzheimer’s disease causes memory impairment.”) and in everyday explanatory ones (“Those three martinis caused him to feel more relaxed and less inhibited.”). It is only to say that, after several thousand years, psychological concepts and explanations have scarcely been replaced (cf. Horgan & Woodward, 1985). Rather, they have survived the long struggle of the survival of the fittest, and continue to do so, constituting what the evolutionary theorist Richard Dawkins (1990) has characterized as “memes.”

Thus, at this point in time, the contentions of the biological reductionist have the status of IOU’s and not of “cash on the barrelhead,” a point that is admitted even by its most ardent supporters (Gold & Stoljar, 1999). They do not state what has already been demonstrated, but are promissory notes issued for the future. This being the case, the burden of proof is clearly on the proponents of this point of view. However, notwithstanding the fact that the goods have yet to be delivered, the reductionist can continue to proclaim, “Someday, you’ll see!” Are there any reasons to conclude that, no matter what scientific advances are made in biology or related areas, there are *in principle* reasons to believe that psychological constructs and explanations will remain with us? Let us proceed to an examination of these questions.

Can Psychological Concepts Be Replaced?

As noted previously, a crucial aspect of the view that psychology will be replaced by biology is that psychology’s *construct system* will be replaced. On this view, where now we talk of “reasons,” “motives,” “thoughts,” “emotions,” and so forth in describing and explaining human behavior, one day this allegedly “prescientific” language will be replaced with the language of biology, and especially that of neuroscience. Thus, we will

describe human behavioral phenomena in terms of brain and other biological processes, and do so in the language of neurotransmitters, synaptic events, action potentials, or whatever the then current biologic construct system dictates. There are strong reasons to conclude that such an outcome may be impossible *in principle* (cf. Davidson, 1970; Horgan & Woodward, 1985; McGinn, 1999; Ossorio, 1982; Searle, 1984) In this section, I shall set forth what I consider to be the foremost of these reasons.

Language as Primarily Pragmatic and Not Representational

In the beginning was the word, and the word drew a distinction that had implications for human action. As many philosophers (most notably Wittgenstein, 1953; see also Harman, 1987; Hospers, 1997, pp. 11-12) and psychologists (Ossorio, 1982) have noted, language is not confined to, nor is it even primarily concerned with, assigning labels to objects and to providing a picture of how things are in the world. While these are certainly common uses, one has only to observe how language is in fact used by people to see that this is so. One can, for example, simply pay attention to any conversation, read any tract such as a novel or a news report, listen to any political discussion, or attend any drama, and track the kinds of things that are said. Language, as Wittgenstein (1953) famously pointed out, is used in an enormous variety of ways. Writ large, it is, as many have expressed it, a set of “tools” that people use for a wide variety of human purposes -- to give orders (“Stop!”), to apologize (“I’m sorry”), to ask questions (“What is gerund?”), to express disbelief (“I doubt it”), to exclaim (“Hooray!”), to degrade (“You’re a liar!”), to convey emotion (“I’m sad.”), to criticize (“Too abstract”), to express metaphorically (“...for all the history of grief, an empty doorway and a maple leaf”), to provide a picture of how things are in the world (“The cat is on the mat.”), and many others.

Within this pragmatic “tool” view of language, Ossorio (1982) and functionalists such as Fodor (1981) and Armstrong (1999) have pointed out that, even in those cases where our focus is on language used in

reference to physical objects, countless numbers of these objects are what they are based on the *functions* they serve. Their names refer neither to their physical makeup nor to the mechanics of their physical functioning. Thus, as Ossorio (1982) has noted, “computer” is not defined, as it might have been in the 1950’s, as a machine assembled from vacuum tubes, air conditioning, and other parts. “Airplane” is not defined, as it might have been in the 1920’s, as an assemblage of covered wooden struts and propellers. A “rook” is not defined by the onyx (or wood or ivory or plastic) that it is made of. “Money” is not defined as a piece of metal or paper with certain distinctive markings. Rather, all are defined by their *function*--by the *role* they play in human social practices. The computer computes, the airplane transports us by air, the pawn has certain move eligibilities when we play the game of chess, money is a means of exchange, and so forth. While their physical realizations change over time and at any given time may be enormously various, what makes each of them what they are remains constant: the roles or places they serve in our ways of life.

This being the case, two things follow. The first is that one could never dispense with the original concept (e.g., “computer” or “rook”) and substitute for it all of the myriad physical realizations of that concept. Not only would this be completely unmanageable, but, once dispensed with, if someone inquired as to why one had grouped all of the objects together (e.g., the objects previously termed “rooks”), there would simply be nothing to say (cf. Bickle, 2002; Fodor, 1981; Putnam, 1988 on “multiple realizability”). Second, the concepts in question have an inescapable reference to the broader social practices at issue--playing chess, exchanging money for goods, performing computations, and so forth. And since these relevant social practices in each instance are much larger than the property-bearing object in question, it would seem in principle impossible ever to reduce what that object is to its physical characteristics (Teller, 1995). One could look for years at a rook -- one could take it apart and examine its molecules, atoms, and quarks -- and never discern that it is eligible to capture the queen.

Much the same is true of behavioral concepts. If we consider, for

example, the commonplace behavior of “making a promise,” it is easy to see that, like objects, it is multiply realizable and not identifiable with any single constellation of physical movements, processes, or sounds. First of all, these movements can and do differ considerably from occasion to occasion. People will say “I promise,” “I swear,” or “I do,” raise their hands in certain distinctive ways, sign their names to certain kinds of documents, and make promises in an indefinitely large number of other ways. Making a promise is essentially making a particularly solemn and binding pledge to another to do or not do something -- and can assume the form of an indefinitely large number of internal and external physical movements and utterances that might be realized on any occasion in so doing. The same can be said of such actions as “criticizing another,” “greeting a friend,” “avoiding a danger,” “doing arithmetic,” “telling a joke,” and so on ad infinitum.

Further, as Ossorio (1982) has pointed out, on any given occasion, to merely describe the physical processes and movements of a person -- however completely and at whatever level of molarity from gross bodily movements to synaptic to atomic events -- is only to describe one parameter of that behavior and not the whole behavior, which requires making descriptive commitments to other parameters. If I merely say, for example, “Pat raised his arm,” this is not enough to inform another whether Pat just “greeted a friend,” “signalled the child not to cross the street,” “took an oath,” or what. To know what behavior Pat engaged in, we need at a minimum knowledge about what Ossorio characterizes as the “Want” parameter--that is to say, we need to know what Pat is trying to accomplish.

Finally, for behaviors as for objects, there exists an inescapable reference to a broader context of social practices. When the duly appointed minister, for example, utters the words “I now pronounce you man and wife,” to the young couple during the marriage ceremony, this action is only intelligible in the far broader context of the cultural social practice of “conducting a marriage ceremony” and the cultural institution of marriage. Anyone who does not understand these things -- a visiting Martian, for example, who dropped down and tried to analyze it on the basis

of the collectivity of biological events just observed -- simply could not understand the minister's behavior.

Thus, for the most part, both objects and behaviors are what they are by virtue of their place in our social practices and ways of life--in our "language games" as Wittgenstein (1953) would have it. Given their indefinitely large number of different physical realizations, their changing realizations over time, their adequate description requiring more than a commitment to the physical events involved in them, and their inescapable context dependency, *it would be impossible to substitute language about this physical realization for language about what object or action it is*. This would remain true even if, on any given occasion, a relation of strong supervenience (Kim, 1993) obtained between an individual's (token) mental acts and physical states of affairs. That is to say, even if it be granted (as the author is inclined to do) that each and every specific mental event depended on physical events in the senses (a) that the mental could not have occurred if the physical had not occurred, and (b) that the mental would have been different if the physical had been different, all this remains true.

Since our primary interest is in the scientific legitimacy of the psychological construct system, the critical point here is that we could not replace such locutions as "she *perceived* it as a compliment," "he *remembered* her name," or "she *learned* her times tables" with descriptions of the biological events that transpired on any given occasion where these descriptions were apropos. Such descriptions could never serve the function in human communication that the locutions "perceived," "remembered," or "learned" perform in a language--the marking off of actions and achievements that occupy certain places in our way of life.

Argument: Psychological Concepts Predate Biological Knowledge

Concepts such as "learning," "remembering," "having a motive," and "acting for a reason" predate significant biological knowledge by thousands of years. They were *created and used* in the first place by persons

with negligible biological knowledge. Further, they are used competently today by children with virtually no biological knowledge. When William Shakespeare or the contemporary child says, "I just remembered the name of that beautiful Egyptian queen who enchanted Marc Antony," and then proceeds to demonstrate that this is so by stating, "It's 'Cleopatra,'" they illustrate that they have a mastery of the concept. Even though we all assume biological events occurred at their respective moments of recollection, and even though we believe that knowledge of the biology of memory is of the utmost importance in understanding our physical functions and conquering diseases such as Alzheimer's, what is clear is that *the individual has the concept, and that having the concept requires nothing in the way of biological knowledge*. Indeed, we might imagine the opposite situation, that in which Shakespeare or the child knew exactly what just transpired in their brains, but lacked the concept of "remembering." In such a circumstance, we should have to say, "They have no idea of the significance of those brain events *unless* they can say that they are the brain events involved in remembering -- lacking this, they know only that some brain events of uncertain import just occurred."

Argument: Emergent Phenomena

It is a commonplace of human experience and of science that, when matter becomes configured in certain ways, new properties are exhibited by the resultant entity that are neither identical to nor inferrable from the properties of its individual physical constituents (Broad, 1925; Kim, 1999; Teller, 1992). Thus, Leibniz notwithstanding, atoms do not so far as we know have consciousness, although when billions of them become configured as homo sapiens, this property is exhibited by the individuals so embodied (McGinn, 1999). Bits of metal and silicon do not have the property of computation ability, but when assembled into the whole that is a computer, that holistic entity does. In such cases, the lexicon or construct system of the parts does not contain the concept of the emergent property, a feature that represents one instance of what Kuhn (1970) has famously described as the "incommensurability" of construct systems

(see also Ossorio, 1982). A different language -- different concepts -- are required to make the necessary distinctions to capture the phenomena at the more complex, emergent level.

In discussions of the biology of humans -- of synaptic events, hypothalamic functions, alpha brain waves, cerebral blood flow, etc., one does not find predicated of these biological structures and processes such properties as motives, understandings, beliefs, memories, emotions, and so forth. Even though the whole that is an embodied person, when such person has been socialized into and is participating in a human community and its ways of life, exhibits these phenomena, they are not contained in the construct system of biology. A different, far older, and indispensable vocabulary is needed: the vocabulary of psychology.

Conclusion

Overall then, the conclusion must be drawn that, even though we are embodied beings, and even though our actions inescapably involve and require the transpiring of biological events and processes, we cannot replace the language of psychology with that of biology. Even at a stage far advanced from our own of (for example) knowledge of the biology of memory, it will always remain the biology of "memory," since no description of a biological state of affairs can replicate the highly functional distinction drawn by this concept.

Can Psychological *Explanation* Be Replaced?

If we take it, per the arguments above, that psychological concepts are not replaceable by biological ones, the question still remains of whether or not psychological *explanations* might be replaced by biological ones. Clearly, there are countless cases where psychological states of affairs are correctly attributed, in whole or in part, to biological ones. Scientific findings attest that certain memory problems are attributable to Alzheimers disease, learning disabilities to brain dysfunction, positive feelings to

the presence of endorphins, negative moods to neurotransmitter deficits, and much more. All of these examples, it may be noted, retain psychological concepts in their specification of what is to be explained, but employ biological concepts in their explanations of these states of affairs. The question becomes one, then, of whether or not we will one day be able to explain all psychological phenomena in this fashion.

There are reasons to believe that this cannot ever be the case. In this section, some of the more compelling of these will be related.

The Possibility of Theory Reduction

If one examines the going variety of behavioral explanations, both in our most prominent behavioral theories and in everyday human attributional activity, one can see that they fall for the most part into explanations in terms of five types of factors. The first of these is *cognitive* factors: persons' behaviors, emotions and more are explained by reference to their beliefs, interpretations, and knowledges (e.g., "He was angry because he perceived her remark as demeaning"). The second is *skill or competency* factors ("She was successful in resolving the dispute due to her excellent negotiation skills."). Third is *motivational* factors ("He cheated in order to win the game."). The fourth is *dispositional* explanations ("She had a hard time making new friends because she was so shy."). The fifth is biological factors ("He is unable to inhibit rage due to a brain injury that he sustained.").

The notion under consideration in this section that *all* psychological explanation may be supplanted by biological explanation has to do with a certain kind of reductionism, one referred to by Teller (1995) as "theory reduction." Applied in the present instance, this sort of reductionism would have it (at least) that the four types of psychological explanation cited above (cognitive, skill, motivational, and dispositional) all reduce to biology and will one day be supplanted by biological explanations. That is to say, for example, that where we might now say, per Beck and his followers, that "Jack became depressed after losing his job because it

reactivated his old core beliefs in his intrinsic inadequacy,” we would in future explain Jack’s depression in terms of what transpired biologically on this occasion, and would be able to dispense with the cognitive type explanation.

Some reports to the contrary notwithstanding, reductionism is neither dead nor a dirty word in science. Many prominent philosophers of science (Bickle, 1998; Churchland & Churchland, 1994; Searle, 1984; Teller, 1995; Toulmin, 1963) have made the observation that science has successfully utilized reductionistic explanations many times in its history. Searle (1984), for example, cites the example of how all of the phenomena explainable by reference to the old gas laws were shown to be better accounted for by the theory of statistical dynamics. In cases such as this, what is retained is the original description of the phenomena to be explained (e.g., “heat” or “pressure”). What is changed is the nature of the theory and the construct system utilized to account for these phenomena.

This being the case, the question becomes one of when, or under what conditions, such reductionistic moves may be considered scientifically successful ones. Before offering a positive answer to this question, I should like to dwell briefly on what I take to be a common (and mistaken) basis for making reductionist assumptions, including the assumption that human behavior is wholly explicable by reference to biological factors.

The lure of “ontological superiority.” The basis I refer to is perhaps best labeled the assumption of “ontological superiority.” To express the matter in its starkest terms, the notion is that some phenomena are more real than others. The particular version of this belief that is most pertinent here is that *only physical states of affairs may be considered to be “really real.”* On this view, what “really” exist are physical objects, processes, events, and states of affairs (Ossorio, 1998). To allege otherwise can only be to posit the existence of spiritual substances--entities akin to ghosts and souls and Platonic ideas--and this is of course a decisively deficient scientific move. (NB: There is a second popular version of the ontological superiority belief, namely that “smaller is realer”--that what there “re-

ally fundamentally *are*” in the world are electrons and gluons and mesons and the other ultimate particles of contemporary particle physics. I shall not consider this view since (a) it is not the reductionist move at issue here, (b) the biological reductionist does not subscribe to it in most cases since, on this view, some of the grosser, more molar, and thus *less real* phenomena that come under fire are things like brains and synapses and neurotransmitters; and (c) the general notion that smaller is somehow realer, when generalized, would commit us to making absurd claims like “the cornerstone is more real than the building.”)

What is wrong with holding that only physical states of affairs are really real, and does its denial involve us in an unscientific spiritualism? If one backs off from any commitment as to what specific phenomena should be counted as real, one can ask the more fundamental conceptual question, “What is it to say of any object or state of affairs that it is ‘real?’” When we, the community of language users who have agreed to use words consensually, use this locution, it would seem that its meaning is well captured in the notion that *reality is whatever in fact is the case*. To say of some X that it is “real” is to say that it is in fact the case. It is to assert, to express the matter negatively, that X is not fictional, or imaginary, or illusory, or in any other possible sense *not* the case.

To claim that only physical realities can be taken to be real, from this vantage point, is to expand the definition of “real” to the following one: “Reality is whatever in fact is the case *so long as ‘it’ has physical properties* such as mass, location, extension in space (if an object); or directionality and magnitude (if a force) . . . etc. On this definition, carried to its logical conclusion, all of the following statements are *not about anything real*:

1. A *rule*, or *operating principle* of science, is that one ought to subject one’s theoretical contentions to empirical test.
2. American blacks and women have striven vigorously in recent times for equal *rights* and *opportunities* with white males.

3. Raising one's middle finger to another has a different *significance* in America than it has in the outback of Australia, and, consequently, engaging in this behavior is likely to have different consequences.
4. Mutual *mistrust* between the Arabs and the Israelis is a major obstacle to peace.
5. Einstein's *concept* of relativity revolutionized physics.

None of the states of affairs italicized in these sentences has physical characteristics. Rules of science, human rights and opportunities, significances, mistrust, and concepts cannot sensibly be said to have mass, extension in space, location, charge, or any other physical property. Do we really want, on this account, to deny them *reality status*? Could we seriously look at each of these sentences and declare, "The italicized words denote nothing real whatsoever"? Further, denying them reality status, would we want to take the next logical step and conclude that therefore none of them could in principle have had any influence whatsoever on the scientific practices, social movements, interminable armed conflicts, and scientific revolutions mentioned in these sentences?

These are the implications of holding to a position that only physical realities are "really real," and of denying the validity of a definition which states that reality is simply whatever in fact is the case. Finally, it may be noted that in attributing reality status to such phenomena as rules, operating principles, relations of mistrust, significances, and concepts, I am not speaking in the least of spiritual substances or entities such as ghosts or souls. I am speaking of everyday, garden variety, empirically discriminable realities.

Thus, claims of ontological superiority, and especially the claim that some states of affairs alone are entitled to be regarded as real because they are physical states of affairs, cannot seriously be carried off. Therefore, they cannot serve as successful rational bases for preferring theories couched in physicalist terms.

What does justify theory reduction? On what basis, then, is it scien-

tifically permissible to make the particular reductive move that is replacing one theory, expressed in one construct system, with another expressed in a different construct system? The answer to this question is a commonplace of scientific understanding: *A new theory is to be preferred to an old when it does a better job of accounting for the empirical phenomena in question* (Kuhn, 1970; Searle, 1984; Toulmin, 1963). It is to be preferred, for example, when it explains the phenomenon better, when it generates better predictions, when it is more parsimonious, and/or when it is able to subsume more phenomena than its predecessor. In effect, the justification here is the same as the traditional and universal one for any theory, reductive or not, that purports to supplant another: it must quite simply do a better job than the theory it replaces. Reductionistic theories, then, may be scientifically successful, not on the basis of some alleged ontological preeminence, but only when they meet this requirement.

The non-replaceability of psychological explanation. Above, it was demonstrated that psychological concepts cannot be replaced by biological ones. It follows logically from this, first of all, that *any explanation posed in psychological terms cannot be translated into, and thereby replaced by, one posed in biological terms*. If, then, the theorist, clinician, or person in the street gives a cognitive, motivational, skill, or dispositional explanation, the precise discriminations captured in such explanations (e.g., “because he wanted to win,” “because she perceived it as an insult,” “because he is shy”) are not translatable into biological ones. As demonstrated above, there are no concepts in the biological lexicon that do the precise work -- that draw the precise discriminations -- that these psychological concepts do. Further, as noted previously with respect to the notion of making a promise, their indefinitely large number of physical realizations, their changing realizations over time, their adequate description requiring more than a commitment to the physical events involved, and their inevitable context dependency, all argue strongly against any isomorphic correspondences between any such psychological explanations and any biological state of affairs.

But, as noted from the outset of this paper, some reductionists would say, “We do not wish to *replace* these explanations by translating them,

we wish to *discard them entirely!*” On this view, captured in the opening quote of this paper, the entire enterprise of psychology, concepts and explanations alike, represents the remnants of a prescientific “folk psychology,” and is woefully scientifically inadequate. Thus, there would be little point in translating it or “reducing” it into biological terms--of substituting a biological description, for example, of what was going on physiologically when a person “pondered” or “perceived” or “remembered” something, for a psychological description. Rather, what one as a scientist ought to do is to abandon entirely this traditional system of constructs and explanations, and to replace it with that of neuroscience (see Churchland, 1988; Churchland & Churchland, 1994, on “eliminative materialism”).

Let us examine the plausibility of this project by considering a concrete example, one that exemplifies (and will stand proxy for) the common situation of explaining psychologically the behavior of a person who is participating in an existing social practice, and whom we would take to be acting for reasons that are intelligible within that practice. The example involves an observation that could be made by any interested observer many times over on any summer afternoon. In a baseball game, a situation exists in which there is a runner on first with no outs. The batter bunts. Asked later why he did so, he gives a psychological account of his action, one that focusses primarily on the motivation or purpose behind it: he was “trying to advance the runner into scoring position.”

Can we count this a good explanation? If one understands baseball, it certainly accounts for the batter’s behavior, and is highly parsimonious. Generalized, the proposition that baseball players will engage in behaviors designed to place their teammates in scoring position would be highly predictive. And since, per our previous argument, we are not required to regard the likes of “motives” and “understandings” and “rules” as somehow unreal or scientifically invalid, we seem to have a sound, usable explanation here.

Can neuroscience, or even biology in general, offer us a better one? Clearly, not at the present time, but what of the future? Let us say it is

a hundred years from now, and we are in a position, via computers and highly advanced biological tracking devices, to record every biological event occurring in the batter. Baseball has survived in its present form and, watching a game one afternoon, we observe the runner on first, no outs, bunt sequence. As eliminative materialists and neuroscientists, we are restricted to giving a *completely* biologic account--i.e., one expressed completely in terms of the neuroscientific (and other biologic) events that transpired in the batter on this occasion. We cannot introduce anything having to do with his or her "motivations," "perceptions," or "knowledge," since on our account, there is literally no reality such as having a motive, acting on one, following a rule, understanding a strategy, and so forth. These psychological notions are nonsense--they belong to a failed, scientifically invalid explanatory system. So, the sequence occurs, but there is literally *no such operative reality* as "being motivated to advance the runner into scoring position." When the sequence does occur, as it does countless times each summer afternoon, and there can be no recourse to such a notion, what *can* the eliminative materialist say about what just transpired? It would seem that it could only be some statement of the following general form: "The constellation of biologic events X_1 through X_n just occurred, with causal connectons C_1 through C_n obtaining between certain of these events."

However, it would seem completely inconceivable that this sequence of events culminating in the bunt *would have occurred at all* were there no such operative realities as "knowledge of baseball rules and strategies" and "a motive to advance the runner." Compare: Martians in the future visit post-apocalyptic earth. In the rubble, they encounter a strange device, but one that we earthlings today would recognize as an electric clock. The Martians, being highly electronically advanced, examine it and understand completely and perfectly its physical structures and processes. However, in their culture, they do not (however improbably) have the concept of "time" or the related cultural activity of "telling time." One must ask: Would this device, whose physical processes we have stipulated are understood completely and perfectly by the Martians, *even exist -- would it even have been invented* -- had there never been such things as the

human concept of time and the social practice of telling time? Paralleling this, we must also ask: would the bunt *have occurred at all* were there no social practice known as “baseball” and no such intelligible motive within it as that of “advancing the runner to scoring position”? The answer to both of these questions would seem to be a decisive “no.”

What is abundantly clear is that at the present time there is no serious possibility of replacing apt psychological explanations of human behavior with biological ones (cf. Davidson, 1970; Horgan & Woodward, 1985; Ossorio, 1982). That is to say, there are no neuroscientific or broader biological accounts that begin to approach apt psychological ones (such as “in order to advance the runner”) in usability, parsimony, and predictive and explanatory power. And, in light of all that has been said above, it would seem impossible in principle that there ever will be

Conclusion

Overall, then, there is no reason to believe that psychology will be replaced or subsumed by biology. Indeed, it appears extraordinarily unlikely, if not impossible, that this could ever be the case. For on numerous grounds, we have seen how neither psychological concepts nor psychological forms of explanation are replaceable by biologic ones. Rather, it appears that the latter must take their place alongside of, and often in concert with, such explanations. At the end of the day, there is no reason to conclude that “it’s all really biological.”

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