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The Brain Between Two Paradigms: Can Biofunctionalism Join Wisdom Intuitions to Analytic Science?

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Biofunctionalism appears to be a pioneering effort to formulate a portrait of the body–mind which acknowledges intuitions we have about human functioning that go beyond the analytic approach of the cognitive sciences but that can yet remain within the worldview and methods of the analytic portrait. The intuitions are (identified as): wholeness, interdependent causality, present temporality, effortless action, realness, panoramic knowing, and value. Such themes are most fully developed in the meditative and contemplative traditions of the world. Biofunctionalism is evaluated both in terms of how well it instantiates those themes and in terms of its ability to generate explanations and predictions within the scientific context.

The papers in this volume teeter on the verge of being quite radical. Our present cognitive sciences and education operate using a particular analytic picture of the human mind and body, a picture which is also operative in our language and folk psychology. We know there is something bogus about this picture, but do not know what to do about it. Humans have an intuition of a quite different understanding of the human mind and body, and throughout the ages, various traditions have emerged to develop such intuitions into full-fledged alternative ways of understanding. Iran-Nejad and his collaborators appear to be struggling to formulate a portrait of the body–mind which acknowledges something of those intuitions, but in a way which stays within the overall worldview of which the analytic picture is a part. Can this be done?

The analytic picture offered by the cognitive sciences is this: the world consists of separate objects and states of affairs. The function of the human mind is to isolate and identify those objects, to find predictive contingencies

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between them, to store the results in memory, to relate the items in memory to each other such that they come to form a coherent and accurate representation of the world and oneself, and to retrieve those representations when needed in order to act in an evolutionarily appropriate manner in the world. Knowledge is treated as an object, like other objects. Actions of any kind, including learning, occur through intention (whether conscious or unconscious) and are effortfull. Note the properties of this picture: it deals with isolated units and with the simplest possible predictive contingencies between units. Momentary occurrences are explained by reference to units that endure through time. To know in this picture is basically to explicitly know such units and contingencies; knowing how is just the automatization of explicit knowing. Such knowing is always an abstract, derived, indirect process since it is done through the representations in memory. Facts and the knowledge of facts are inherently separate from values.

But humans have other intuitions[1] about the nature of the world and about what it is to be a human being in the world: (1) Wholeness. There is a powerful intuition of wholeness which goes beyond conceptual analysis into isolated units — and beyond the explicit concept of wholeness. (2) Causality. There is the intuition that causality (and/or contingency) is not the one-on-one relationship between separate units which we find it easy to imagine, but rather a basic interdependence of phenomena. (3) Time. There is the sense that time may not be merely the linear flow we take for granted but that supposedly lasting objects and experiences may be made up of the momentary and that the momentary can have a sense of timelessness. (4) Effort. Humans have the experience of action that appears to arise spontaneously without intention or effort, without the sense of "me" doing it. In fact some of the most valued of actions appear thus. (5) Realness. Humans can be haunted by the intuition that experience can be real and direct rather than an abstraction filtered through representations, and they can spend a lot of time confusedly trying to "get real." (6) Knowing. There is a strong sense that there is a kind of knowing not captured by our models, a fundamental knowing not explicit or graspable. This is the kind of knowing that senses wholeness, interconnectedness, and so on. (7) Value. The intuition that to be alive and mortal and have experience has some inherent value is basic to human life and art. This issue is generally bypassed completely in all of our sciences.

These intuitions are most fully developed in the meditative and contemplative traditions of the world. Only pale shadows of them appear, when at all, in our human sciences. The conundrum is this: within the meditative tra-

[1]Note that I am not using "intuition" as a technical term but as a means of pointing the reader to his or her experiences of these matters.

ditions of the East and contemplative traditions in Western religions, there have evolved complex systems for talking about these intuitions and rigorous methods for training people and monitoring their progress in developing in themselves the alternative ways of being in which such intuitions can be known and lived. Within our scientific traditions, we have likewise developed rigorous methods for performing experiments and for constructing complex theories and models which are dependent on the analytic worldview. Between these two great and powerful traditions there is a no man's land. Anyone who tries to introduce the intuitions based on this broader sense of knowing into our human sciences enters the no man's land in which there are no vocabularies or established modes of discourse and, worse yet, no rules for how to procede — no practices, realizations, experiments, and so on, that could define whether or not one is on track or even making sense. Such is the challenging arena in which the papers in this volume are at play.

How then do Iran-Nejad and his colleagues instantiate their intuitions that humans do not fit the analytic portrait? The alternative they offer is called a biofunctional approach. Their first move is to carefully show how all of the established present approaches are just variations on the same analytic theme. This volume would be worth its weight in gold alone just for its demonstration that PDP connectionism is actually a form of associationist behaviorism and that so-called constructivist theories are virtually the same as their non-constructivist counterparts except for the change in the locus of the actions. But how does biofunctionalism go beyond these approaches?

Iran-Nejad argues that our understanding of the mind must be grounded in the brain, but in a functional rather than an anatomical view of the brain. There are two aspects to brain functional activity which are analogous to a visual figure–ground relationship. The ground is the ongoing activity of brain subsystems which work in concert in a wholistic and integrative fashion. The figure is a momentary firing of microsystem constellations. Ongoing brain activity gives rise to pre-representational thematic knowledge in the mind. Momentary constellation firing gives rise to categorical knowledge. There is no storage of discrete units of any kind.

Let us see how Iran-Nejad uses this approach to exemplify the seven intuitions of a different kind of knowing. (1) *Wholeness* of a certain kind is built into the basic idea of biofunctionalism. At the level of the brain there is whole system functional equipotentiality even though at the anatomical level there may be specialization. At the mental level, ongoing brain activity manifests itself in terms of "wholethemes" which are pre-representational, domain-comprehensive, and all encompassing (space, time, and freedom are given as examples) and "themes" which are more specific instantiations of wholethemes. The firing of a momentary constellation and the categorical knowledge that comes from that arises out of the wholeness

of the ongoing brain activity with its themes and wholethemes. (2) The *causality* involved in the arising of themes and of categories thus becomes a matter of the coming together of multiple sources, as in Iran-Nejad's analogy of a storm, rather than a one to one relation as in the classic billiard ball image. (3) *Temporally*, momentary constellations are momentary in their very nature rather than a momentary display of pre-existing stored information (whether discrete or distributed). Even the ground of ongoing brain activity is a form of momentary *activity*, not something which is dependent upon structures. "There is no storage of knowledge of any kind within us. Intuitive self-awareness is in a perpetual state of re-creation and change" [Iran-Nejad, 2000, this issue, p. 67]. (4) While *effort* may seem to be involved in certain conscious attentive activities, conscious attention is actually grounded in the deeper and more wholistic functioning and interdependent causality of the brain–mind relationship just described. "Dynamic self-regulation is non-executive, unintentional, and effort-free in nature" [Kawai et al., 2000, this issue, p. 45]. (5) A sense of *realness* is derived from the biological and temporal components: "Biological subsystems that comprise the physical nervous system have the capacity to create in us a live, as opposed to a pre-recorded, experience . . ." [Iran-Nejad, 2000, this issue, p. 67]. (6) *Knowing* is an intuitive activity which arises out of all of the previous functions. "Psychologically this internal ground manifests itself from one moment to the next as an ongoing self-awareness of what we know" (Iran-Nejad, 2000, this issue, p. 73). This is the way that knowing can be pre-representational and all encompassing (via wholethemes) at the same time that it may or may not be explicit via categories. It is how we can have a sense of the interdependence of causes even while perhaps searching for a single cause (to blame). It is how, with even minimal self reflection, we can see that any given moment of experience is momentary, even though all our conceptual notions imply duration. It is how most of our functioning can flow without effort. And it is why we have a haunting sense of live, as opposed to abstract, experience. (7) *Value* is the intuition least explicitly addressed in these papers, though there are hints that it is to be derived from the most wholistic levels, from wholethemes through themes to categories. (For example, constructive and unconstructive wholetheme modes of functioning are indicated as the source of constructive and unconstructive dispositional modes, which in turn affect performance in experimental tasks.)

What is to be made of all this? There are two extant points of view from which to evaluate it. From the point of view of the meditative and contemplative wisdom traditions, does Iran-Nejad's formulation do justice to the intuitions that underlie it? And from the point of view of the cognitive sciences, is the theory an understandable and viable one; for example, does it offer what counts as scientific explanations, and can it generate experimental

research and/or practical applications? These issues will be discussed from the point of view of each of the intuitions.

Wholeness. The wholeness of biofunctionalism described in these papers is at the level of individual organisms. From the point of view of the intuition of wholeness and its development in the wisdom traditions, this raises two issues: How well does biofunctionalism capture the intuition of wholeness within the individual body, and do we need to go beyond the individual altogether?

In some of the meditative traditions, particularly as they developed in China, direct experience of the integrated wholeness of one's own body is a fundamental first step toward developing other kinds of awareness. In fact, out of all the world's traditions, the biofunctional approach may be most similar to Chinese medicine which also approaches the body as a dynamical interdependent web of systems seen in their functional, rather than anatomical, capacity — even at the level of the bodily organs (see, for example, Kaptchuk, 1983). The similarity is only partial however. In the first place, by "body" or "nervous system," Iran-Nejad seems to mean only the brain. "Only the brain knows how to understand, hear, or see" (Iran-Nejad, 2000, this issue, p. 71). This reduces bodily integration (not to mention the mental level) to only one of its subsystems, an anathema in Chinese medicine. Perhaps more importantly, in the Chinese system, experience of the bodily level (*jing*) is only the beginning of understanding, which then proceeds to the energy level (*chi*), and onward to still more comprehensive levels (*shen* and beyond). There is nothing analogous in biofunctionalism. (For reasons why our neuroscience might not wish to limit itself to a brain-centered view, see Rosch, 1999.)

Iran-Nejad claims that biofunctionalism is not reductionistic because it moves between levels rather than reducing phenomena to simpler versions within the same level. Yet surely the very prototype of reductionism is a between level leap such as the claim that chemistry is only physics or that the mind is but brain states. More convincingly non-reductionistic is the fact that it is a functional, not anatomical, brain of which Iran-Nejad is speaking, one which has its very existence perhaps only as a part of the "brain–mind cycle of reflection." Whatever its theoretical status, this brain–mind operates at the level of individual organisms. The environment enters the picture only as evolutionary goad or constraint.

Intuitions of wholeness, however, do not stop at the skin. Meditators eventually discover a form of awareness in which the body and its senses are part of a larger, more panoramic way of knowing (Varela, Thompson, and Rosch, 1991). From this point of view, it is apparent that our usual sense of being trapped inside the head peering out is only a contracted form of a more basic way of knowing. Iran-Nejad seems to have at least an implicit sense of this; note his description of the ground (the ongoing brain activity part of the

figure–ground relationship): "The internal ground is not a patchwork map of the external scene. Rather, it is holistic, global, and goes far beyond what is being directly observed. For instance, even though the person is facing the landscape, the internal ground is likely to extend continuously to what lies behind, underneath, and above the individual. Neither does the internal ground stop at the distant horizon that surrounds the person" (Iran-Nejad, Marsh, and Clements, 1992, p. 484). This is a beautiful description of the direct experience of people who have relaxed their perceptually self-centered fixation somewhat. Most people have had at least momentary experiences like this in their lives: perhaps while playing a team sport, hiking, improvising music with others, relaxing after a difficult deadline, crossing a bridge, walking downtown in a city with tall buildings, engaging in martial arts, gazing out into space from a highway vista point, or innumerable other idiosyncratic trigger situations. People usually discount such awareness as either a rare and special experience or as an elusive, domain specific, personal talent. Iran-Nejad realizes its importance for psychology but attributes it to something internal — to be sure to ongoing brain activity rather than to schemas or frames — but nonetheless to something which leaves our basic picture of what an organism is and what the world is basically unchanged. (The same may be said of current psychological accounts which emphasize the importance of non-conscious, automatic, environmental control over our cognition and behavior — see Bargh and Chartrand, 1999). Suppose we were to take experience of a more panoramic way of knowing seriously?

Even Western thinkers who take seriously the intuition of wholism have argued that the individual organism is not the proper unit for analysis. As Prawat (2000, this issue) has pointed out, philosophers such as Dewey and Peirce reconceptualized subject and object such that knowing and acting was an emergent from their conjoint reality. For different reasons, Whitehead's process thinking forces a field oriented view of the universe. An isolated knowing subject is untenable as the basis of our understanding in the philosophies of Heidegger and Merleau Ponty, philosophers who have had some influence, at least nominally, in cognitive science. It is J.J. Gibson (1979) who brought this point of view home most explicitly to the cognitive sciences with his vision of an ecological psychology. For Gibson, "organism" and "environment" are mutually defining terms, meaningless without each other, and he invented a new field, ecological optics, to describe the perceived and acted-within world from the point of view of that mutuality. Experientially, the subject (what I experience as "me") is part of the same informational field as what I call the object (the environment). This is most easily understood in relation to location; I know where I am in the environment only in relation to my perception of where other things are and vice versa. Perception is *direct* in that it is the percept, with all of its immediate

information about both subject and object, which is primary and which Gibson takes as the basis for his science. The field of ecological psychology is presently burgeoning (Neisser, 1993), although it tends to rely more on Gibson's experimental demonstrations than on his overall vision (Rosch, in press) — again demonstrating how difficult it is to capture the intuition of wholeness within the analytic confines of our present cognitive sciences.

The experiential descriptions of wholeness from the meditative and contemplative traditions are more comprehensive even than this. That is because they are rooted in the more fundamental mode of knowing which underlies the entire set of intuitions previously outlined. The problem is that our philosophical and cognitive science attempts to instantiate the intuition of wholeness and tends to be from the point of view of our constricted subject–object mode of knowing (as if peering hesitantly out at a larger world) rather than from the point of view of fundamental wholistic knowing seeking to understand its more constricted forms. But, of course, biofunctionalism did not set out to capture the intuition of wholeness in its full extent, but rather to offer a new view within the cognitive sciences. How well does it do at that?

Does biofunctionalism provide what can count as satisfactory explanations within the analytic mode of thinking of the sciences, and can it generate predictions testable by experiments and/or workable practical applications? The problem is that the functional level at which biofunctionalism operates is non-specific in the extreme. On the biological level, we have the ongoing activity of integrated brain subsystems, punctuated by the momentary firing of microsystems. This seems quite plausible, indeed undeniable, until we realize that we are understanding it by analogy to the anatomical level, that is, to neurons and the firing of neurons. However, if we understand it in this way, then systems and subsystems become traceable structures of interlinking neurons with possible anatomical locations, and all of the damning evidence against Lashley's (see Iran-Nejad and Homaifar, 2000, this issue) hypothesis of equipotentiality (when that is interpreted anatomically) become damning evidence against biofunctionalism. But such an interpretation is explicitly not what Iran-Nejad has in mind. So the functional level must be left as something presently quite abstract and unspecified. (This is another way in which biofunctionalism differs from Chinese medicine where systems and subsystems, though understood at the functional level, are specified in great detail.) How then can biofunctionalism either explain or predict?

Let us take a specific example, the famous P300 waveform elicited by infrequent events in evoked potential electrophysiological brain research. Iran-Nejad cites Donchin's (1981, p. 498) argument that "the statement that P300 is elicited by surprising events is an assertion about the antecedent conditions of the P300. It tells us nothing about the process . . . manifested by the P300. Thus, it does not constitute a theory of P300." Biofunctionalism is offered as

the missing theory and account of process. But what does biofunctionalism provide other than to say that there is ongoing brain activity (OBA) and momentary constellation firing (MCF) and that the P300 is an MCF. It is an abstract *description* of the phenomenon but hardly an explanation or a theory. It classifies the phenomenon into a minimalist classification system (which has only two members), but classification is not yet theory (Rosch, 1994). Can biofunctionalism predict that a surprising event will elicit a P300 rather than some other waveform? It is much too general for that.

The same issues arise in other domains where biofunctionalism is said to offer an explanation. Intersensory integration, incubation effects in problem solving, the fluency of well learned skills, and the self propelling power of big ideas are all attributed to ongoing brain activity. (A vast array of non-conscious, automatic or involuntary effects, such as those described in the July 1999 *American Psychologist* special issue on involuntary behavior, could be likewise so attributed.) That's fine as far as it goes, but surely a great deal more need be said about ongoing brain activity before it can provide a differentiated and predictive account of such diverse phenomena. How, for example, could ongoing brain activity alone predict that vision would be more coordinated with touch than with motion, whereas audition is more coordinated with motion than with touch? Just calling them "subsystems" may name and classify them but does not explain. (Gestalt psychology had analogous problems with explanation and is known today primarily for its wealth of experimental demonstrations, something which biofunctionalism has not yet engendered.) To be sure, it is a breath of fresh air to have the spotlight pointed at wholistic phenomena that are approached clumsily, if at all, by present research. And classification can be the first step toward theory, explanation, and prediction. But a great deal needs to be done beyond classification before these goals can be reached. The problem is: Can any more be done to make biofunctionalism a proper scientific account, according to our current rules, without stripping away whatever portion of our intuition of wholeness it may presently contain? In demanding explanation and prediction of a certain sort, are we not imposing a model of one-on-one causality which is antithetical to intuitions of wholeness? We turn now to this issue.

Causality and interdependence. The intuition about interdependence is not simply that causality is complex or that there are multiple causes for any given phenomenon. It is that what we call an object or an event is not actually something with a separate identity, but rather is part of an interdependent whole of happenings — as in the following description:

> If you are a poet, you will see clearly that there is a cloud floating in this sheet of paper [paper is held aloft by the speaker]. Without a cloud there will be no water; without water trees cannot grow; and without trees, you cannot make paper. So the cloud is in here. The existence of this page is dependent on the existence of a cloud.

> Paper and cloud are so close. Let us think of other things, like sunshine. Sunshine is very important because the forest cannot grow without sunshine, and we as humans cannot grow without sunshine. So the logger needs sunshine in order to cut the tree, and the tree needs sunshine in order to be a tree. Therefore, you can see sunshine in this sheet of paper. And if you look more deeply . . . with the eyes of those who are awake, you see not only the cloud and the sunshine in it, but that everything is here, the wheat that became the bread for the logger to eat, the logger's father — everything is in this piece of paper . . . this paper is empty of an independent self. Empty, in this sense, means that the paper is full of everything, the entire cosmos. The presence of this tiny sheet of paper proves the presence of the whole cosmos. (Nhat Hanh, 1987, pp. 45–46)

Within our sciences, this intuition is closest to dynamical systems theory. (This is the view in which it is popularly said that the flapping of a butterfly's wing in Brazil can affect the weather in New York.) Although there have been attempts to do cognitive science within a dynamical systems framework (Thelen and Smith, 1994), the extent to which these have been influential is open to debate. The fact is that the coin of the realm in the cognitive sciences is experimental research and models which carve out delimited pieces of phenomena, make one-on-one causal predictions, and set up oppositional causal explanations (Tannen, 1998) between factors which often would be seen as co-operators from a larger systems point of view. Dynamical systems theory models tend not to generate experiments of this type.

In biofunctionalism, the arising of themes and categories is described as the coming together of multiple causal sources, as in the analogy of the formation of a storm. Beyond this analogy, however, the process is not further elaborated. The one experimental study cited in which a generalized positive attitude predicted greater success with magic-eye pictures, is open to multiple interpretations. Iran-Nejad (2000, this issue) does point out that lower order factors are dependent on the higher order units in which they are embedded, as in the example of the difference in meaning between the wind on a sunny day and the wind in a storm (the kind of example that Gestalt psychology explored at length). This shows how closely allied the issue of interdependence is with the issue of wholeness. As with the issue of wholeness, causal interdependence in biofunctionalism must be further worked out and specified before it can function viably as a generative cognitive science theory. And as with wholeness, there is the question of whether the original intuition can be maintained when there is such further specification.

Time. Since at least the time of Greek philosophy, Western conceptions of knowledge have been at war with temporality. Although each sensory experience is unique, fleeting, and of a particular thing, for the Greeks, *knowledge* was necessarily only of what was universal and stable. In the cognitive sciences, it is taken as unquestionable that both the subject and object of knowledge must last through time; this is how "cognitive representations" come to be the major building blocks of many cognitive science systems. But

such is not the only possible approach to time. Some cultures envision the world as in a state of perpetual change, impermanence, and re-creation (Nisbett, Peng, Choi, and Norenzayan, in press). Beyond this, as humans we are heir to intuitions of a different kind of time from clock time — a sense of time which is both momentary and timeless. Think of your reactions to a particularly moving work in the arts or a particularly poignant moment of love. The meditation traditions reveal to people the ways in which all moments are similar to this.

In biofunctionalism, both ongoing brain activity and momentary constellation firing are activities, not structures. What is more radical still is that neither are dependent upon structures. There is no storage in this system. But surely cognitive science researchers will ask what it is that is producing all this ongoing activity and this momentary firing of microsystems. It is a deeply ingrained aspect of our way of thinking that something must be posited that lies behind momentary events, especially behind momentary physiological events, that gives rise to those events, something that lasts through time. And it is only that something that is taken as the proper cause or explanation of the events. Can biofunctionalism possibly become an acceptable source of explanation and prediction within cognitive science without coming to posit structures? (For example, what lasting influence have the various attempts at deconstructing memory had?)

The issue of temporality raises another problem. Events that are momentary are also unique. (Events seen wholistically also tend to be seen as unique.) Let us look at the analogy of the storm: If we accept that the wind on a sunny day is importantly different from the wind on a stormy day, what in biofunctionalism is to prevent us from following through with this logic until we are left with only momentary unique occurrences? This is indeed the vision that we get from the meditative traditions where each occurrence may be described as new, fresh, open, filled with timeless wisdom, and so on. But how can you perform science (as it is presently conceived) on unique momentary occurrences? Biofunctionalism sidesteps this issue by talking of such things as themes and categories which the reader tends to interpret as cognitive representations (of some sort) according to the old models. Note that even Barsalou (1987), who argued that categories are constructed "on-the-fly" rather then pre-stored, posited that they were constructed on-the-fly from something that underlay them that was stored.

It has been argued that cultures, such as those in East Asia, that see the world as in a constant state of multicausal change and re-creation (called naive dialecticism by Peng and Nisbett, 1999) do not develop science (Nisbett et al., in press). The challenge for scientists who wish to pay attention to human intuitions that there is real truth in such a "dialectical"

description, is a challenge to create a science of the momentary — necessarily a quite different science from what we now know.

Effort. Some activities appear consciously controlled, labored, and effortfull, as in first learning to type or trying to write a paper when one has writer's block. Others seem to run off non-consciously and automatically, as in the movements of an experienced driver. Still others appear neither labored nor automatic, as in the flow of a creative project that is going well. And then there are those actions that just seem to pop up out of nowhere without forethought or decision, as in discovering that one has dived into icy water to save a drowning child, uttered an unusual but magically appropriate statement to comfort a friend, or executed a complex martial arts maneuver before the cues showing the need for it were available. Furthermore, there is the haunting human intuition that one's actions (all one's actions, not just the "magical" ones) really come from, or could come from, someplace other than the self (or whatever it is) that we normally take for granted.

It may be the intuition that action is not what we think it is that underlies the present burgeoning interest of psychology and cognitive science in involuntary behavior (Bargh and Chartrand. 1999; Kirsch and Lynn, 1999; Libet, Freeman, and Sutherland, 1999; Wegener and Wheatley, 1999). While many experimental effects have been demonstrated in this domain, there is no consensus about what they imply about human beings — as in debates over the implications of Libet's (1985) finding that brain readiness potentials *precede* conscious intentions to perform voluntary motor acts. Does this negate free will, or automatize and dehumanize humans? The problem is (from the point of view of the meditation traditions) that when we discover such effects through our present science and then contemplate them by means of the analytic models and constricted ways of knowing inherent in our present modes of thought, the conclusions can only be a kind of intellectual, deterministic nihilism.

Quite different is the meditative development of this intuition. Meditators and contemplatives know that there is a way of living, being, and acting other than the self-centered one of intentions, desires, fears, time, causality, effort, and so on. The Eastern traditions speak of spontaneous actions born from wisdom, the Western theistic traditions of a divinely directed way of living, as in Mother Theresa's famous statement, "I am only a pencil God uses to write with." The point here is not the particular belief system that is espoused but the common aspects of experience. In fact it may be the intuition that there is available a mode of being which is more basic, genuine, and spontaneous than our usual state of mind that drives our present (generally counterproductive) obsession with being less uptight? Alas, as many a teenager discovers, acting non-consciously or impulsively is not the same as acting spontaneously from wisdom.

The psychological and cognitive science literature on attention, effort, and automaticity tends to treat "automatic" as synonymous with "non-conscious" or "involuntary" (and often is not explicit about the hypothesized origins of such automaticity). Biofunctionalism argues that most behavior is neither consciously controlled *nor* automatic. It seeks to account for this third alternative, the great preponderance of non-consciously controlled but appropriate behavior, by means of dynamic self-regulation which is grounded in ongoing brain activity. Dynamic self-regulation gives a name to the phenomenon of non-consciously directed behavior, but does it explain it? What specific testable predictions does it offer? What predictions would it add to the work on implicit learning and memory and to the demonstrations of automatic and involuntary behavior already present in psychology and cognitive science? Until biofunctionalism is further elaborated and specified, we cannot answer these questions. The problems with this account are similar to those of the other intuitions; biofunctionalism neither admits the full phenomena of effortless action as this has been developed by the meditative and contemplative traditions, nor does it as yet offer a fully specified alternative within the cognitive science tradition.

Realness. In the meditative traditions, experience of realness comes when experience is direct and present, rather than filtered through the dualism of subject and object and the endless tangle of memories, wishes, narrative, biography, and conceptualization that accompany such dualism. Humans have not only an intuition of realness but also a longing for it — a longing which may be currently represented in the cognitive sciences by the many diverse systems that speak of "embodied cognition," and in the everyday world by people's various attempts to "get real," often by means of intense sensory or emotional stimulation. Biofunctionalism talks of live, as opposed to pre-recorded, experience which, because of the momentary nature of ongoing brain activity and microsystem constellation firing, is itself present and momentary. However, it attributes this realness and liveness entirely to the "biological subsystems that comprise the physical nervous system." Thus it is real because it is biological. Commendable as it is to get away from abstract computer models, this alternative looks like biological reductionism if ever anything did — a reductionism which Iran-Nejad and his collaborators explicitly reject. Such reductionism also goes against the intuitions of wholeness (previously discussed) and the intuitions developed in the meditation traditions where the body, as we ordinarily know it, may be an inherent part, but never the sine qua non, of realness. This is another example of the tension in biofunctionalism between trying to root the system in a biology where theoretical accounts are usually substantive and structural and the attempt to re-formulate that very biology itself in a way that is sensitive to our other intuitions, in this case the intuition of a direct, alive, momentary presentness.

Knowing. Knowing is a particularly apt topic for this journal's special issue on education. Our intuition is that knowing is something not captured by any of our present formulations of it. The meditation traditions point to a fundamental awareness which is different from conscious directedness, automaticity, sleep, or flow. This awareness knows as a whole, directly, timelessly, effortlessly, and intelligently and, in some traditions, is considered inseparable from the skillful, compassionate action which puts that knowing into effect. In the meditative and contemplative traditions, many methods have been developed to uncover this wisdom knowing and to guard against the biases of fantasy, emotionality, and wishful thinking that could obstruct it. Analogously, in the sciences, experimental methods and the lore of what constitutes an acceptable theory have been developed to guard against biases, wishful thinking, and exploitations of various kinds. In institutions of formal education, methods and customs abound for teaching knowledge and skills which are considered true and useful that seem to require explicit teaching (for example, most children do not learn to read unless explicitly taught). In all of these cases, it is acknowledged that the methods used to keep people on the right track can become detours and straitjackets which actually inhibit the development of the very knowledge that is sought.

All of this presents a great dilemma for any system like biofunctionalism which seeks to introduce intuitions about knowing, analogous to those developed by the meditation traditions, into the scientific and educational world, for, as has been previously pointed out, it fits none of the existing formats very well. Knowing awareness in biofunctionalism is a function of the wholistic and integrative internal ground of ongoing brain activity which manifests itself from one moment to the next in the firing of self-awareness microsystem constellations. Once again this neither captures the full extent of wisdom knowing of our intuitions as developed by the meditative traditions nor does it as yet provide the specific explanations and predictions demanded by the cognitive sciences. For education, biofunctionalism seems to offer the general heuristic that teaching should be done from the most wholistic and inclusive vantage point possible. The one case of this discussed in detail in the papers is that of second language learning (see Kawai, Oxford, and Iran-Nejad, 2000, this issue). The method recommended is one of total immersion, a method already known to be highly effective though difficult to implement in the normal school setting. That education should be as total and meaningful as possible can be derived from many points of view besides biofunctionalism; however, biofunctionalism could be of great heuristic value to education if it leads to the development of specific wise and ingenious educational applications.

Value. In our science and our education, facts and values are considered indisputably two separate things, but in our intuitions about value, they are

inseparable. The development of this intuition in the meditative and contemplative traditions (and the arts) reveals a world of inherent unconditional value (for example, where the terrible climax of a tragedy can feel incomprehensibly, timelessly perfect). The cognitive sciences cannot deal with inherent value; the only grounding for value in cognitive science is evolution, with its goals of survival and reproduction. But our intuitions include the infinite value of failure as well as success, of failures to reproduce or survive. Humans are, of course, cognizant of the power and ubiquitousness of the street-fighter and deal-maker modes of being acclaimed by Darwinian selection, but are also aware, if not with the rational mind, of the value mode of being.

In biofunctionalism, ongoing brain activity and, its mental counterpart, wholethemes are said to be grounded in evolution. As is usual in the cognitive sciences (with the exception of evolutionary psychology), this is an act-of-faith gesture toward evolution rather than a detailed derivation. Because of the fundamental importance of the sense of value for psychology and education, biofunctionalism needs to develop this aspect of its theory more fully. If values, from wholethemes to themes to categories, are to be derived from survival and reproduction, then Iran-Nejad and his collaborators need to spell out in detail what the various themes are and just how they are so derived. If the sense of inherent value is to be honored, then biofunctionalism will have to be modified in interesting ways to accommodate it. Can we have a theory that both looks like science and accommodates such a sense of value? This is the same challenge presented by each of the intuitions.

Conclusions. There is a great divide in modern life. On the one side we have the analytic sciences and the portrait of the human derived in that manner. On the other side we have a set of intuitions about what it is to be and to know, which are quite different from this. There is a disciplined development of the analytic portrait of the mind on the part of the cognitive sciences and a disciplined development of the set of intuitions on the part of the world's meditative and contemplative traditions. There is nothing in between and no rules for how to create something in between.

Does biofunctionalism bridge this gap? Not yet; not in its present form. It is neither expansive enough to capture the wisdom traditions nor analytic enough to satisfy cognitive science sensibilities. Yet biofunctionalism can be considered a pioneering effort in this direction. It is difficult to work in that no man's land between the scientific and meditative disciplines; neither side likes whenever one does. Biofunctionalism is still a highly abstract and generalized proto-theory, more like a philosophy than a science. It is important to develop it further. Surely it is a cultural insanity that our human sciences should be so out of touch with what humans deeply know about themselves. Einstein said that problems can never be solved with the same mind that created them. We need efforts like this one.

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