Paper Title: Synapse and Spirit: a New Look at Some Old Problems
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Paper Abstract:
The many interesting discoveries of modern neurophysiology and cognitive science pose a significant challenge to the view of humans as spiritual beings. On the basis of a growing understanding of the brain processes underlying what we usually call mind, assertions are made that would essentially eliminate any spiritual dimension from humanity that goes beyond poetry and metaphor to claim an ontologically real status. Mind and self become epiphenomena of physiological brain states, and the elimination of mind and self imply the non-existence of soul and spirit. Such assertions are not new, of course, and the issues have been debated for thousands of years. What is new is the amount of detailed information that we now have available, and this information must be accounted for within any proposed view of humanity, religious or secular.

In this paper, I critically examine the issues involved in the mind/brain relationship within the context of a generalized complementarity framework that I have developed. This development of complementarity, which was presented last year at the 2005 Metanexus Conference, is based on Bohr's epistemological insights but is suitably broadened and modified so that it can be applied to problems and issues that transcend empirical science. The mind/brain relationship is just such a problem. One of the overall implications of adopting this complementarity framework is the conclusion that nature in general is both mundane and sacred with no necessary contradiction between these two views. In the case presently under consideration, this means that the neuroscientific results are completely valid within their realm of applicability, but that this realm of applicability is not unlimited.

Several alternative views of mind/self that are consistent with a spiritual vision of humanity are outlined and compared with the beliefs of various religious and mystical traditions, showing how they collectively present a coherent alternative view to scientific materialism, and further showing that they do not contradict any known or anticipated scientific results. A key methodological aspect of my complementarity approach is to carefully and critically examine the conditions under which knowledge of a phenomenon is acquired; this is done for both the neuroscientific view of the mind/brain relationship and the alternative presented here, in order to explore the validity and the limits of applicability of each. Lastly, the paper addresses explicitly the way in which these two views ("neuroscientific" and "spiritual") of the human mind are mutually exclusive, yet not contradictory, and both necessary to avoid an incomplete understanding.

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PAPER TEXT:

The existence of mind in a world of matter has been a deep mystery from antiquity until the present day. Idealism, Materialism, and Dualism have all made valiant attempts to solve this mystery and explain the relationship between the mental and the physical, between mind and brain as we would now say. No compelling explanation has so far been presented, and I certainly don't have one here. But, can complementarity offer us a method by which some new insights might be found?

In a mundane world, only brains exist and mind is merely a word to designate particular conditions of the brain. "…there is no such thing as the mind. There are certain activities of the brain…that it is convenient to consider as mental activities." [Nathan, in Underwood, 53] In contrast, a sacred world reveals that mind is intimately related to the soul. If these complementary views are somehow descriptions of the same world, then we might infer that soul and brain are related in some fashion that can be coherently explored. We'll eventually come back to this idea, but we first need to detour through the modern discoveries of neuroscience, cognitive science, and the philosophy of mind.

Anatomy of the brain on a large scale

On a large scale, anatomists divide the brain into a variety of areas, many of which have well documented functions. The outermost layer of the brain is called the cortex, which takes up a greater fraction of the brain in humans than in any other species and is generally thought to be responsible for our greater self-awareness and linguistic power. The different parts of the cortex have many complicated relationships with each other and with other parts of the brain, so individual sub-areas are not solely responsible for specific functions; but having made this *caveat*, we can roughly attribute visual processing to the occipital lobes at the rear of the cortex; auditory processing to the area in front of this, on the sides of the cortex in the temporal lobes; language processing to the left temporoparietal area; motor and somatosensory functioning to areas around the top of the cortex; and association, learning, and attention to the frontal lobe.

Within the cortex are other parts of the brain such as the cerebellum, thalamus, hypothalamus, pons, and medulla. Whereas the cortex is more directly associated with

cognition and conscious awareness, these inner parts of the brain perform vital functions at levels below our awareness. Some of our motor activity is directly willed, for example, but much of it is rather "automatic" like the feedback mechanisms that allow smooth movements, controlled by the cerebellum. Vital functions like breathing and heartbeat, not under our conscious control, are related to the medulla. Initial stages of sensory processing, before any information can enter our conscious awareness, occur in the thalamus. The hypothalamus is part of the limbic system, which is associated with emotions and learning. Other parts of the limbic system include the hippocampus, cingulate gyrus, and amygdala. In addition to all of these parts of the brain (plus many more that I've left out), which along with the spinal cord are collectively called the central nervous system, there is also the peripheral nervous system spread throughout our bodies carrying motor commands, sensory information, and control systems for various bodily functions. The entire nervous system is highly integrated, and all of the anatomically distinct regions listed above are interconnected to the others in complex ways. Any particular experience will involve most of these areas operating together in a systemic fashion.

Neurons, synapses, and brain physiology on a small scale

The small functional units that underlie the operations of the brain (and the rest of the nervous system) are single cells called neurons. Emanating from the cell body of a neuron are the filamentary branching strands known as dendrites and axons. The dendrites receive signaled information from other neurons; dendrites tend to be heavily branched and relatively close to the cell body. Axons send the signaled information out to other neurons, and although they vary in length (as well as in how much they branch) from one cell to another, some axons are extremely long. The axons from one cell terminate onto the dendrites of other cells at connection points known as synapses, but the manner in which information is transferred at the synapse is complicated. Leaving this complication aside for the moment, note that the pattern of interconnections for just one single neuron can be remarkably dense and convoluted. Since each neuron is connected into a network of other neurons with equally rich interconnections, the complexity of the pattern quickly becomes enormous even for a fairly small number of cells. Now note that the number of neurons in the human brain is roughly 10^{11}!

Another layer of complications involves how information is transmitted throughout the nervous system. The signals are transmitted along the axons by a mechanism of membrane depolarization. To understand this process, we must begin by realizing that in the neuron's normal state, with no signal propagating, the neuron maintains a potential difference (voltage) across its membrane. The inside of the neuron is about 60 mV negative compared to its environment; this is called the resting potential. The resting potential is partially maintained by the balance between concentration gradients and electrical attraction amongst various ions, including K^+, Cl^-, Na^+, Ca^{++}, and negatively ionized heavy proteins. This balance is maintained in part by differing membrane permeability for each ion, but the Na^+ ions are also actively pumped outside the membrane by the cell. Thus the Na^+ ion concentration gradient is particularly high. The Na^+ ion channels through the membrane are gated in a way that is controlled by the

voltage across the membrane. If the resting potential is disturbed by driving it more positive, and if this positive change exceeds a certain threshold value, then the membrane becomes temporarily permeable to Na^+ ions, which flood inside the cell driving it even more positive until there is even a reversal in the membrane polarity (i.e. the inside becomes briefly positive). The situation does not last long; within milliseconds, the membrane reestablishes its impermeability to Na^+ ions and instead becomes permeable to K^+ ions, which flood outside the cell to restore the resting potential. Meanwhile, however, the region of the axon near this event has now also experienced a slight positive voltage change (due to the event), and this change in turn drives another temporary positive spike in the voltage, which then induces yet another spike near itself in the same way, and so on down the length of the axon. This is called an action potential. An action potential, then, is basically a traveling positive voltage spike along the axon, caused by depolarization due to Na^+ ion transport across the axonal membrane. This is how neurons communicate with each other. But, what initiates the action potential in the first place? In other words, what is the source of the small positive voltage disturbance that causes the neuron to fire?

To answer this question, we need to realize that the gated ion channels in the neuronal membrane can be controlled by chemical signals as well as by voltages. The chemical molecules used in this process are called neurotransmitters, and they are crucial to the functioning of the nervous system and brain. Recall that an axon terminates onto one of the dendrites of another neuron, forming a synapse. The synapse is actually a small gap (about 30 nm). When the action potential reaches the termination of the axon, Ca^{++} ions are induced to flow across the membrane, and these ions initiate a mechanism that causes a stored neurotransmitter to be released into the synaptic cleft. The neurotransmitter diffuses across the synapse to the dendrite membrane, where it binds to a receptor protein. The receptor protein, when activated by the neurotransmitter, then controls the operation of ion channels in the postsynaptic neuron, either directly (in a rapid process) or indirectly by altering other proteins ("second messengers") in a slower but longer-lasting process. In both cases, the result of changing the operation of the ion channels is a change in the membrane potential difference, contributing to the initiation of an action potential if the voltage change is positive. In this case, the action of this synapse is called excitatory, because it helps excite the firing of the postsynaptic neuron. Generally, several excitatory signals must be received simultaneously to reach the threshold for firing a neuron. But, the ion channels can also be instructed by the synaptic signal to make the inside of the cell even more negative, which opposes the kind of change needed to initiate an action potential. This will act to suppress the firing of the neuron, and so these are called inhibitory signals. Whether a neuron fires thus depends on the net effect of all the excitatory and inhibitory signals that it is receiving at a given time.

Whether the effect of any given synaptic event is excitatory or inhibitory depends on the neurotransmitter and receptor that are involved. Scores of substances have now been identified as neurotransmitters, and the effects they have can depend greatly on the kinds of receptors available at a particular synapse. A number of important neurotransmitters are amino acids, including glutamate, gamma-aminobutyric acid (GABA), and glycine. Glutamate is probably the most important and widespread excitatory neurotransmitter in

the brain, and it has several kinds of receptors (the NMDA and AMPA receptors most prominently) that control different ions on a variety of time scales. GABA and glycine are inhibitory neurotransmitters, with GABA especially playing a major role throughout the brain. Some GABA receptors control chloride ions directly while others employ second messenger proteins. Another important class of neurotransmitters consists of amine molecules. This class includes acetylcholine, epinephrine, norepinephrine, dopamine, serotonin, and melatonin. Acetylcholine was the first neurotransmitter discovered, and it has essential functions in both the peripheral nervous system and the brain. Dopamine, serotonin, and epinephrine are monoamines, and these molecules are often referred to as neuromodulators because they work indirectly by affecting the operation of other neurotransmitters. "Unlike most other transmitters and modulators, the cells that produce monoamines are found in only a few areas, mostly in the brain stem, but the axons of these cells extend to widespread areas throughout the brain. In this way, a small number of highly localized neurons making monoamines can influence cells in many other locations." [LeDoux, 58] A large number of psychoactive drugs appear to work by attaching to the receptors for dopamine and serotonin, either blocking or imitating their actions as the case may be. Lastly, a number of neurotransmitters are peptide molecules. These neuropeptides include the now-famous natural opioids, endorphins and enkephalins. A number of peptide hormones, such as oxytocin and vasopressin, also function as neurotransmitters. The distinction between a hormone and a neurotransmitter is sometimes blurry, but the hormones affect synaptic events by flooding the environment of the neuron (sometimes delivered through the bloodstream) rather than by being released from synaptic vesicles. The situation is made even more interesting when we consider that the hormonal action of the pituitary gland is under partial control of the hypothalamus in the brain. Obviously, the complexity of these neurochemical processes in the brain is astonishing. Several hundred molecules have now been identified as having probable roles in synaptic transmission, and we've seen a few small examples of the kind of tangled feedback mechanisms that are involved. The picture I've drawn is actually quite oversimplified, leaving out many interesting facts such as the purely electrical synapses that don't need chemical messengers, the many intricate steps involved in the second messenger processes, the myelin sheaths that increase axonal transmission rates, and so on. Rather than looking at such details, let's instead turn our attention to some examples of the specific brain functioning that arises from these neuronal processes and gives rise to perception, memory, and the other elements of our experience.

Mechanisms of brain functioning

Many aspects of the crucially important functions that our brains perform (perception, cognition, memory, emotion, motor control, and physiological regulation) are beginning to be understood. Visual perception, for example, has been studied extensively, and we now know a good deal about the processing pathways associated with vision. The lens of the eye focuses an (inverted) image onto the retina, but even at this stage some neural processing has occurred since the motion of the eye, dilation of the pupils, and shape of the lens all need to be controlled by neural feedback mechanisms. The image on the retina then needs to be converted into signals in the nervous system, a task accomplished

by special sensory transducer cells known as rods (for low light intensity) and cones (for color perception at high intensity). Light-sensitive molecules (such as rhodopsin) in these cells undergo chemical changes that ultimately result, after a complicated chain of chemical reactions, in the initiation a membrane hyperpolarization by blocking sodium channels. There is not a simple direct connection between the rods and cones and the brain. The rods and cones make multiple complex connections to so-called bipolar cells, which are interconnected to each other by so-called horizontal cells. The output end of the bipolar cells connects to the ganglion cells, which might be thought of as the interface with the brain (this end of the bipolar cells also includes lateral interconnections by means of so-called amacrine cells). The purpose of all this complexity is to perform a massive amount of information processing (e.g. lateral inhibition) on the input signals before they even leave the retina. Action potentials are first generated by the ganglion cells, and these action potentials are conveyed along the output axons of the ganglion cells into the brain. These afferent axons constitute what we usually call the optic nerve, and they terminate in an area of the thalamus known as the lateral geniculate nucleus. A smaller number of optic nerve fibers go to the superior colliculus and the hypothalamus, where the retinal information is used to inform motor, spatial, and circadian rhythms below the level of visual awareness. The visual information itself is transmitted from the lateral geniculate nucleus into the visual processing area located in the occipital cortex. Though some go to other areas of the visual cortex, the majority of the axons from the lateral geniculate nucleus terminate in a striated part of the primary visual cortex, denoted area V1. Area V1 performs a number of basic visual processing tasks, discriminating shapes, position, orientation, and movement (possibly involving a kind of spatial Fourier analysis). Area V1 sends axons to other areas of the visual cortex, and these areas perform higher-order tasks such as the perception of forms, the motions of objects, and depth perception from stereoscopic cues. This is also the stage at which neural processing operates to produce our perception of colors, mostly in area V4. The cones themselves have a very broad and crude spectral response. This low resolution spectral information is heavily processed in the retina and in the lateral geniculate nucleus. The visual cortex further processes this information to generate the rich and varied set of hues and saturations that comprise our visual world. Finally, the information from the visual cortex is combined with other inputs (sensory, memory, emotional, etc.) to form our conscious experience, probably mostly in the frontal lobes.

Memory is another aspect of our mental functioning that crucially shapes who we are and how we think. The neural bases of memory are not fully understood by any means, but a great deal of progress has been recently made. Although memories are not stored in any particular localized region of the brain, certain brain structures are vital to the process of memory formation. “The hippocampus is most usually associated with learning and memory encoding (e.g. long-term storage and retrieval of newly learned information), particularly the anterior regions.” [Joseph, 345] At the synaptic level, the brain is known to have a great deal of plasticity, i.e. synapses grow, form, wither, strengthen, and weaken as a result of experience. Dendrites and axons create new branches, and also lose existing branches. These kinds of processes are related to the formation of memories. For example, the successive simultaneous firing of multiple synapses on the same cell results in the strengthening of those synaptic connections (i.e. they are more easily fired

in response to the next input signal), a phenomenon named Hebbian plasticity after the psychologist D. O. Hebb. A closely related phenomenon is long-term potentiation, in which a high frequency of firing at a synapse results in that synapse firing more easily in response to subsequent stimuli. The mechanisms of long-term potentiation have been studied extensively. In one case, the release of the neurotransmitter glutamate activates only the AMPA receptors under normal conditions, but a high rate of excitation can remove the Mg^{++} ion that usually blocks the NMDA receptor resulting in a much larger entry of Ca^{++} ions into the cell in response to the glutamate. These calcium ions initiate a cascade of protein reactions, including both phosphorylation and synthesis of several different protein molecules, by activation protein kinases. These proteins (a prominent example is CREB) then produce the long lasting changes in the behavior of the synapse associated with long-term potentiation. Good evidence exists to implicate mechanisms like this in the formation of certain kinds of learning and memory.

A number of other processes are coming to be better understood. One key aspect of conscious awareness, for example, is attention (what we are focusing on at any particular time and the mechanism by which the brain chooses what it attends to). Models for such attentional control have been proposed and compared to experimental findings, and a particularly important role seems to be played by the anterior cingulate gyrus, a part of the frontal lobes. The attentional control networks are distributed throughout the brain, with the anterior cingulate gyrus playing the role of coordinator in such networks rather than issuing commands. "Anterior cingulate connections to limbic, thalamic, and basal ganglia pathways would distribute its activity to the widely dispersed connections we have seen to be involved in cognitive computations….computations appear to pass information back and forth to coordinate their results." [Posner and Rothbart, in Koch and Davis, 197-198] This kind of computational model, characteristic of the discipline known as cognitive science, has also been applied extensively to the problem of language acquisition and use. Cognition itself is often reduced to deployment of language algorithms in this kind of approach, and a large body of work exists in the area. "The basic idea of cognitive science is that *intelligent beings are semantic engines*—in other words, automatic formal systems with interpretations under which they consistently make sense." [Haugeland, in Cummins and Cummins, 48] This kind of information processing paradigm is especially powerful when it can be combined with real data about how the brain operates in terms of neurophysiology and neuroanatomy, and a good deal of progress along these lines has been made. Most of this progress has been made in the areas of cognition and perception, not in other areas such as emotion. Research on emotion has mostly been limited to primitive instinctual responses like fear, and within this restriction much has been learned. In particular, the role of the amygdala in the fear defense system has been studied extensively. The lateral nucleus of the amygdala receives sensory inputs directly from the thalamus and again from the higher cortical areas. The less-processed inputs from the thalamus offer a much faster response (to a loud noise, for example) but no detailed information about the threat (or lack thereof). The processed information from the cortex is slower but offers more accurate knowledge of whether the threat is real or not, all underneath the level of conscious awareness. These few examples of our understanding of brain functioning could be expanded

considerably, but they will suffice to typify the kind of things we know and the sort of knowledge we have.

Neuroscientific tools

How do we know these things concerning the workings of the brain? More precisely, what do we know and what do we infer? These narrative descriptions of how the brain works, which we have been considering, are all basically coherent explanations of indirect data obtained from a variety of sources. Each source of data provides information for a limited range of time scales and spatial resolutions, and the data needs to be interpreted appropriately.

Basic anatomical information, both large-scale and microscopic, provides a foundation to build on. Microscopic anatomical information is greatly augmented by the use of stains and dyes with optical microscopy, and extremely high resolutions are possible using electron microscopy. Tracing the complicated networks of neuronal connections is also accomplished by injecting dyes and radioactive tracers into neurons, which then transport these materials throughout the axonal and dendritic pathways. None of these methods can be performed *in vivo*, however, and hence provide no physiological information.

To get information about the actual functioning of the nervous system, a variety of methods are available. Electrical recording of neuronal activity has traditionally been an important tool. The overall electrical activity of the human brain can be measured by placing electrodes on skin outside the head, and this method has the ability to record activity on a rapid time scale (ms), but it lacks spatial resolution (because the cerebrospinal fluid is fairly conductive) so the data represents the average activity throughout the entire brain. The most useful measurements have been those that employ a lot of averaging and compare the electrical signal to some specific stimulus, producing a so-called "event-related potential" (ERP). Electrical recording can also be performed on single neurons by using microelectrodes, but only if the neurons are accessible (usually in animals or cultured tissue samples). An early example of this method was the exploration of the action potential using microelectrodes placed through the membrane of the giant squid axon. More recently, the method was used extensively to study long term potentiation and to look at the functioning of other neuronal circuits. In the case of single cell recordings with microelectrodes, the spatial and time resolutions are both excellent, but the problem is that *only* microscopic single-event information is available; the functional operation of any single neuron is only meaningful taken in relation to the functioning of the other neurons making up the circuit of which it's a part. Also, the need to have physical access to the cell is clearly a disadvantage. Another non-invasive technique to study the human brain's electrical activity is to measure the magnetic fields that are produced. This method offers higher spatial resolution than studying ERPs, but it is very difficult to measure such tiny fields and to interpret the data after it's measured, so this technique has not been used a great deal. Electrical activity is not the only important data, however, since chemical neurotransmitters play such a key role in neural functioning.

To explore these aspects of synaptic functioning, drugs are administered that block or imitate the role of some specific agent, and the effects of this intervention are observed. The famous poison curare, for example, acts by attaching to acetylcholine receptors and blocking their action. A chemical called amino-phosphonovaleric acid blocks the NMDA receptors. The mechanisms can also be more complicated than attaching to a receptor; a chemical might enhance the release of a neurotransmitter or amplify its effect, or the reuptake of a neurotransmitter back into its vesicles after a synaptic firing might be blocked. All of these mechanisms can serve as tools to study the workings of the synaptic junction, with behavioral changes, electrical measurements, and chemical analysis all used to ascertain the effects of administering the pharmacological agents. Sometimes these agents may even destroy the neural tissues they affect, and the observation of effects due to destroyed areas of the nervous system (lesions) has also been a source of information more generally. In humans, this destruction can be caused by accidents and diseases, for example, and the behavioral effects correlated with the anatomical areas affected. One famous instance of this method is the research on "split-brain" patients with a severed corpus callosum, but many studies have been done attempting to locate the parts of the brain that store memories or integrate the personality and so on. All such studies have severe limitations (the lesions can't be controlled, most brain functions are not really localized, and the tissue can't be examined until after death).

A recently developed tool for studying the human brain non-invasively is the use of modern imaging techniques such as the CT (computed tomography) scan, MRI (magnetic resonance imaging), and PET (positron emission tomography) scans. These methods have spatial resolutions down to about a mm and can collect data within a few seconds of a stimulus under favorable conditions (usually longer, though). Along with anatomical information, scanning techniques (such as PET) can measure metabolic rate information, telling us which areas of the brain are using more energy during the accomplishment of some cognitive or perceptual task. It's good to remember that the information is indirect, however, and may be telling us very little about the processing mechanisms of interest. Indeed, this point is true of all these techniques, and in practice we must combine pieces of information from disparate sources in order to make a coherent narrative. Single cell electrical recordings from hippocampal *in vitro* tissue, studies of long term potentiation and NMDA receptors in the sea slug *Aplysia*, and the effects of hippocampal lesions on human memory are all combined to formulate a model for how memories are formed. The models are interesting, and we have good reasons to believe that neurochemical processes occurring in sea slugs and glass dishes really are similar to those occurring in our living brains. But a model should never be taken too literally, and what the model doesn't tell you should always be considered.

Mind, self, and consciousness

The various neuroscientific models we've looked at so far all explain some interesting things (and leave open some interesting questions) within the framework of what such models might possibly be able to explain. Now we will expand our horizon a bit and consider whether such models have intrinsic limitations on what they even possibly *could* explain, and what those limitations might be. To start to grasp what these models leave

out, consider your own first-hand conscious experience of the world. All the interesting facts we learned about the visual information processing circuitry of the eye and brain, for example, don't ultimately translate into your direct visual experience of the seen world. Our knowledge concerning the role of the anterior cingulate gyrus in controlling attention doesn't offer you any new insights into how you are making the decision, right now, to pay attention to this text or to something else. What we learn about is the operations of electrochemical neural circuitry; what we experience is our conscious awareness. How does our conscious awareness arise from the working of our neurons? This is still a mystery, on several different levels, that's not effectively addressed by the methodology of cognitive neuroscience. The discipline that tries to take this mystery seriously is usually referred to as philosophy of mind.

We have now introduced a distinction between mind and brain. Mind is what experiences the world and has self-awareness. The brain is clearly related to mind in some important way, but the brain is not the same as the mind. This assertion, incidentally, is by no means accepted by everyone, and we will explore the issue more thoroughly as we proceed. But consider this line of reasoning: "…where do we situate the qualities of experience? Your first instinct was to locate them in the brain. But inspection of the brain reveals only familiar material qualities. An examination of the brain….reveals no looks, feels, heard sounds…..The idea that these qualities reside in your brain, then, appears unpromising. But now, if the qualities of your experience are not found in your brain, where are they? The traditional answer, and the answer that we seem driven to accept, is that they are located in your mind. And this implies, quite straightforwardly, that your mind is somehow distinct from your brain." [Heil, 4-5] There are a variety of strategies to counter argumentation of this sort, but most of them rely fundamentally on the presupposition that the qualities of experience are not genuine phenomena and therefore require neither an explanation nor a mind to reside in. We'll examine several variants of this position more carefully later.

There is another even more radical assertion that we might make by following this line of reasoning. If we accept that the mind is the seat of conscious experience and awareness, and if we accept the distinction between the mind and the brain, we may then ask where the mind is located. Further, we may ask what the mind is made of. Assuming that the mind is neither located in the brain nor made of the material the brain is made of, we are left with few other options to answer such questions. It becomes difficult to avoid the conclusion that the mind is not a part of the material world at all. Mind, in this view, is a non-material entity with properties that are different from any material thing. Such conclusions, concerning mind, have indeed been asserted by several philosophers over the centuries (and including the present day) in several different formulations. For example, "the failure of logical supervenience directly implies that materialism is false: there are features of the world over and above the physical features." [Chalmers, 123] The "features of the world" referred to here are basically what we call mind, and a large amount of subtle argumentation is offered to substantiate this stated conclusion. Materialists have mounted some strong counterarguments, though in certain cases some of these materialist arguments either miss the point or else look suspiciously close to the views they are attacking.

The ontological issues require considerable nuance in their handling, though, and fine distinctions must be made. "In contemporary philosophy of mind, substance dualism has largely been abandoned….Thus, *ontological physicalism*, the view that there are no concrete existents, or substances, in the spacetime world other than material particles and their aggregates, has been a dominant position on the mind-body problem….the only substantive remaining issue concerning the mind-body relation has centered on *properties*—that is, the question *how mental and physical properties are related to each other*. Here, the main focus of the debate has been, and continues to be, the controversy between reductionism and non-reductionism." [Kim, 211-212] In other words, the mind (in this view) is not something apart from the material world but instead is a novel property not predictable from and unlike any other property of the material world. Hence we see that philosophers of mind holding exceedingly similar positions might be categorized as either materialists or non-materialists in their understanding of the place of mind in the world, the difference turning on whether the acceptance of a so-called "property dualism" for mental phenomena is tantamount to a rejection of materialism or not.

A related issue concerns the distinction between logical supervenience and nomological supervenience. Supervenience means, very roughly, dependence upon or determination by. The conductivity of a metal, for example, supervenes on the electron states of the individual metal atoms. But although my first example suggests reductionism, supervenience does not necessarily entail reductionism. The existence of a strange attractor in the motion of a forced, damped pendulum supervenes on the physical details of the pendulum design, but the strange attractor is not reducible to or derivable from these details. Or consider this example (adapted from Kim, pg. 222): the beauty of a painting supervenes on the exact distribution of the paint on the canvas. But the beauty of the painting is not reducible to the paints, it is something extra. In the present application, we may say that mind supervenes on the brain (plus the rest of the nervous system and body). In this way, we retain some sense of a materialist ontology while admitting that the mind is not just another routine part of the material world but instead entails novel properties. The foregoing is nomological (lawful) supervenience because it tacitly assumes that the laws of nature are true. Logical supervenience would make the stronger claim that mind supervenes on the brain in any conceivable universe; identical conscious awareness *must* emerge from an identical body/brain in the way that a circle *must* contain points equidistant from a center not because we happen to live in a world where that's true but because it's a logical contradiction for it to be false. Those who attach great importance to logical supervenience (and agree that the mind does not logically supervene on the brain) will consider the case against mental events being a part of the material world to be a stronger case.

As interesting as these technical points in the philosophy of mind may be, most of them are pressing issues primarily due to the presupposition of an otherwise materialist ontology to start with. Although traditional Cartesian substance dualism appears to be an almost universally rejected idea, there might also be novel (or even old traditional) alternatives both to Cartesian dualism and to a monism grounded entirely in scientific

materialism. We'll look at some of these alternatives later, and consider whether they might be part of a viable and coherent metaphysics within the complementarity framework. The present considerations based on contemporary philosophy of mind, like the previous neuroscientific findings, will provide valuable input into that examination. Before we engage in this further widening of our horizons, however, let's take a closer look at some of the particular formulations devised within philosophy of mind.

Duality, identity, functionalism, and so on

Since many of the ideas we'll look at are presented using the Cartesian mind/body split as a kind of foil, let's briefly consider Descartes's concept. In this view, the mental and the material are two fundamentally different kinds of substances. Material substances have spatial extension, in contrast to mental substances which do not. Material objects are located in space, but mind has no particular location or other spatial attributes; no material object, on the other hand, is capable of thinking. This conception leads to the infamous mind/body problem, because our bodies are material objects and they don't seem to be independent of our minds. A number of corollary problems follow: How does our mind, made of a different and incommensurable substance, affect (or be affected by) our body. How can mental events, operating outside the material world, have causal consequences within the material world if this world is considered to be causally closed and operating according to lawful patterns of interaction? These kinds of problems have resulted in Descartes's concept, usually called substance dualism, having few proponents for the last couple of centuries. While we can get rid of dualism by postulating that everything in the world is fundamentally mental (a view known as Idealism, which has had several champions over the years), we've already noted that the more popular form of non-dualistic metaphysics these days is scientific materialism. Let's look at some attempts to locate the mind in such a system.

The most influential school of thought around the middle of the twentieth century was the so-called identity theory. Identity theory claims that our consciously aware experience at any given point in time is nothing more than the specific detailed neurophysiological state of the brain at that point in time. In other words, our mind *is* our brain; nothing more and nothing less. Identity theory claims, justifiably, the virtues of parsimony and simplicity. In addition, identity theory certainly does get rid of dualism. The argument for identity theory is often presented in the form of an analogy: we can speak of lightning strikes or speak of electrical discharges, but we are not speaking about two different things, only one single thing because lightning is identical to an electrical discharge. In the same way, we might speak of our conscious experience as well as of our brain states, but we are really only speaking about one thing. So why include both? There is no particular mystery to solve in this view. "Once we rid ourselves of the phenomenological fallacy we realize that the problem of explaining introspective observations in terms of brain processes is far from insuperable." [Place, in Cummins and Cummins, 366] The argument may be interpreted in two ways, though, and one of these ways claims much more than the other. That any particular mental state (experienced awareness) bears a one-to-one correspondence to some specific neurophysiological configuration is plausible enough in principle (albeit not necessarily of any particular

practical use). But the stronger claim that this truism essentially implies the nonexistence of experienced awareness as a category separate from the neurophysiological configuration is certainly not compelling. Our experienced awareness is precisely the primary data that we wish to explain by reference to the brain functioning, and saying that this awareness simply *is* the brain functioning explains nothing at all. Assuming that we wish to take mind and conscious awareness seriously, identity theory seems to beg the question of how these things arise. Somewhat surprisingly (at least to me), however, the major objections to identity theory are not based on this type of reasoning. Instead, the main objections to identity theory are based on the idea of multiple realizability.

The central premise of the multiple realizability argument is that the neurons themselves are not the important aspect of brain functioning, but rather it is the *organization* of the neurons that plays the vital role. This view is generally known as functionalism. Once again, the basic idea here is rather plausible. After all, the neurons of most species operate in very similar ways; what separates a human from an earthworm isn't having a radically different kind of neurons, it's having a radically greater complexity in their number and organizational interconnections. But the claims of functionalism go well beyond such common sense considerations. The next step of the argument is to point out that this organizational pattern doesn't necessarily need to be realized in a human nervous system. Since it is the organizational pattern as such that plays the key role, this pattern might be realized in any number of different material substrates, and in every case the same pattern would give rise to the same conscious awareness regardless of the material realization (hence the term "multiply realizable"). The analogy that is often made uses a computation performed by some sort of device. The device may be made of many different materials: transistors, vacuum tubes, gears & levers, beads on wire, or perhaps neurons. This material manifestation is unimportant, because the truly crucial thing going on here is the algorithmic operations needed to perform the computation and these operations are the same in every case. The differences are in how these operations are realized by a concrete material system, but these inessential differences don't matter for the result since the essence of the computation consists of the operations themselves. We might say that the software can be multiply realized in a variety of hardware choices, but it's always the same software. Note that the organization and operations (software) have taken on a kind of ontological status independent of any particular realization (or, indeed, any material realization at all). The main point of functionalism is that we should associate mind with the (multiply realizable) software, which happens to be realized by the hardware of our brains.

An extensive discussion of functionalism soon leads to the consideration of Turing machines, Searle's Chinese room argument, and other arcana dealing with the question of whether a machine can think. I won't undertake such a discussion here because the material is widely available elsewhere and it would take us too far afield from our main purpose. It's worth briefly noting that the question comes up so often because functionalism underlies much of the work done in the influential disciplines of artificial intelligence and cognitive science. Cognitive science, although it combines elements of psychology, linguistics, artificial intelligence, and neuroscience, is primarily influenced by the paradigm of thinking as computation. Functionalism provides an ideal

philosophical underpinning to this approach. Arguably, both functionalism and cognitive science represent the dominant way of conceptualizing mind/brain issues today. The major drawback to this approach, I believe, is that it tends to limit our focus to those aspects of mind that are amenable to algorithmic analysis. Another important problem is that although realizations of the organizational pattern underlying mind may indeed be independent of their material substrate in principle, in actual practice the details of the implementation have proven to be decisive, a fact which has been the bane of the strong AI movement. Only in science fiction has this problem been overcome. On the other hand, functionalism is an intriguing idea, and even an appealing idea if you have a certain predilection for the abstract. If you restrict your discourse to imaginary situations and construct them carefully enough, functionalism can overcome many of its drawbacks. I will have some possible uses for the functionalist point of view later.

All of these viewpoints share certain shortcomings. One issue is the limited contact they seem to make with the facts of neuroscience, which offer a rich array of empirical insights into the workings of the brain that ought to inform us (I would think) about the workings of the mind. At the same time, in contrast, a second issue is the impoverished conceptualization of mind and self that they seem to be trying to explain. The richness of our emotional lives, aesthetic insight, creativity, and so on don't seem to exist in a discourse that "reduces mental properties to causal powers." [Heil, 123] In fact, the magnitude of this shortcoming is demonstrated by the role played in philosophy of mind by the so-called "problem of qualia." Qualia are the phenomenally experienced perceptual sensations: the blue of the sky, the red of the tomato, the smell of the perfume. The qualia are the actual experienced feels, sounds, sights, smells, and tastes, the raw material of consciousness. Yet, in most of these philosophical theories of mind, qualia don't exist. There is a raging debate over whether this means that the theories are deficient or that the qualia really must not exist because there is no place for them in the theories. I wish to suggest that the existence of this debate implies that we need to broaden our horizon yet again, and we are about to do so.

A radically different view of mind

"….not only does the capacity of our total consciousness far exceed that of our organs, the senses, the brain, but that even for our ordinary thought and consciousness these organs are only their habitual instruments and not their generators. Consciousness uses the brain which its upward strivings have produced, brain has not produced nor does it use the consciousness." [Aurobindo, 332] We see in this statement a very different approach to the questions we've been considering, starting with the assumption that the material world is not the sole aspect of reality; in fact, it's not even the primary aspect. Based on traditional Hindu metaphysics combined with the spiritual experiences of the author (Aurobindo), this view makes the primary aspect of reality an underlying spiritual unity termed "Sachchidananda." Similarly to the Trinity in Christian metaphysics, Sachchidananda is One and also Three, namely existence, consciousness, and bliss. Consciousness in this usage obviously has a different meaning than we've been assigning it so far (individual experienced awareness). Here, consciousness is a universal property that imbues all things, material and immaterial alike. The consciousness of an individual

human being in this view is a limited participation in this universal consciousness. All beings and things, animate and inanimate, partake in this universal consciousness to the extent possible given their mode of existence in the material world. While I wouldn't presume to try to describe or explain this consciousness aspect of Sachchidananda, I am confident that I can say that it is nothing like our ordinary human consciousness and undoubtedly incomprehensible in terms of any rational categories we might construct. The key point here is that our own minds don't emerge from the processes of unconscious matter but instead are material manifestations of an already existing mentality in the world.

This idea of the cosmos having an underlying substrate of mentality is not unique to Hindu philosophy by any means. "Greek thinkers regarded the presence of mind in nature as the source of that regularity or orderliness in the natural world whose presence made a science of nature possible….They conceived mind, in all its manifestations, whether in human affairs or elsewhere, as a ruler, a dominating or regulating element, imposing order first upon itself and then upon everything belonging to it….The life and intelligence of creatures inhabiting the earth's surface…represent a specialized local organization of this all-pervading vitality and rationality, so that a plant or animal, according to their ideas, participates in its own degree…intellectually in the activity of the world's 'mind', no less than it participates materially in the physical organization of the world's 'body'." [Collingwood, 3-4] Here again, mind is conceived as a primary entity that organizes matter and eventually manifests itself as the mentality of organisms that are made of matter, in contrast to the presupposition of the previous sections that matter is primary and that mind supervenes on it. Another variation of this theme, stressing a holistic underlying unity, is found in Chinese thought. "Indeed, the dichotomy of spirit and matter is not at all applicable to this psychophysical structure. The most basic stuff [*ch'i*] that makes the cosmos is neither solely spiritual nor material but both. It is a vital force….We want to know in what sense the least intelligent being, such as a rock, and the highest manifestation of spirituality, such as heaven, both consist of *ch'i*….The uniqueness of being human, however, is not simply that we are made of the same psychophysiological stuff that rocks, trees, and animals are also made of. It is our consciousness of being human that enables and impels us to probe the transcendental anchorage of our nature….The internal resonance of the vital forces is such that the mind, as the most refined and subtle *ch'i* of the human body, is constantly in sympathetic accord with the myriad things in nature." [Wei-Ming, in Rouner, 114-124] In one form or another, ideas similar to this (in which the source of mind exists outside a mundane materialist framework) can be found in many times and cultures, including examples such as the writings of Plotinus, Avicenna, Ficino, and Whitehead.

There is also a different, but not unrelated, strand of thought that grounds the human mind in the existence of a divine Mind. Here the greater Mind is outside the material world rather than inherent within it, but the element of something in mentality that lies beyond the material is similar in both views. Thus, we can refer to "the existence of natural beings who at the same time transcend the natural level because they are rational" [Artigas, 320] and consider this rationality of the human mind to be a reflection of and partaking in the divine Mind. To examine the details of these many different

conceptualizations is beyond our scope, but the existence of such a rich literature, at least some of which is contemporary, invites us to ponder whether the presuppositions of neuroscience and conventional philosophy of mind may be too limiting. We'll return to this question in more detail and consider the degree to which it's possible to take these ideas seriously in light of modern knowledge, and what conclusions might be reached if we do, later. First, we must consider another ramification of our broadened outlook concerning the mind, namely the relationship of mind and soul.

What might soul mean?

Words like soul, mind, spirit, and psyche are not very sharply defined. Not only do these words have overlapping connotations that merge into each other, but they also change over time, vary with culture, and present formidable problems for translators of texts from these times and cultures. In the ancient Hebrew of the Old Testament, *nepesh* might mean vital force, breath, desire, or even self. This word was subsequently translated and retranslated serially into *psyche* (Greek), *anima* (Latin), and soul (English). The Hebrew word *ruach* (usually translated as *pneuma* and *spiritus*) also broadly meant life-force or breath, but its connotation tended to be more general and less associated with an individual human. What we would call mind, however, is most closely associated with the Hebrew word *leb*, which literally translates into English as "heart" since this organ was considered the source of memory, emotion, cognition, and intellect. All three of these attributes (*nepesh*, *ruach*, *leb*) were integral parts of what it meant, beyond the existence of flesh, to be a human being.

Similar kinds of overlapping usages are found in the ancient Greek texts of Homer, where *psyche* (life-force), *thymos* (source of emotions), *nous* (mind), and *menos* (soul as substance) are all employed in a variety of different contexts with related shades of meaning. "Of the three terms used by Homer in descriptions of individual souls, the term most closely associated with what we now think of as higher-order cognitive functions was *nous*…which we might perhaps render as 'intellect'." [MacDonald, 16] There was no single term that precisely and uniquely meant either soul or mind, but instead there were many terms that contained elements of both. There was one feature of all these conceptualizations of the soul, both Hebrew and Greek, that they held in common, namely that all of them tied the soul to the body in some way. An immortal and disembodied soul does not seem to be a part of either of these ancient cultures. This concept of the soul appears to enter Greek thinking through contact with Eastern, shamanistic, and perhaps Thracian cultural sources, and it's found explicitly in the Pythagoreans and Orphic cults as well as the writings of Empedocles. Development of this concept culminated in Plato's philosophical treatment of mind and soul, which has been so influential ever since.

Plato's conceptualization of the soul is not a single unified presentation. His descriptions change over time, from one dialogue to another. Generalizing, though, we can say that the soul (as *psyche* is often translated) is more important than the body, is the main entity associated with selfhood, is that aspect of us that must strive for the good and is in closer contact with the Forms, is immaterial, and is immortal. We can also say that the soul has

a triune aspect (while still being a single thing) consisting of a lower appetitive and "animal" nature, an emotional ("spirited force") nature, and a higher rational nature (*nous*). The *nous* also plays an important role in Aristotle's treatment of *psyche*. The analytic treatment offered by Aristotle is performed in terms of a matter/form dichotomy similar to his analysis of other phenomena. The form taken on by the matter that allows it to function as a living being is the soul. Soul, in this view, is a property rather than a thing, though the distinction becomes difficult to maintain consistently throughout the discourse. In addition, the rational mind, or *nous*, assumes a different status from all the other functions (which we share with animals) of the soul and has several anomalous characteristics such as separability from the body, imperishability, and connection with divinity.

Notions concerning mind and soul also developed in a variety of cultures far from the ancient eastern Mediterranean. In many primitive cultures, these notions were based less on philosophy and more on myth and ritual. "In regard to death, the rites are all the more complex because there is not only a 'natural phenomenon' (life—or the soul—leaving the body) but also a change in both ontological and social status; the dead person has to undergo certain ordeals that concern his own destiny in the afterlife, but he must also be recognized by the community of the dead and accepted among them." [Eliade, 185] In India, on the other hand, several sophisticated philosophical traditions grew out of the primary revelation offered by the Vedic scriptures. Within one of these philosophical systems, the *Vaisesika*, soul (or self) and mind are two of "the nine substances which comprise all corporeal and incorporeal things. The existence of soul is inferred from the fact that consciousness cannot be a property of the body, the sense-organs, or the mind. Though the soul is all-pervading, its life of knowing, feeling, and willing resides only where the body is. The plurality of souls is inferred from their difference in status and their variety of conditions. Each soul experiences the consequences of its own deeds…" [Radhakrishnan and Moore, 386] Although a descriptive explanation of the soul isn't given in the *Bardo Thodol* of Tibetan Buddhism, instead an elaborate description of the experiences and activities of the soul after death is offered. If the true knowledge of the Void is not grasped at this key time, the soul wanders through a dreamlike state until coming back to the material world through rebirth. This more mystical interpretation is found frequently throughout world cultures. To offer just one more example, the Persian Sufi Ibn 'Arabi wrote "'I shall return in the end to the beginning, just as in describing a circle the leg of the compass returns to the beginning when it reaches it's end. Thus is the end of life bound up with its beginning and its prenatal eternity fuses with the eternity after death. Existence is only transient…, but there is a lasting enduring vision.'…Thus man is dualized by the limits of his consciousness, he consists of an earthly and a transcendent mode of being, and it is the eternal, supralunar aspect of his twofold unity which, according to the religions, survives a man's death; for the most part we remain unconscious or barely conscious of this transcendent aspect, and often it therefore seems nonexistent to us, although the mystics have experienced its reality time and time again and have gained awareness of it as the cause of spirit in themselves." [Meier, in Campbell, 158-159]

A number of different conceptualizations of mind and soul have also developed within Christianity. The early Church inherited all the differing views of soul in the Jewish and Greek cultures that formed its developmental matrix. The ideas of Plato were especially influential, as were those of the neo-Platonists such as Plotinus. Other intellectual and spiritual currents that affected the early Church included the Stoics, Epicureans, and Gnostic sects. Within Christianity, the highly original formulations of St. Paul concerning the relationships of body (*soma*), mind (*nous*) and heart (*kardia*), soul (*psyche*), flesh (*sarx*), and spirit (*pneuma*) are both important and also ambiguous. All of these heterogeneous influences lead to a variety of views expressed by the early Fathers of the Church, culminating in a coherent synthesis by St. Augustine. "…the soul is not the whole human, it is his better part. Perhaps, he said, one should rather declare with St. Paul that the soul is the inner human, and the body the outer human…..the Holy Spirit's gift to humans alone in virtue of their having *rational* souls….The rational soul comes to live in a human in a second sense of life; it is not the sense of life conveyed by the identification of soul with the principles of self-movement and alteration…..in humans alone the ensouled and inspirited 'parts' cohere in one nature. In virtue of its having (or being) a rational soul, God breathes in a spirit which the human can either accept or reject—in accepting, he becomes a new being, and in rejecting he becomes like a beast…" [MacDonald, 155-156] Much later, St. Thomas Aquinas would revisit the issues of mind and soul from the standpoint of Aristotelianism and develop a sophisticated version of how they relate in Christian thought. He starts from Aristotle's metaphysics of matter and form, wherein these must be united in actual objects, like a human body. "According to Aquinas, however, there was one form capable of existing without the body of which it is the form, namely the human soul." [Kenny, 25] Some aspects of the soul, such as the senses, require a body, but the intellect is considered part of the immaterial soul alone. "…the intellect is a power of the soul. It is not identical with the soul; the soul has other powers too, such as the senses and the powers of nutrition….Aquinas thinks of the mind as consisting not just of intellect but of intellect plus will….he regards thought as an activity which has no bodily organ. Because the activity does not involve the body, he goes on to say that the power, which is the source of the activity, must belong to the soul." [Kenny, 42] Aquinas then works out as coherently as possible how the immaterial and immortal soul can subsist without its body after death.

There seems to be tension between this idea of soul and mind as immaterial and the earlier ideas of St. Paul that implied a greater degree of corporeality in the spiritual substance even while castigating the body/flesh as typically construed. This issue of corporeality appears in a variety of contexts. For example, in the philosophy of Schelling we find a kind of spiritualized materialism that yields ideas of mind and soul requiring some sort of bodily existence, though not the mundane one that we usually enjoy. "Schelling rejected a purely idealistic interpretation of being, with its contempt for physical existence, while at the same time he criticized the materialism of his time for its purely abstract notion of spirit…..It was Schelling's fundamental belief that there can be no spirit without a body, just as matter cannot exist without an inner life spirit…." [Benz, in Campbell, 233] In contrast to these tendencies to attribute some sort of corporeality to our spiritual dimensions, Descartes instead pushes the categorization into material and

immaterial aspects to a new extreme. The material body is simply matter in extension behaving according to mechanistic laws, so that the older functions of the soul as vital force and living breath are no longer invoked. Meanwhile, the functions of the rational soul are detached from their older context and redefined as the immaterial mind. Each of these two categories is separately subject to its own reasoning process and epistemological analysis in Descartes's work, but this does not necessarily imply that he believed they were truly separate and separable things. "In terms of the whole person, the mind is intermingled with (*permixtio*) the whole body as it's (the person's) own extension. According to the order of reasons as developed through the *Meditations*, clear and distinct knowledge of the essence of mind and the essence of body reveal a *real* distinction between the two, such that they can be conceived as existing independently of each other. But according to the order of essences, clear and distinct knowledge of the whole person reveals that the whole mind and whole body are related as interdependent parts that contribute to a functionally greater whole." [MacDonald, 290-291]

Complementarity and a broader view

We've now examined mind from three points of view, namely the neuroscientific, philosophical/analytic, and philosophical/religious/mystical. These views don't appear coherent with each other. What are we to make of all this? Is the soul (or even the mind) a chimera or sloppy use of language? Or is there more than a single valid way to understand these things and a kind of coherence to be found if we employ complementary perspectives? I believe that humans can in fact be seen as spiritual beings in the light of modern neuroscientific knowledge. This latter knowledge is acquired under the usual conditions typical of all mundane knowledge: it's based on replicable data that can be verified objectively and interpreted coherently, consistent with any other knowledge we have in the natural sciences and expressible in language that anyone (in principle, at least) can understand. Knowledge of humans as spiritual beings is acquired under totally different (and sometimes mutually exclusive) conditions, which may sometimes involve a component of private first-hand experience and may be incommunicable using normal language and may also depend on a particular cultural context. The validity of the neuroscientific knowledge is virtually undeniable, and I have already offered arguments in favor of the validity of the complementary knowledge concerning the spiritual dimensions of human existence. Here I would like to suggest that both of these kinds of knowledge are needed to formulate a complete conception of mind, and that some of the mysteries we have encountered can be approached productively by this route.

To proceed further down this route, I wish to suggest a few more specific complementary pictures to compare with the mundane view of mind. In this mundane view, only matter is real. Processes that take place are considered to be governed by laws determining how matter behaves and have no further significance. But process can just as well be considered as primary and matter as secondary; there is no compelling metaphysical reason to do otherwise. Processes are what is real in this view and the matter they instantiate into acquires its reality from partaking in the process. There is nothing antiscientific about this assertion, since it's consistent with our present views of both quantum field theory and self-organization (N. B. "consistent with" *not* "entailed by").

If we consider processes as real in this way, then the mind can be associated with these processes of the brain. This view, in which process has an ontological status of its own (we might phrase this by saying that we consider process as object) implies the reality of mind and can also be extended to include the traditional functions of soul (again as process). The complementarity of process as primary and matter as primary involves us in no contradictions unless some process violates laws governing matter. A more difficult question is whether a process can exist independently of any matter instantiating it (we'll discuss this soon). Finally, there is the question of whether we have really gained anything here, or whether we are simply using alternative words to render the same incomprehensible mystery. The two small gains that I see are (1) that we are forced by complementarity to take both mind and brain seriously in an antireductionist schema and (2) that the view of mind as a process and process as a thing might allow us to devise (and even suggest to us) novel relationships between mind and brain that more conventional views would not allow or suggest.

Can a process exist without the matter that the process occurs in? To explore this odd question, let's broaden it further by identifying the process as information, since information specifies a process, a form, a structure, or anything else. Information content is generally embedded in some material manifestation, for example the paint on a canvas specifies the information content of a painting. But, this information can be encoded in a set of numbers in a digital image file. This file still has a material manifestation of some sort, perhaps a set of magnetic domain directions or the voltage values in a set of logic circuits. The information content itself is an abstraction independent of each of these material manifestations in some sense. So, does this information exist independently of these particulars in the material world? This is a metaphysical question, and I would argue that we can answer yes in a complementary viewpoint to that of materialism (where we would need to answer no). If we assign this ontologically existent status to information, then the processes, minds, and souls that correspond to specified sets of information are able to subsist (to use the old-fashioned word) independently of their material instantiations. This strange doctrine contradicts no known objective fact. Indeed, it probably *can't* contradict any such facts and hence might be attacked as unfalsifiable. But this attack can at most disqualify our contention as science, and there's no claim here that it is science (also note the extreme violation of Occam's Razor). The important question is whether the idea of abstract information as an existing nonmaterial thing is somehow useful to deepen our understanding, whether it adds value to our discourse. Before we address that question, note in passing that this idea is rather similar to certain established mystical worldviews. An example is the version of Qabala advanced by many 19th and 20th century mystics, in which the Sephiroth called "Yesod is that subtile basis upon which the physical world is based….an omnipresent and all-permeating fluid or medium of extremely subtile matter; substance in a highly tenuous state…which is the model upon which the physical world is built." [Regardie, 61] In my analogical version of this Qabalistic idea, Yesod is where the information resides (although "where" is a misleading word since space and time are part of the physical world and themselves grounded in Yesod).

So how might this idea of information as a nonmaterial existent, which has no apparent scientific content, be valuable? First, let's reemphasize that this ontology is complementary to materialism (which we affirm to be true) and not a replacement for or alternative to materialism. Second, let's reaffirm the validity of the experiential knowledge attested to by many people (saints, mystics, Sufis, Zen practitioners, initiates of the Orphic Mysteries, and so on) that also goes well beyond scientific content and that warrants a spiritual understanding of nature in general and mind in particular. If our goal is to make a coherent worldview that accommodates this knowledge, then the ontology that we're suggesting here has some advantages. One advantage is that the claimed nonmaterial order of reality is not totally disconnected from the material world; the forms, structures, and processes do ultimately instantiate (in part, at least) to the material forms, structures, and processes that we observe, and this imposes some constraints on what might happen even in the nonmaterial realm. A theory of the soul that blatantly contradicts the existence of the brain (and the things we know about it) is untenable. In fact, we might explicitly make contact at this juncture with one of the mainstream schools in philosophy of mind, namely functionalism. The functionalist concept of mind as organizational structure rather than implementation is very much in accord with the ideas presented here, but no longer tied to the need for some kind (any kind) of material implementation. When the functionalist argument arrives at a point where mind as a nonmaterial category is admitted even within an otherwise materialist ontology, it arrives at a dead end. In the view presented here, the emphasis on the one known implementation (the brain) provides us with opportunities to vet our proposals, look for and eliminate contradictions, and invite creative novel interpretations of the mind/brain relationship. Additionally, we have a more effective bridge between the spiritual and mundane modalities of human nature. Extending our previous analogy with Qabalistic thought, we might say that just as mind is existent in Yesod and existent in the world as instantiated by the brain in matter, this same mind is also related to a higher spiritual Self which is associated in the Qabala with Tiphareth and is the subject of much commentary in Hindu psychology, for example (where it is clearly differentiated from the personal ego).

The simplest interpretation of the foregoing idea would assign a straightforward one-to-one correspondence between any given realized neuronal configuration and some sort of eidolon of this configuration reflected in Yesod (or wherever) as immaterial information. This simple interpretation has some problems, though, and may not be the best way to envision the situation. Our neuronal configurations change with time. Our moods alter, our memories fail, injuries or lesions affect personality, developmental changes make us different people over the years, as do experiences, psychoactive drugs affect our brains and hence our minds, we have religious conversions, we learn new skills, we die, we're born. What is stable and constant in all of this? What is the self? I believe that we need an extended concept of self that includes all of this collectively. A person's entire life, all of their experiences, all of their conscious and unconscious mentality, the entire arc of their material existence from before birth to after death, the memories of their friends and loved ones as well as their own memories, their effects on the world through their interactions in an ever-expanding web; all these things are a person's self. A person's brain is the central locus of all this where the experiences are known and stored and

expressed, at a certain moment in time in the manner appropriate to that moment. But events and moments have no meaning in Yesod, which is the foundation of the material world as it manifests itself in time. If the mind is existing there, the mind encompasses this extended concept of the person even as the mind also instantiates itself in time by means of the brain. Can the mind then exist without the brain? Certainly in the metaphorical sense I've just described we would need to say yes. A person whose memories, cognition, and sense of self have been corroded by brain lesions is a great tragedy, and we have little reason to believe that their minds are somehow preserved in time as they had once been but located in some immaterial place. But the person is not gone if this person is the sum total of their personhood extended throughout their entire life, and this is the complementary view of person, self, and mind that I am proposing as a serious alternative to a static mundane view. The tragedy, in the example I've used, becomes a part of the person's selfhood and by implication a part of their not-time-bound mind. Although I've developed this idea of an extended self as a web of relations in time and space by starting with the concept of immaterial information, the two concepts are actually independent and can be developed separately; the latter isn't needed to find value in the former. As just one more example, the mundane view of a depressed person is that he or she has some brain deficiency that can be cured with a drug. In the proposed complementary view, the person has an entire life history consisting of experiences and physiological states, with one important experience being an encounter with the drug that alters his or her subsequent experiences, the sum total of which (both before and after) comprise the mind of this person. While this example doesn't explicitly make contact with the sacred, I'd argue that to do so is easier in the complementary description. To make a more explicit connection, recall the often-repeated message from mystics that our true Self exists outside time in Eternity. For this Self, our manifestation in time and the material world must be as I've described it, collective and whole.

Turning to another topic, the reasoning faculty of mind has played a special role in many philosophies, especially in the Western traditions, for millennia. In some cases, the reasoning faculty alone is equated to the mind, and it's also sometimes considered to be a power that transcends bodily functioning. Modern neuroscience offers convincing evidence that this latter contention is not correct, and I believe that a better way to view the mind includes a broader array of attributes, including emotions, perception, memory, will, and self-awareness, as well as ratiocination. Reason is special for many thinkers because we share all these other attributes, except reason, with animals; I don't find this very persuasive, because I believe the differences are a matter of degree and not categorical differences. However, reason still maintains a unique and important role in the scheme of things, because reason allows us to make contact with universals in a demonstrable and comprehensible fashion. This quality is what so impressed Plato, Pythagoras, and Kant about mathematics. That nature behaves in a rational way has convinced many thinkers that nature has a mind or else was shaped by a (divine) mind. That our minds can apprehend this rationality in nature is proof, to some, that we too have a share of the divine. In the mundane view, selection pressures have merely shaped the brain's functioning to include reasoning/language as extra survival tools, mathematics is an invented symbol manipulation game, and the fact that nature exhibits mathematical regularities is due to a combination of cleverness and coincidence. Actually, it's not

entirely obvious that extreme forms of these opinions are tenable even in a mundane world. However, the overall attitude is defensible and the fundamental ideas can be considered true, within their horizon, in the complementarity framework we've elaborated. But it's also true, within this complementarity framework, that for a chunk of matter (the brain) to accomplish these tasks is at the very least amazing, is surely highly significant, and is arguably miraculous. Nor is it any less miraculous that we perceive the world, know ourselves, and love. To equate mind with reason is a mistake that was shared by both Cognitive Science and Thomas Aquinas, but an attribute we can share with both machines and angels certainly deserves the central position it occupies in both the mundane and the sacred views of mind.

Lastly, let's briefly look at one more issue, namely the spirituality of corporeal existence. There are a number of religious traditions that regard the body (or some aspect of the body) as inferior to a postulated immaterial mode of being (e.g. the soul is considered to be imprisoned in a tomblike body, trapped in the material world estranged from its true celestial and divine home). In contrast, other traditions assert that matter itself partakes of the divine spirit and that all orders of reality from highest to lowest are indissolubly linked, different aspects of the same divine ground of being. In this latter view, we may coherently refer to the consciousness of matter, though matter is obviously not conscious in the conventional sense of the word. Matter charged with such a spiritual essence may then manifest this quality by means of the forms it acquires, and one of these forms with particular importance here is the human brain. Phrased inelegantly, the brain is a way for spirit to manifest itself in matter and hence know itself explicitly. This theme can be developed in a manner that's independent of any reference to anything immaterial, leaving only matter with existence. But the properties of matter in this context are radically different from the properties of matter in a mundane view. No contradictions need arise, however; these two views are complementary. Whether we have knowledge of the spiritual qualities of matter and see these qualities in the development of mind and brain, or not, depends solely on the conditions under which we acquire our knowledge of matter. We have here an illustration of the ability of the complementarity framework to make distinctions and yield insights: I would argue that everything we know about the brain is more consistent with this idea of spiritualized matter than with the contrasting view of an incorporeal spirit trapped in an evil shell of matter.

To briefly sum up, mind is a part of both mundane and sacred worlds. In a mundane world, mind is a by-product of the activity of the brain. The truth of this statement is virtually undeniable, but the limits to the range of validity of its truth are shown by the philosophical difficulty of specifying just how mind fits into this mundane world. In a sacred world, mind is an aspect of a spiritual Self (or soul) employed to comprehend and experience existence. This statement is equally true within its own range of validity, the limits of which are suggested by the absence of any mention of the brain. The value of this complementarity framework to understand the mind lies in the explicit connection made between brain and soul, and tools offered for analysis of how they are connected.

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