Alternative Assumptions for Neuroscience: Formulating a True Monism

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The field of experimental psychology, especially neuroscience, is exploding with important advances in research and medical technology as well as significant findings in brain/behavior relationships. As Hedges & Burchfield have shown in their chapter of this volume, the history of neuroscience research on depression is filled with noteworthy developments. For this reason, the current assumptions and overall view of neuroscience research appear to have served this field well. Why, then, explore alternatives? Why describe in this chapter a different set of presuppositions for neuroscience inquiry?

The answer is at least twofold. First, presuppositions are notoriously difficult to critically examine and test. They occur at such a basic and often unrealized level that testing them scientifically is difficult, if not impossible. In fact, we will argue that the current assumptions of neuroscience have not been empirically tested. Second, there is reason to believe that some of the main assumptions of neuroscience, at least as understood by many, are somewhat constricted and often misleading. We will try to show in this chapter that a better approach might be possible, one that is more consistent with current neuroscience research and more stimulating for future investigations.

Our alternative is a particular kind of monism or oneness of mind and body that we believe is more in keeping with the original pioneers and spirit of neuroscience. Indeed, we hold that many neuroscientists already assume this type of monism informally. Our job is to articulate it more fully for possible use in experimental research and practical application. Consequently, we outline some of the implications of this alternative conception for neuroscience, using

research on children who are diagnosed with Attention-Deficit Hyperactivity Disorder (ADHD) as an example of how this alternative view of inquiry might make a significant and positive contribution.

Current Assumptions

Perhaps the central presupposition of neuroscience is that the mechanisms of biology are sufficient to explain the human mind and behaviors. In other words, many neuroscience researchers assume that they can explain their findings exclusively in terms of biological mechanisms. Consider the research on children diagnosed with ADHD. Kirley et al. (2002) and Hawi et al., (2002), for example, indicate that abnormalities in the dopamine and serotonin systems of the prefrontal cortex and related subcortical systems explain (or are responsible for) the distractibility of ADHD children. Although these researchers placed several qualifications on their conclusions, it is clear they considered biological factors in the brain to be responsible for the behavioral effects that occurred in the individuals of their study who were diagnosed with ADHD. No other factors than biological were identified as having this responsibility, even partially. The biology of the body alone was assumed to be sufficient to explain and account for their research findings.[1]

This presupposition or assumption is known generally as **materialism** – the sufficiency of the material of the body (biology) alone for explaining our minds and behaviors (Chapter 5; Churchland, 1986; Dupre', 1993; Fisher, 1997; Muse, 1997). This assumption is so common in neuroscience that it is rarely made explicit or formalized. Indeed, few neuroscientists specifically argue for it, and many neuroscientists may not formally intend to make this assumption. They are merely using the traditional explanations and methods of their discipline – which allows them to garner research funding and publish their findings. Yet, this lack of

explicit intention does not mean that this presupposition is not assumed. As noted neuroscientist Elliot S. Valenstein (1998) observes, "It was not so very long ago that the cause of mental disorders was thought to be rooted in early experiences within the family, but now it is widely believed by most authorities and the public alike that the cause is a chemical imbalance in the brain . . . . Brain chemistry is believed to be not only the cause of mental disorders, but also the explanation of the normal variations in personality and behavior" (p. 1).

Two features of materialism will help clarify how materialism is assumed in neuroscience. First, materialism does not mean here merely the importance of the body. As we will show, our alternative to this assumption also involves the importance of biology and the body. Materialism (and sufficiency) here means exclusive reliance on mechanisms of the body for explanation – whereby other, nonmaterial and nonbiological factors are viewed as less than fundamental or unimportant (see Hedges & Burchfield, this volume). Materialism in this sense does not mean the nonexistence of the nonbiological factors; it means their lack of importance. Only the matter matters. If nonbiological factors were fundamental or important, they would be involved in this research at the outset or described as distinctly missing for full understanding and explanation.

The second feature of this materialist assumption is that it only pertains to the explanations or interpretations made of neuroscience data, not to the data themselves. For example, the data of Kirley et al., (2002) and Hawi et al., (2002) may clearly indicate the involvement of neurotransmitter abnormalities in the distractibility of those diagnosed with ADHD. However, it is the assumption of materialism – not the data – that leads these researchers to make the additional inference that only biological factors are involved in their findings. These researchers do not state this inference explicitly, but they interpret and explain

their findings as though nonbiological factors are irrelevant to their data. The problem is that no data in these studies support this interpretation. Indeed, as we will show, it would be a very rare piece of research that could make the additional inference that nonbiological factors (e.g., culture, spirit) can be ruled out as important in interpreting the results. This interpretation is typically made because of a usually unexamined theoretical assumption – the assumption that the biological is sufficient for such explanations.

Even when nonbiological factors have demonstrated involvement in a psychological disorder, neuroscience research is primarily interpreted as if biological factors are sufficient (Churchland, 1986). In ADHD research, for example, there is considerable evidence that environmental factors, such as family-environment (Biederman et al., 1995), play an important role. Still, few neuroscience researchers assess both the biological and environmental factors involved in ADHD. Common research practices, especially, lead these researchers to assume that they can conduct their studies and explain their findings without reference to nonbiological realities. Researchers may assume they can limit a specific study to the biological only, with some other investigator studying the nonbiological facets of the topic of interest. However, this assumption is still materialistic because it assumes that the biological can be studied without the nonbiological, or, to put it another way, that the nonbiological is not needed to make sense of the biological.

Many neuroscientists also couch their explanations in qualified terms, such as "is implicated in," "plays a role in," and "contributes to" – as in "serotonin systems play a role in ADHD distractibility." This terminology implies that other factors could be involved – play a role – in the object of inquiry (e.g., ADHD distractibility). We support this qualification, as our own alternative will show. Still, such qualifications do not violate the assumption of materialism

unless nonbiological factors are the "other factors" to which these qualifications refer. A quick review of neuroscience articles, however, shows that this qualifying terminology refers primarily, if not exclusively, to other biological factors. Nonbiological factors are seldom implied, let alone explicitly noted in this regard, leaving the assumed sufficiency of the biological (materialism) intact.

Again, we recognize that materialism is so common in neuroscience that it is rarely made explicit or formalized. Few neuroscientists specifically argue for it, and many may not formally intend to make this assumption at all. They are merely following the traditional explanations and methods of their discipline. However, our point here is that this lack of explicit intention does not prevent the assumption of materialism from being influential to those who read and consume neuroscience articles – such as students, physicians, the lay public, drug company executives, and psychologists – thus having potentially significant practical implications.

Implications of Current Assumptions

Let us take a look at some of these implications, especially as neuroscience research is interpreted by psychologists, students, and the general public. We will see that the assumption of materialism, however unintended, is a potent force in psychology, neuroscience, medicine, and society. The power of the pharmaceutical industry is perhaps one of the primary and continuing impetuses for this materialist interpretation (Relman & Angell, 2002). If a person's biology (e.g., brain electrophysiology) is solely responsible for his or her emotion and behavior (e.g., ADHD, depression), then drugs are an effective and easy treatment for changing emotion and behavior, which benefits the pharmaceutical industry. If, however, nonbiological factors are also important to mood and behavior, then these drugs could be perceived as less effective, resulting

in decreased pharmaceutical revenues. In other words, there are significant economic forces that support the assumption that nonbiological factors are unimportant.

What types of nonbiological factors might there be? Many scholars have suggested, for example, that culture is an important consideration in understanding and accounting for human behavior (Geertz, 1973; Ratner, 1997; Richardson, Fowers, & Guignon, 1999; Shweder, 1991). If culture is not a biological factor, as many scholars presume (see Pinker, 2002 for alternative view), then materialism would imply that the researchers do not need culture to explain their findings. In this sense, explaining the distractibility of ADHD children requires only brain mechanisms and not cultural factors. After all, Kirley et al., (2002) and Hawi et al., (2002) (above) did not present their findings as if they were incomplete, requiring cultural factors to make full sense of their data. Their explanations make clear that they believed the biological mechanisms cited in their articles were alone responsible for their findings.

By contrast, the importance of nonbiological factors has long been widely recognized in psychology and psychiatry, as evidenced by the number of compound-word models – "bio-psycho-socio-etc." – that are proposed as alternatives to materialism in psychology (e.g., Paris, 1998; Sarafino, 2001; Whitbourne, 2000).[2] These models show how many scientists sense the incompleteness of materialist explanations and postulate a number of other factors, such as culture (the "socio"), to make them complete.[3] We support these efforts. However, these compound-word alternatives rarely serve as true alternatives to current neuroscience assumptions. As we will see, many compound-word conceptions retain assumptions associated with materialism and overlook the most difficult issue of materialism – the issue of human agency.

Agency. Human agency is the notion that humans have free will, choices, or possibilities. Whatever humans do – how ever they think and behave – the notion of agency says that they could have acted or thought otherwise (Rychlak, 1988; Slife & Fisher, 2000). Human agency is rarely mentioned in neuroscience research. As Chapter 5 explains, the assumption of materialism – the custom of explaining things as though the biological were sufficient in itself – has led neuroscientists to present their findings as if they were complete without human agency. This is not to say that some neuroscientists do not assume informally that something like agency, such as top-down causation, is occurring in the human mind, with some assuming it more formally (e.g., Brown, Murphy, & Maloney, 1997). Nevertheless, most neuroscientists make no mention at all of agentic factors in their research reports. They, instead, explain their findings using conventional understandings of biology, such as natural laws. The clear implication to the lay consumers of this research is that they consider biological mechanisms to be solely responsible for their findings.

If biological mechanisms are solely responsible – sufficient in themselves to explain human behaviors, thoughts, and values – the implication is that agentic factors, such as a person's decisions, cannot be responsible, even partially. Some neuroscientists might say these decisions are themselves taking place in the brain (and, as we will later describe, there is an important sense in which we agree). Still, it is one thing to assume that decisions take place in the brain and quite another to assume that the mechanisms of biology are solely responsible for these "decisions." In other words, the issue here is not the importance of biology per se; the issue here is the adequacy of the mechanistic interpretation of biology. By **mechanistic**, we mean that biology is frequently understood to be governed and controlled by natural laws (causal

necessity), much as machines are considered to be controlled by natural laws – hence the label "mechanistic."

With this interpretation, human action, and thus brain action, is no different from any other natural event. The natural event of a boulder rolling down a mountain is not considered to be agentically responsible for the direction it rolls. The boulder cannot do otherwise than what natural physical laws – the mechanisms of nature – dictate. The boulder thus has no self-directed possibilities and thus no agency. It might seem silly to talk about boulders in this manner – analogizing boulder actions to human actions – but we use this analogy to raise the natural law question: If our brains are governed by natural laws, why expect our brains, and thus our minds, to be different in kind from the boulder rolling down a mountain?

We should be clear that we, like many neuroscientists, consider our brains to be quite different from boulders. The boulder analogy is only meant to help us begin to understand the reason for this difference. Or put another way, this analogy is intended to help us understand how the brain and the boulder have to be different: they both cannot be governed by natural laws in the same sense. Otherwise, our actions are no more purposeful and meaningful than those of the boulder.

We recognize that some people may contend that the boulder analogy is too simple – that biochemical processes are far more complex than a boulder rolling down a mountain. Some may even hold that such processes are so complicated that they emerge into a different form altogether, with different qualities and properties (e.g., Brown, Murphy, & Maloney, 1997; Brown, 2002). However, the question here is: do these emergent processes transcend the determinants of natural law? In other words, these processes could have quite different

properties from those they emerged from, without these properties escaping the control and determinism of natural laws.

Complicating our boulder analogy might help illustrate this issue. We could enlist millions of boulders for our analogy, rolling down complex mountains and hitting one another in complicated ways. There is no doubt that we would have a fascinating system of boulders interacting in patterned and perhaps even "emergent" ways. However, there is also no doubt that most people would view this system of complex boulder interactions as still controlled and ultimately determined by natural laws. Neuroscientists may suspect that biochemical processes are different even from such boulder systems, but the natural law question is again pertinent: Do these differences include the escape of natural laws? Maybe the reason the boulder analogy seems oversimplified is agency itself. That is, our brains have a kind of agency and are not merely a complex system of natural laws.

Mixing Agency and Natural Law. Can we put agency and natural law together in the same explanation? Let us return to our boulder analogy for help. If the boulder was to roll into a hiker, we would likely not hold the boulder agentically responsible for the hiker's injuries, because the boulder could not have done otherwise than it did. From this same mechanistic, natural law governed point of view, humans would have no possibilities in this agentic sense and could not be held agentically responsible for their actions (Rychlak, 1988; Slife & Williams, 1995). The good deeds of humans could not be praised and their criminal actions could not be blamed, because the people involved in these behaviors were not ultimately responsible for them (Honderich, 1988, 1993; Pereboom, 2001). Even a person's desires, intentions, and preferences would be totally determined by natural laws and thus determined by the causal necessity of the relevant neurochemical processes.[4]

The responsibility issue has led some neuroscientists to recognize the importance of agency in the brain. Pinker (2002), for example, straightforwardly acknowledges its importance in this passage: "The experience of choosing is not a fiction regardless of how the brain works. It is a real neural process, with the obvious function of selecting behavior according to its foreseeable consequences" (p. 174). The problem is that free will (choosing) and determinism (mechanistic processes) are typically viewed as incompatible with one another (Rychlak, 1981; Slife & Fisher, 1999). How, then, can agency be a "real neural process" and thus allow for personal and agentic responsibility?

First, there is an important sense in which materialism allows a type of responsibility. After all, when the boulder hits the hiker, there is a real sense in which the boulder is responsible for the hiker's injuries. Similarly, there is a sense in which persons acting criminally – whether or not they are controlled by external means such as natural laws – are responsible for their actions (Slife, Yanchar, & Williams, 1999). However, this is not the type of responsibility in question here. The issue in question is whether the boulder and human criminals could have directed themselves to act otherwise than they did. In this chapter, we have consistently referred to this issue as agentic responsibility. Without agentic responsibility, the boulder and criminal have to act the way they do, because the natural laws and principles that govern all natural events determine them.

A major problem with this deterministic feature of materialism is that many people believe that humans have agency, and thus some agentic responsibility for their actions. This belief might be easily discounted if it were merely the belief of naïve lay persons. However, many prominent scholars and researchers of many disciplines have contended that agency is a basic characteristic of humanity (Van Inwagen, 1983). The law, for instance, presumes that

humans have agency until proven otherwise (Rychlak & Rychlak, 1998), and ethicists assume that moral actions require specifically agentic responsibility (cf. Richardson, Fowers, & Guignon, 1999). In addition, many psychologists and neuroscientists hold that humans are agentically responsible and thus self-determined in this same sense (Brown, 2002; Howard, 1994b; Pinker, 2002; Rychlak, 1988).

Although the amount of self-determination may be in question, humans are frequently thought to make decisions and choices that are reflected in their behavior and attitudes. Unlike boulders, and even complex interactions among millions of boulders, humans are thought to act purposefully, choosing one possibility from among others and implying that there are reasons or meanings involved in the particular possibility chosen. In this sense, a good deed from a human being is meaningful because the person could have acted otherwise. A "good deed" from a computer, on the other hand, is not meaningful in the same sense because it could not have acted otherwise than what the mechanisms of its hardware and software specify. Thus, many scholars and researchers believe that agency is necessary for meaning as well as agentic responsibility. In other words, neither meaning nor agentic responsibility is possible if biological mechanisms are the only factors responsible for our behaviors and thus are sufficient for explanation. Humans would not be different, in this sense, from a computer in its lack of agentic responsibility – another type of mechanism.

Materialism as a One-Sided Dualism

This problem of agency is the reason that some have cast the assumption of materialism as a one-sided dualism (Chapter 5; Muse, 1997). Conventional (two-sided) dualism is the notion that humans have two (dual) separate realities – the immaterial mind and the material body. The philosopher Rene Descartes is noted for believing that two such realities are necessary to truly

understand humans (Descartes, 1641/1952). In fact, the problem of agency is one of the main reasons he felt it necessary to postulate two separate realities (Griffin, 2000; Toulmin, 1990). Although Descartes would have agreed with today's neuroscientists that the body is best understood as a predictable reality, governed by natural laws (mechanism), he realized that such entities are rarely considered agentic. As we have discussed, mechanisms such as computers cannot do other than what they are told through their hardware and software, so Descartes formulated a second, nonmechanistic reality to house agency – the mind.[5]

Few neuroscientists have followed Descartes' lead in endorsing this second reality. Indeed, many neuroscientists have argued that they are monists (with only one reality) because their explanations assume that only the body is responsible for behavior, including what might be considered "agentic" or decision-making behavior. If this is true, then they are materialists in the sense we have defined it here, because this type of monism would imply the sufficiency of the body and the biological for their explanations. However, as Chapter 5 describes, this materialist position can also be understood as a one-sided dualism. That is, neuroscientists could merely be focusing on the body side of Descartes' dualism, ignoring what Descartes considered the mind, and keeping all the other assumptions of Descartes intact.

The obvious problem with this understanding is that neuroscience is, in an important sense, all about the mind. This discipline investigates and delves into memory, intelligence, decision-making, and a host of other topics involving the mind; the "neuro" of neuroscience denoting this fact. Still, it is also clear that many neuroscientists view the mind as a mechanism of the body or the brain. Just as they have assumed that the material of the body is sufficient to explain the body, they have assumed that the material of the body is sufficient to explain the mind, another form of materialism.

If, however, the material of the body works mechanistically, then the agency that Descartes housed in the mind either remains to be explained or does not occur. The brain would work like any other natural object – bound by natural laws like the boulder or the computer – and disallow true choices and decisions, meaning and personal responsibility. We say true choices and decisions because choices and decisions that are controlled ultimately by external entities, such as natural laws, are not truly the choices and decisions of the persons supposedly making them; they are the "decisions" of the natural laws that control them. It is this sense in which many neuroscientists can be said to be one-sided dualists: materialism prevents them from accounting for both qualities of the Cartesian mind – especially its agentic qualities – so they focus on the mechanisms of the body. This does not mean that the body is not vitally involved in decision-making and choosing, but it does mean that decisions and choices, and thus the mind in Descartes' sense, cannot be explained as the product of biological mechanism.

There is also considerable historic evidence, as Chapter 5 argues, that this one-sided dualism (materialism) is method-driven. That is, the original move of neuroscience to the body was not the result of neuroscience data. Early scientists moved toward the bodily and material side of Descartes' dualism because of their methods, not because they deemed the bodily side sufficient in itself for understanding human behavior. The methods that had worked so well in the natural sciences were specifically formulated for material and non-agentic objects. These scientists had no methods to study the Cartesian mind, even if they had wanted to. The Cartesian mind was immaterial and filled with, presumably, an unpredictable free will. Understandably, they ignored study of this notion of the mind and focused instead on the body, with its mechanistic predictability.

The point is that there is an important sense in which neuroscience explanations are dualistic, because they have not – under the assumption of materialism – accounted for important, agentic qualities of the mind. Some scholars may believe they have evidence that agentic qualities do not exist. They might argue that neuroscience data indicate the elimination or nonexistence of agentic qualities because biological mechanisms are sufficient in themselves (Churchland, 1986; cf. Pinker, 2002; Valenstein, 1988). However, as we have discussed above, the sufficiency of the mechanistic and the elimination of agency are the result of inferences beyond what the data can support. In other words, assumptions have been made in the interpretation of the data, such as materialism, without the data requiring these assumptions (see "Current Assumptions" section). If this is true, then there is no evidence against agency; there are only interpretations made about the data that omit agency as a consideration rather than eliminate it as a reality, leaving a one-sided dualism.

This creates an interesting dilemma, which is a modern variation of the ancient mind/body problem. Materialism presumes that the mechanisms of the body are sufficient and thus operate like any other natural process, whereas agency presumes that at least some qualities of the mind are not mechanistic in this sense and cannot be controlled by natural (biological) laws. Either humans have a predictable mind that is controlled mechanistically by the body (its neurobiology), but unfortunately cannot have meaning and agentic responsibility. Or humans have an unpredictable mind that is controlled agentically by its choices and decisions, but has little scientific merit and conflicts with the predictability of many neuroscience findings.

The Alternative – Holistic Monism

In this section, we explore the possibility of a monism that may resolve this dilemma in a way that is consistent with neuroscience findings. However, to conceive of a monism, we have

to know its requirements, so we begin by attempting to clarify what these might be. This clarification will also help us to know when conventional approaches to the mind/body problem are dualistic.

Requirements of Monism. Two requirements are needed to formulate a true monism, as opposed to a dualism or a one-sided dualism:

> #1 – A monism cannot postulate two completely different realities (or ontologies) – such as a material reality and an immaterial reality. A monism requires, by definition, only one basic reality, preventing the inevitable incompatibility of two differing realities.
>
> #2 – A monism must account for the basic qualities of both mind and body, including, but not necessarily limited to, agentic responsibility and biological predictability. In other words, a monism cannot be attained by arbitrarily ignoring, deleting, or destroying one aspect of these qualities.

We assume that Requirement #1 is noncontroversial because a monism, by definition, is the postulation of one basic reality, though this reality may have many qualities or "aspects." Requirement #2 is also straightforward but some readers may need further justification. Basically, there are two reasons why a monism cannot be based on the arbitrary elimination of the qualities of one side of a conventional dualism. First, a monism is not a monism just because someone says it is. In other words, the arbitrary elimination of one side's qualities, such as agency, implies that this elimination occurs without appropriate evidence or rationale. Agentic qualities are not so much eliminated as left unaccounted for or ignored. As mentioned, there are some neuroscientists who would argue that research has demonstrated the nonexistence of agentic qualities (e.g., Churchland, 1986). However, as described above, these arguments stem from theories or interpretations, not data. There is no neuroscience evidence against agency;

there are only assumptions and interpretations made about the data, such as materialism, that omit agency as a consideration rather than eliminate it as a mode of explanation.

This omission of agency hints at the second reason for Requirement #2. Even if one side of a conventional dualism is appropriately eliminated from consideration (the first reason), this elimination does not necessarily imply that the general framework associated with dualism is itself eliminated. For example, the notion of "eliminating one side" itself assumes that the two sides operate independently of one another to some degree.[6] In other words, it assumes that the two sides are not so interconnected that the elimination of one side also eliminates the other side. This assumption of self-containment and independence is itself a defining assumption of dualism (see Chapter 5 on "atomism;" Richardson, Fowers, & Guignon, 1999; Slife, 2004). Consequently, if Requirement #2 is not met, dualism may be implicit.

Let us now apply requirements #1 and #2 to conceptions of the mind and body in psychology. Conventional dualisms, such as Freud's theory (Chapter 5; Rychlak, 1981), violate the first requirement because they postulate two completely different realities – the immaterial mind and the material body. However, one-sided dualisms are just as problematic. As mentioned, many neuroscientists have contended that materialism – the sufficiency of the body – is itself a monism (Churchland, 1994). The problem is that this sufficiency <u>eliminates</u> rather than <u>accounts for</u> the basic agentic qualities of the mind, such as meaning and responsibility – violating Requirement #2 (see "Agency" section above). A similar problem occurs with another type of one-sidedness, the sufficiency of the mind, sometimes considered the monism of idealism. Here, for example, agency alone (e.g., free will) is sometimes thought to explain or account for human behavior (cf. Slife & Fisher, 2000). Yet, this one-sidedness cannot be a

monism because it omits the import and qualities of the biological, also violating Requirement #2.

The point is that the notion of sufficiency, either from the body or the mind, is incompatible with monism. Giving special reality status to one side of a dualism – particularly through theoretical assumption rather than empirical evidence – does not account for the qualities of the other side. Indeed, the heart of the mind/body problem is that the qualities of each side of the dualism cannot account for, or be reduced to, the qualities of the other side. As described in the section above, the mechanistic body does not appear to account for the agentic mind, and the agentic mind does not seem to account for the predictability and automaticity of a healthy body, at least as conventionally conceived (Bargh & Chartrand, 1999; Park, 1999). Somehow, both properties of the mind and the body must be fully included in a true monism (Requirement #2).

Our proposal in this light is a deceptively simple one: we propose that the mind and the body are necessary rather than sufficient conditions for understanding and explaining human behavior. No one condition can be sufficient in itself for explanation and understanding. However, each condition plays an irreducibly necessary role in understanding human behavior in the same way that each part plays an irreducibly necessary role in a whole (Gazzagina, Irvy, & Mangun, 2002; Gehring & Knight 2000). Indeed, our notion of necessary condition here is best viewed as analogous to a part of a metaphoric whole (Bohm, 1980). Each individual part has a distinct role in the whole, yet each of these roles is united in a mutually constitutive arrangement of parts – the whole. In other words, each part has a unique and unduplicated function in the whole, but each part plays a pivotal role in the qualities of the other parts, and thus how this

uniqueness is expressed. To make this clear, we pause briefly from the mind and body here to explicate the qualities of a whole.

Holism. First, let us see how the qualities of a whole meet the requirements of a monism above. Beginning with Requirement #2, how does a whole allow each part to have its own qualities or role without other parts dictating those qualities or reducing them to their own qualities (i.e., sufficiency)? The key is that each part of a whole is unique and irreducible, meaning that each part cannot be reduced to or explained by the other parts. This irreducibility is evidenced by two commonsensical qualities of any whole. First, a part's very existence within a whole depends upon its being uniquely differentiated and identified as a part. Second, and perhaps more importantly, each part is a necessary condition for the whole. Each part has a distinct and necessary status because deleting any one part destroys or changes the identity of the whole.

Consider a simple stick figure. Removing its legs changes the whole from a stick figure to a symbol for a female. Also, simultaneous with this change in the whole is a change in meaning of each part. The "circle" at the top of the stick figure, for instance, loses its headness in this change. Consider also the explanation for a tragic plane crash many years ago (Time, 1979; Slife & Lanyon, 1991). All the conditions that caused the crash – the wind sheer, the weight of the fuel, the design of the plane, the tensile strength of the rivets – were simultaneous and necessary. If any one condition were absent, no crash would have occurred. The point with both of these wholes – the stick figure and the cause of the plane crash – is that all elements or parts are irreducibly necessary conditions for the whole to be the particular whole it is. Each part is distinctly and uniquely needed because its elimination is the elimination of the unique qualities

of the whole itself. This irreducibility satisfies the second requirement of a monism because holism preserves the basic qualities of each part.

Does holism satisfy Requirement #1? That is, does a whole also imply one basic reality for all its unique and necessary parts? This requirement might seem contradictory to Requirement #2, because the second requirement demands separability, whereas Requirement #1 demands inseparability – hence, the age-old difficulty in resolving the mind/body problem. However, the qualities of a whole involve this type of dialectic. The parts of a whole are inseparable as a unit, and the same parts cannot be reduced to one another (and must be valued for what they uniquely bring to the whole). They are the classical definition of a dialectical relationship: they are one and they are many, simultaneously (Gunton, 1992; Rychlak, 1976).

Requirement #1 is satisfied because each part is inextricably dependent on all the other parts for its very nature and qualities. All parts have a shared being and thus one reality because they mutually constitute one another. The head of the stick figure, for instance, gets qualities such as headness not only from its circular shape, and thus its irreducible uniqueness, but also from its relation to the other parts – the figure's trunk and legs. Another way to put this is that the qualities of each individual part stems, at least to some extent, from its relation to the other parts. Studying the parts individually will not only miss vital qualities of the whole but also vital qualities of each part, because each part derives its very nature and meaning from its relations to the other parts. In this sense, any substantive change in one part changes the whole and thus the meaning of each part.

If all things, including biological things, are wholes in this basic sense, then all the properties of wholes just described apply to them. In medicine, for instance, the insufficiency of a single biological factor is well recognized. The pathogen of disease, for example, is rarely

considered a sufficient cause for the disease itself. Other conditions of the body are also necessary, such as immune system problems, for this entity to become a pathogen. Many pathogens, such as bacteria, are often already present in the body or its environment, waiting for other conditions to change. Indeed, whether a factor is considered a pathogen at all – its very nature – depends on a multiplicity of other factors. In this sense, these other factors constitute pathogens. Pathogens also cannot be sufficient conditions for a disease; pathogens are only necessary conditions, among many other necessary conditions.

As perhaps a more relevant example to neuroscience and psychology, consider the phenomenon of depression. Hedges and Burchfield (this volume) argue, for example, that depression is better understood through necessary rather than sufficient causes. Although monoamines were once considered to be the sufficient cause of depression, many researchers now argue that this theory is, at best, overly simplistic. Many other biological mechanisms appear to be involved (e.g., "cascading effects;" Valenstein, 1996). Moreover, Hedges and Burchfield (this volume), along with Healy (1997), note the intimate involvement of nonbiological factors, such as culture, in the diagnosis and manifestation of depression. The point is that single biological factors are insufficient in themselves to produce particular cognitive and behavioral effects such as depression.

Causation and Method. These holistic explanations challenge important understandings of scientific research, including causation and the scientific method. The notion of cause, for instance, is frequently understood as a factor that is sufficient for the effect that follows (Bunge, 1959; Rychlak, 1988). That is, no other factor is necessary for the effect to occur; otherwise, it is not the cause. This understanding of causal sufficiency is the reason that certain variables were originally considered to be "independent variables" in experimental designs. These variables are

thought to be independent of, and thus causally sufficient for, the effect follows – the "dependent variable."

The problem is that this understanding of cause and effect would mean that pathogens are sufficient alone to cause disease. It would also imply that pathogens were pathogenic by nature and thus inherently sufficient causes of disease, when pathogens only make sense in conjunction with other necessary (and simultaneous) factors. Pathogens, in this sense, are not sufficient causes; they are necessary causes. This distinction also better explains the claim that smoking causes cancer. Smoking is a necessary and not a sufficient cause of some cancers, because some people who smoke never get cancer and some people with cancer never smoked. Thus, holism better explains the causality of pathogens and other medical phenomena, because a holistic cause only makes sense in relation to other simultaneous causes. Just as parts derive their very qualities from their relationship to other parts, variables considered as causes derive their specific nature and qualities from other simultaneous variables or causes. Many causes, in this sense, are only necessary and not sufficient conditions.

Current scientific methods make it impossible to determine anything more than necessary conditions. That is, no data can indicate the sufficiency of <u>any</u> factor. All data are gathered under conditions that include other conditions than the specific factor being studied. This situation is obviously true for correlational data. Correlation, as the research aphorism goes, never yields causation in the sense of sufficiency. In other words, the factors under study are never measured in a way that excludes the influence of other factors that are holistically related to the factors studied. However, the "gold standard" of neuroscience is experimental design in the formal sense of randomized, controlled, and double-blind studies (Moncrieff, 2001). According to method texts, these designs involve the "independent" variables mentioned above,

and thus should theoretically provide causally sufficient conditions – conditions that are independent of other conditions – for the dependent variables or effects that follow.

However, these experimental designs rarely seem to be interpreted as causally sufficient data. Reports of neuroscience studies, regardless of their experimental nature, rarely use causally sufficient terms, such as "produces," "causes," or "stimulates," to describe their findings. As mentioned above, researchers frequently use terms associated with necessary conditions, such as "is implicated in" or "plays a role in," as in "neurofibrillary tangles play a role in Alzheimer's disease." We believe there are two reasons for this necessary-condition terminology. First, neuroscientists recognize the distinct possibility that other, perhaps unrealized necessary conditions may also "play a role" in their findings, in the best tradition of medical research (e.g., pathogens). As explained earlier, this recognition does not necessarily mean that they have given up materialistic sufficiency, because they may assume that the other necessary conditions are exclusively biological.

Second, neuroscientists intuitively understand the frequently unacknowledged limits of scientific method. Even the most highly controlled of experimental studies—a truly experimental design—contains factors other than the independent variables that contribute to the study's outcome. These factors may be controlled or equated across experimental groups or conditions, but they are never eliminated. Their influence is present and still necessary to whatever effect occurs. For instance, the influence of gravity in most earthbound experiments may be taken for granted and even measured as equal across experimental conditions. However, this control and this equality do not mean that gravity is not a necessary condition for whatever occurs, or that the loss of gravity would not change the outcome of whatever occurs.

These understandings of causation and scientific method have significant import for neuroscience. Taken together, they imply that evidence of causal sufficiency is not possible with current research. Inherent method limitations mean that inferences about causal sufficiency are always over-inferences; researchers have evidence of necessary and not sufficient conditions. Consequently, a necessary-condition framework, such as holism, better fits neuroscience findings than a sufficient-condition framework, such as materialism. As we will also see, a necessary-condition approach better accounts for the mind and the body, not to mention the relation between the two.

Mind and Body as Holistic Monism

A holistic monism means that the qualities of mind and body are necessary rather than sufficient conditions. Both sets of qualities are vital, even pivotal, to understand the behaviors of a person, yet neither set is sufficient to explain either itself or the person as a whole. Agency is not present in a nonfunctional body, and biology is not meaningfully human without human agency. Still, agency and biology are not identical or reducible to each other. Our biology is not solely a product of our will, and our will is not solely a product of our biology.

In this sense, mind and body can each be understood as having causal import – if we understand causation in the holistic way described above. Causation from this perspective cannot be a sufficient condition for an effect. A cause is only a cause in its relation to other conditions (e.g., the pathogen). A decision or a choice, in this sense, is only a mental cause in relation to its constitutive biological causes. Indeed, these necessary causal conditions are all our methods can ever tell us about mind and body, because our methods do not exclude all other conditions. Agentic conditions are not excluded in research on the body, nor are biological conditions excluded in research on agency. (See Rychlak, 1988 and Howard, 1994 for examples

of empirical research on agency.) Indeed, if monistic holism is correct, neither set of qualities could be excluded because humans are embodied agents.

Embodied Agency. "Embodied agency" means that agency occurs in and through the context of the body, or the body occurs in and through the context of the agent (cf. Brown, Murphy, & Maloney, 1997). That is, agency is manifested in, and is not separate from, the body. However, this one basic reality – this monism – of two distinct qualities may seem contradictory to many readers. After all, the body has traditionally been associated with mechanistic predictability, while agency has traditionally been associated with an unpredictable, "free" and thus independent will. Fortunately, however, both these traditional associations are just that – associations. Viewing the body as a mechanism is an interpretation of its predictability – not a fact of its predictability. The predictability of the body can be understood in other ways, with other interpretations, as we shall see.

Likewise, viewing agency as completely unpredictable is also an interpretation. In fact, this view is likely to be a misinterpretation, because agentic theorists rarely, if ever, see agency as completely unpredictable (Howard, 1994a; Howard & Conway, 1986; Rychlak, 1988; Slife & Fisher, 2000). Many agentic theorists, for example, consider a person's agency – their choices, meanings, etc. – to be aligned with a person's goals and purposes, so that any assessment of goals, reasons, and purposes is a good predictor of agency. Similarly, a person's behavioral history is an indicator of prior choices, goals, and meanings – all, in this sense, potential predictors of a person's agency.[7]

The notion that agency is unpredictable stems from a common but false dichotomy – that natural events are either determinate or indeterminate. Neuroscientist Pinker (2002) exemplifies this false dichotomy when he alludes to Hume's fork: "Either our actions are determined, in

which case we are not responsible for them, or they are the result of random events, in which case we are not responsible for them" (p. 178). Either events are "caused," and thus determined by and related to other events, or events are uncaused or chance, and thus undetermined and unrelated to other events.

Most scientists have rightly assumed that the world consists of many related events. Otherwise, there is little reason to do science. If the world consists only of unrelated events and there is no order, then the world is chaotic or even random, with no scientific knowledge available. The problem is that if agency and free will are not determined, as we have described, then agency fits better the indeterminate side of this dichotomy and becomes the enemy of science and knowledge. In a leading methods text in psychology, for example, Heiman (1995) assumes not only that free will is essentially unpredictable or random in this indeterminate sense, but also that free will is fundamentally unrelated to anything else – otherwise, it is not "free" and independent.

This misconception of agency is significant because it has led many scientists to assume that agentic explanations cannot account, even in part, for their findings of predictability. Similarly, it has led many to assume that any reasonable level of predictability is an indication of deterministic results. For example, the behaviors of most college students are fairly predictable at the end of class – they leave. The dichotomy of determinate and indeterminate events would lead us to presume that this predictable behavior was necessarily determinate in the causally sufficient sense; the students had no real choice but to leave. Yet, there is nothing about this predictability that prohibits the students' own self-generated goals and choices – their agency – from being a necessary condition in this behavior. Their predictable behaviors could stem from consistent choices and overall goals, which are themselves freely chosen. The predictability of

the body and behavior, from this perspective, occurs as a consequence of agency, not in spite of it (Howard & Conway, 1986; Rychlak, 1988; Slife & Fisher, 2000).

Consider, for example, how agentic factors contribute to the neuroscience and predictable findings of Baxter et al. (1992) and Schwartz, Baxter, Martin, and Phelps (1996). In investigating the neurological effects of certain therapeutic processes, these researchers demonstrated that consciously and willfully withholding obsessive-compulsive behavior had the same eventual effect on distributions of neural activity – measured by positron-emission tomography (PET scans) – as the recommended drug (clomipramine) for obsessive-compulsive disorder. In other words, these findings indicate that agentic factors, such as exerting one's will to consciously withhold certain behaviors, can be just as effective as biological factors, such as drugs, in predicting even the neurological outcome of treatment for obsession-compulsion disorder.

Mind/Body System. An embodied agentic explanation also moves us away from the spatial and self-containment metaphors of Descartes. With Descartes, the mind and body reside in separate "spatial" locations, with the qualities of each considered to occur in self-contained and relatively independent entities. However, with the holism of embodied agency, mind and body are viewed as parts of a larger system in which mind and body mutually constitute one another. They are not, in this sense, independent or self-contained. Moreover, mutual constitution is not mutual interaction. When psychologists discuss interactions, whether between people or between variables, they typically mean the interaction of self-contained and thus localized entities, with the nature of each entity self-constituted before interaction.

Mutual constitution, on the other hand, means that other entities contribute to the very nature of the entity. Mind and body have a shared existence, with neither being entirely

separable or localizable in the traditional sense. Interestingly, this holistic and systemic sense of the body has been supported by recent neuroscience research. Materialist assumptions have traditionally led neuroscientists to localize mental functions in separate spatial locations of the brain (see Chapter 5). Indeed, holism would support this tradition to some degree and predict a unique contribution from distinct parts of the brain (Requirement #2). Still, holism would also predict that these unique parts receive at least some of their qualities from their relationship to other parts of the brain (Requirement #1). No one part of the brain, and thus no one spatial location, is sufficient in itself to produce the effect in question.

Consider Broca's and Wernicke's areas, for example. Until the last decade or so, these locations in the brain were understood to be responsible or sufficient for language and speaking (Damasio & Damasio, 2000). However, recent research has indicated that this materialistic understanding – both of brain function and of language – is, at best, simplistic. Language is far more complex a phenomenon, involving semantic and syntactical structures that are not material and thus not observable. Also, neuroscience research has demonstrated that language requires more than Broca's or even Wernicke's area of the brain, including many neural sites linked as systems and working in concert (Damasio & Damasio, 2000). Broca's area may be a necessary condition for language, but an act of language entails an entire system of brain functions and locations. Damaging any one region – any one necessary condition – affects language. Persons might continue in some manner without the damaged region, but their language abilities are greatly affected.

Widening the System. From this holistic perspective, there is no need to stop with the mind/body system. Holistic monists would also include the wider system of which the embodied agent is part – its context, including its environment, culture, and history (see Chapter 5, this

volume). Because holism does not limit its parts or its wholes to their locality, there is no reason to assume that an embodied agency is solely within an individual, bounded by our skin. This wider system does not mean, via Requirement #2, that we are not separable blobs of protoplasm or locatable in this sense. It merely means that we are not fully explained or understood without this wider system (Richardson et al., 1999).

As neuroscientist Valenstein (1996) notes, "it is impossible to understand consciousness and thought without considering the psychosocial context that not only shapes the content of thought, but also the physical structure of the brain" (p. 140). Indeed, modern physics has itself questioned the traditional localization of material entities (Wolf, 1981). Increasingly, context is viewed as a necessary condition for understanding the material events of physics, such as Einstein's inertial frame of reference being necessary to measure motion and time (see Chapter 5; Slife, 1993). We propose a similar move, where an embodied agent's context is also an irreducibly necessary condition for full understanding and explanation.

Consider, for example, the good deed. We would argue that all three sets of necessary conditions – mind, body, and context – are required to account for or explain this deed. First, and perhaps least controversial, at least among neuroscientists, a good deed requires a relatively sound body. Good deeds simply cannot be performed without the biological properties of a relatively healthy body. Second, the meaning of "good deed" requires human agency. As we described above, few would consider a boulder that just happens to roll passed a hiker to have done a good deed in avoiding the hiker, because boulders are determined and cannot have done otherwise. Agency, then, is pivotal for a human to be purposefully and meaningfully responsible for a good deed.

However, we are still missing a vital element in the good deed. We are missing the moral or cultural context that allows the behavior to be considered good. That is, if we are concerned at all about human meaning, and we must be if we are to account for the humanity of humans, then we need context as well as agency in accounting for it. Deeds are not inherently good, nor are deeds inherently "deeds," without the cultural and moral contexts in which they occur. In the same sense that a word or sentence gets its meaning from a paragraph or chapter, an action or behavioral pattern (personality) gets its meaning from a cultural context. Healy (1997, 1999) shows, for example, how depression gets its meaning, indeed its very existence, from the context of its culture.

Consequently, there are at least three "parts" or three general categories of necessary conditions required for a complete explanation of any human behavior: its context (the deed is good), the mind (the purposefulness of the deed-doer), and the body (the biological properties to perform the purpose). We emphasize "at least" these three conditions because we do not rule out the possibility of more necessary conditions. One of the many virtues of a holistic monism is that it allows the data to indicate what the necessary conditions are and where they begin and end. In other words, the holist has no pre-investigation restrictions about the number and quality of conditions that are truly necessary to explain human behavior. Indeed, our own postulation of three sets of necessary conditions is itself subject to test and verification.

Our point here is that holistic monism is scientifically open to whatever investigations yield on this issue. Conventional explanatory frameworks, such as materialism (body only), idealism (ideas only), and dualism (two categories only), ultimately restrict the conditions open to investigation before investigation begins. That is, these conventional frameworks are ultimately philosophical, rather than scientific in nature. Holistic monism, by contrast, carries no

such pre-investigatory, philosophical restrictions concerning conditions. It is, in principle, open to several creative possibilities. For example, several leading neuroscientists have argued that research indicates a fourth necessary condition – spirituality (e.g., Eccles & Robinson, 1984; Popper & Eccles, 1977; Sperry, 1988, 1995). We do not mean to argue for a fourth condition here. We merely wish to note the heuristic openness of holistic monism for scientific investigation.

Research Implications

For several reasons related to research, holistic monism is a better framework for neuroscience. First, it takes into account the inferential limits of current methods – namely, that traditional scientific methods can yield only necessary, rather than sufficient, conditions. Second, a holistic monism is more amenable to being data-driven – more open to other empirical possibilities and necessary conditions – than other frameworks. The problem is that conventional quantitative methods have not themselves been open to other empirical possibilities, favoring, as they have, the bodily and the biological at the expense of the agentic and the contextual (see Chapter 5). That is, traditional scientific methods were originally formulated to investigate the observable and material conditions of natural science events. Even studies of the "operationalized" manifestations of nonobservable factors (e.g., attitudes) do not mean we are studying the nonobservable factor itself (Slife, 2004; Slife, in press). Recall that this was the initial historical impetus for neuroscientists focusing on the mechanistic qualities of the body rather than the agentic qualities of the mind.

If holism is correct, however, then all categories of qualities require investigation. Agentic and contextual conditions are just as necessary and important as biological and neurological conditions. Perhaps more significantly, no category of necessary conditions can be

understood fully without the other. Research methods are needed not only to investigate less conventional agentic conditions, such as meaning and choices, but also to complement in the holistic sense the traditional, quantitative methods of biology. Space limitations prohibit a complete discussion of this issue here. However, several authors have proposed a **methodological pluralism** in which different methods, with many differing conceptual targets and philosophical bases, complement rather than conflict with one another (Roth, 1987; Slife & Gantt, 1999).

As an example, remember how the restriction to materialism and conventional quantitative methods has limited our understanding of children diagnosed with ADHD (or depression in Chapter 5). Conventional methods have focused on the effectiveness of certain drugs in treating observable symptoms – an obviously important issue. However, these methods generally attempt to establish effectiveness by controlling and excluding, through the sterility of laboratories and the determinism of experimental design, both context and agency – two conditions necessary to understanding the meaning of ADHD and thus the experiential effects of these drugs. Only recently have methods been formulated that specifically include context and agency in understanding meaning and experience. Labeled qualitative methods, to distinguish them from quantitative methods, these methods target the meanings of humans in their lived experiences of the world – their understandings, interpretations, and perceptions.

A preliminary study of children diagnosed with ADHD (Burchfield & Slife, 2003) illustrates not only the usefulness of qualitative methods in this regard but also the conceptual influence of materialism and determinism in the lives of these children and their parents. Preliminary results of this qualitative study show what taking drugs for ADHD behaviors means to these children. Foremost perhaps, the results show that many of these children view

themselves as not agentically responsible for their behaviors associated with ADHD. Although they might consider themselves agentically responsible for other behaviors, they view their biology, not their personal agency, as responsible for their "hyper" or "bad" behaviors. Parents, too, receive similar materialistic meanings. Drug taking means to them that they are not bad parents – that their children's "bad" (ADHD) behaviors have nothing to do with their parenting. Their children's biology is viewed as solely responsible or sufficient for these behaviors, so there is no point in even trying to parent them for these behaviors.

Qualitative research of this sort is important in many ways. First, it complements the quantitative research already being conducted. Information from qualitative investigations could be significant in providing complete care to ADHD children and their parents, not just treatment for their physical symptoms. Second, it seems vital that we know the specific human meanings associated with the diagnosis and treatment of ADHD. Do we want these children taking less responsibility for their ADHD behaviors? Do we want parents taking less responsibility for parenting their children? Third, qualitative research gives visibility to relatively overlooked necessary conditions in medicine and psychology – contextual and agentic conditions. This visibility could not only spur more research, in new and less known areas, but also help professionals to view their clients in more comprehensive, beneficial, and human ways.

Conclusion

Like many assumptions, materialism is rarely discussed and even more rarely advocated, at least explicitly in neuroscience research. Nevertheless, as the results of the qualitative study (above) reveal, this lack of explicit discussion does not mean that materialism is not highly influential in people's practical lives. Many children and their parents may orient much of their behavior and attitudes to this assumption, mostly without awareness. Indeed, there is little doubt

that the considerable power of the pharmaceutical industry is being brought to bear in promoting materialism at this practical level (Relman & Angell, 2002). The problem with this promotion is, as we have shown, there is no empirical evidence for the assumption of materialism. Neuroscience has clearly demonstrated the importance, even the necessity, of the biological and the physical. Still, no research has shown – indeed, no research can show – that biological factors are the only factors of importance. Nonbiological factors must also be considered seriously, even in neuroscience research.

We believe that our proposal of holistic monism will best facilitate this research because it does not arbitrarily rule out agentic and contextual factors before investigation has occurred. We are aware that valuing nonbiological and biological factors may itself seem dualistic. However, holistic monism differs from dualism in three important respects. First, it deals only with explanations and interpretations of data, not the data themselves. For this reason, we are not postulating different "realities" with these factors; we are postulating different aspects of our interpretive framework for understanding and making sense of neuroscience data and related everyday experiences. Second, the various necessary conditions of our explanatory framework are inseparable, as in any whole. Unlike Cartesian dualism, where the different realities operate relatively independently, the necessary conditions of our interpretive monism are mutually constitutive, and thus inextricably united and monistic. Third, these necessary conditions do not contradict the predictability of neuroscience research. The agency of the human body preserves the purposefulness of humans and their biologies, without construing them as inherently chaotic and unpredictable.

The key to making this shift from materialism to holism, we believe, lies in distinguishing data from data interpretation. Neuroscience findings are always data

interpretations, not "the data" themselves, so there is always more than one way to interpret these data. The alternate interpretive framework we offer here – holistic monism – takes into account both biological and nonbiological necessary conditions and encourages new and creative ways of doing research. Moreover, holistic monism acknowledges the limits of current research methods, which yield only necessary and not sufficient conditions. Thus, we believe it provides a more adequate and comprehensive understanding of meaningful human action, while helping to resolve many of the controversies surrounding today's neuroscience and psychology.

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[1] We acknowledge that some studies have demonstrated the effectiveness of purely biological interventions, such as drugs, for some behaviors associated with ADHD (Swanson et al., 1993; Thurber, 1983; US Dept of Health and Human Services, 1999). However, we are not challenging the importance of biology, but the sufficiency of biology.

[2] We recognize that some neuroscientists would hold that the most fundamental elements of the "psycho" or the "socio" in compound word models are the biological representation of the psycho and socio. In other words, they would contend that these models are really bio-bio-bio-etc. models and do not entail nonbiological entities at all.

[3] Research shows that genes are not the sole determinant of brain anatomy and behavior; environmental factors can not only modify gene expression but also influence brain anatomy (Diamond, 1988).

[4] We include "desires, intentions, and preferences" here to indicate that there is no room here for what philosophers call the compatibilist's view of free will/determinism (Richardson & Bishop, 2001).

[5] As Stephen Toulmin observes, "At the base of Descartes' epistemology lay the distinction between rational freedom of moral or intellectual decision in the human world of thought and action, and the causal necessity of mechanical processes in the natural world of physical phenomena. This distinction cut so deep that, in Descartes' eyes, it justified separating the two "substances" of mind and matter . . ." (p. 107).

[6] Other examples of an implicit dualism include scientists needing agency themselves to conduct their research purposely and responsibly (Primus, 2002) and many research programs requiring (ultimately) measures of a subjective, nonmaterial feeling (e.g., depression) (Hedges & Burchfield, this volume; Slife & Williams, 1995).

[7] Awareness of goal or purpose is not a requirement of agency (Slife & Williams, 1995). Goals may be agentically selected (e.g., avoiding speeding trucks) without a full awareness that the behaviors that follow from these goals (e.g., walking on the sidewalk rather than the street) are connected to them. In this sense, a lack of full awareness of predictable bodily processes does not imply a lack of agency.