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by Paul Moes

Much of the current emphasis on ways of knowing arises from debates fueled by post modern philosophical views that reject a reliance on rational thinking and empirical knowing. This reaction to the modern emphasis on scientific objectivity coincides with increased interest in several themes: non-western philosophies and religions which stress personal experience; the social construction of knowledge; and the value of emotional understanding in knowing. As Richard Middleton and Brian Walsh (1995) argue in their pivotal book, *Truth is stranger than it used to be*, the "cognitive" and "rational" truths elevated in the Cartesian tradition are now viewed as mere constructs created by modern man and thus not reliable sources of truth. Likewise, Paul Vitz (1996) describes changes afoot in psychology that reflect a growing disdain, by a small number of psychologists, for a rigid adherence to mechanical views of human beings which has little room for the "person."

The post-modern view reverses a long trend in philosophy that has increasingly emphasized the scientific understanding of human behavior. Rene Descartes' dualism of mind—particularly the rational mind—and body was only the beginning of a series of attempts to compartmentalize the mind, and/or brain, into component parts. Willhelm Wundt, often considered the father of modern-day psychology, believed the mind could be divided into component structures, much as physicists were dividing matter into molecules and atoms (Wertheimer, 1987). A similar trend continued with some of the early brain research which suggested that specific mental operations were localized in very specific brain areas (Jeeves, 1994). This localizationist view of the brain also tended to relegate emotions and other non-rational functions to the lower (i.e. below the cerebral cortex) brain structures and to regard these functions as inconvenient legacies from our evolutionary past. While much of the localizationist view has been demonstrated to be correct, new views have challenged a simplistic interpretation of localized functions. More recent interpretations have emphasized the importance of

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inter-location dynamics to produce complex behavior and thought. However, the overly simplified and compartmentalized views of mind and brain dominated both psychology and brain research up until the past 10-15 years.

I hope to use the most recent advances in brain science—particularly the branch called neuropsychology—to make the discussion on ways of knowing more concrete. Modern medicine has given us the ability to save the lives of individuals who have sustained serious brain injury. Although this ability leaves many survivors suffering from serious mental or emotional disabilities, it also permits an unprecedented window into the workings of the brain. In addition, technological advances in neuroimaging have permitted amazing opportunities for observing the operation of the awake, thinking mind, allowing new ways of understanding the dynamic function of the mind/brain. The clinical case studies from these patients, along with systematic imaging studies, have shed light on our dynamic ways of knowing.

Individuals with a strong post-modern perspective might argue that using such findings from medical science is an automatic capitulation to the modernist view of knowing. However, I should point out that the predominant views in neuropsychology over the past 12 years have shown a genuine openness to learning about the function of the brain through a variety of techniques -- including experiential and existential knowing. Oliver Sacks (1985) reflects this attitude when he states in his widely read book, *The Man Who Mistook His Wife for a Hat*, "...everything in classical neurology is correct. But our mental processes, which constitute our being and life, are not just abstract and mechanical, but personal, as well—and as such, involve not just classifying and categorizing, but continual judging and feeling also" (p. 19).

The case studies described throughout the paper are presented to support the following main points:

First, the modernist view that cognition, senses, and feelings are distinct entities has some merit, since recent studies appear to confirm the existence of "semi-independent brain modules" that are capable of independent mental functions.

Second, the post-modern emphasis on the necessity of holistic experience and the collective construction of knowledge also has merit from recent findings showing the unity of function within and between these brain modules.

Third, neither modern nor post-modern views are complete in understanding the mind; a mind that is embodied in biological substance—yet which also supersedes that embodiment. God has created a system of knowing that is embodied (and therefore has mechanical aspects), but the full embodied knowledge supersedes the substance and the elements of knowledge.

While the evidence I provide in support of these statements is often anecdotal or based on a minimal number of studies, a large and growing body of evidence supports these ideas. The reader should be aware that modern neuroscience alone will not be able to answer all of the questions concerning our ways of knowing. However, modern neuroscience, along with studies in psychology, can give us a glimpse into the fundamental building blocks that the brain/mind uses for ways of knowing.[1]

Neither modern nor post-modern views are complete in understanding the mind.

Cases of brain damage or "Ways of *Not* Knowing"

In order to understand the descriptions that follow of persons with brain damage, one must understand the relationship of brain function to mental activity and behavior. Many cases of brain injury create profound deficits in sensation and perception. When discrete brain damage occurs, there can be amazing specificity in the mental deficit that is created as a result of the injury. For the past three decades, neuropsychologists have been documenting a variety of injury-induced perceptual deficits called agnosias. Derived from the Greek word *gnosos* (known), the term suggests that individuals with agnosias are unable to know certain types of perceptual experiences, while other mental abilities remain largely unaffected. While we often do not understand the exact nature of the deficit or the mechanisms for the inability, the individuals appear

to show a profound lack of knowing about some specific aspect of reality, as opposed to a difficulty in communicating what they know or a general inability to process any information. What is most unsettling is that some cases of agnosia go beyond the perceptual and cognitive realms and enter into the social, emotional, and personal realms. This result not only presents challenges about our traditional views on knowing, but also raises disturbing questions about what constitutes the person.

Face knowing

One form of agnosia is prosopagnosia, a syndrome characterized by the inability to recognize or know faces. Damage to discrete areas of the posterior temporal or inferior occipital lobes, especially in the right hemisphere, can result in the inability to recognize familiar faces, even though the individual can still recognize most other common objects. Individuals can recognize objects such as trees, animals, and houses, but they cannot name familiar faces—including pictures of their own face, or of a person's emotional expression. The title chapter from Oliver Sacks' book, *The Man Who Mistook His Wife for a Hat*, is based on such a case. Sacks describes Dr. P., who perceives his wife's head to be his hat hanging on a hat rack. In addition, Dr. P. has trouble recognizing a rose. While he can describe the rose in great detail (describing it as "a convoluted red form with a linear green attachment" p. 12), he cannot identify it or name it—until he smells it. Thus, Dr. P. has difficulty only in the visual modality in finding the whole from the sum of the visual parts.

There have been similar cases of visual agnosia for "face-like" objects. One farmer, after a stroke that damaged the upper-middle right hemisphere, had difficulty recognizing his cows, which he previously had been able to recognize individually. His human face recognition, however, remained intact (Jeeves, 1994). An avid bird watcher with damage to similar brain areas had difficulty identifying any birds.

One important observation needs to be made about the specificity or localization of such mental abilities. To demonstrate that specific abilities such as these are indeed confined to specific brain regions, researchers must show "double dissociation." Double dissociation is demonstrated when two specific mental abilities can be selectively disrupted with differing areas of brain damage. Thus, for face recognition to be a truly unique skill that is indeed localized and distinct from other perceptual abilities, one must show that damage to a specific area will create difficulties with face recognition and spare other functions, while damage to a different area creates difficulties for other categories of objects and spares face recognition. While Dr. P did not show a double dissociation, many cases have shown this sort of specificity. This same criterion has been met for all of the other syndromes described in the remainder of this paper (although not in every individual case).

Linguistic knowing

There have been several documented cases of various agnosia syndromes for language. Some individuals can produce language, but have difficulty understanding spoken messages. Others can understand spoken messages, but cannot read any words. Such cases, called pure alexia, can be particularly startling when the person can produce written words, but when shown their writing the next day, are unable to read their own words (Carlson, 1995). Even more startling is that they can perceive words that are spelled aloud to them!

Recently, brain imaging techniques have allowed researchers to visualize the activity of various brain areas while a person is speaking or receiving any form of speech communication. Very specific regions become active with various aspects of language processing. Thus, there are centers for associating messages with memory systems, visual centers for processing written messages and translating spoken messages into visual images, and auditory centers for processing spoken messages and translating written messages into sounds. There are still other centers for judging emotion, cadence, and prosody (tone and rhythm). In everyday speech, these "modules" work in concert to produce the final "understanding" or "output of language" (Beeman & Chiarello, 1998).

Mathematical knowing

Brain damage that results in a disruption of mathematical understanding can cause more than one type of mathematical difficulty. Two fundamental abilities required to do mathematical calculations

are called numerosity and magnitude. Numerosity is the ability to judge 'more than' and 'less than,' while magnitude is the ability to estimate actual quantities or counts. Both of these abilities have been shown to be present in children as young as seven months, and even in some animals (Davis, Albert, & Barron, 1985; Davis & Memmot, 1982; Grafman, 1988). Damage to different brain areas can selectively eliminate one or the other of these abilities (Grafman, 1988). Therefore, some individuals can make more-or-less judgments but cannot do simple addition or subtraction. Others (with different areas of brain damage) can add or subtract, but have great difficulties in more-or-less judgments. Both of these syndromes can be independent of other reading, language, or spatial processing problems.

One important observation concerning this seemingly inherent numerical ability is that the "pre-educational" nature of such ability argues against the post-modern view that the measurement of objects, time, or behavior is the mere invention of empiricistic, western minds (Vitz, 1996). Rather, the concept of measurement appears to be woven into the very fabric of mind.

Spatial knowing

Individuals who receive damage to areas of the right hemisphere may have difficulty perceiving parts of space—the side of space opposite the damage. These individuals typically have a condition called left hemifield neglect, which means that they perceive information to the left side of space at an unconscious level, but they will have little conscious understanding or recognition of objects that appear to their left. Researchers can demonstrate in a variety of ways that the information is "registering" at some level, but the patient will act as though that side of space does not even exist (Ogden, 1996). When asked to draw objects shown to them, patients will draw all parts of the object, but all of the parts will be placed to the right. For example, when given a paper with a circle on it and asked to draw the face of a clock, they place all of the numbers and the two hands on the right side of the circle. What is particularly surprising is that they see nothing wrong with their reproduction of the object. When asked to make a mark that bisects a horizontal line in two equal halves, they will make the mark far to the right of center. When given food to eat, they will eat only the food on the right side of the plate, denying that any food exists to the left.

These same individuals often have difficulty with position words such as *down, up, over* and *under*. Despite having no other language problems, they will not understand sentences such as, "the book is *over* the cloth." Nor could one patient answer correctly whether or not the floor was *under* the ceiling, despite being able to point correctly to the ceiling and then to the floor. Surprisingly, the patient could correctly understand sentences such as "they got *down* to business" and "He got sick and threw *up*." (Carlson, 1995, p. 409). The patient appears to have knowledge or understanding of the words; the problem lies in being unable to conceptualize actual positions or spatial arrangements of objects using the words.

Discrete brain damage creates specific mental deficits.

Body knowing

An aspect of reality that we typically know very well and usually take for granted is knowledge of our own body. Yet individuals with right parietal lobe damage (similar to those with visual neglect) often do not recognize parts of their own body as belonging to them. In yet another story told by Oliver Sacks, an intelligent, middle-aged man who has a stroke during the night, damaging the right parietal area, tries to throw his left leg out of bed upon waking because he is convinced that someone has placed a severed human leg in bed with him. Since he is attached to the leg, he ends up on the floor with it. These same individuals will typically not groom the left side of their body, or will leave the left side undressed—all the while not recognizing that this unusual dress pattern appears odd to others nor feeling unusual in any way (Ogden, 1996).

Left sided damage in the area corresponding to the right side mentioned above results in an equally

unusual condition called autotopagnosia. This syndrome is characterized by an inability to point to body parts on verbal command. Patients retain a memory of names for body parts because, when asked to name pictures of isolated body parts, they perform normally. Jenni Ogden (1996) recounts one interchange between an interviewer and a patient with autotopagnosia who is handed a tooth brush and begins to shave himself with it:

Examiner:	What are you doing?
Patient:	Well I'm shaving, aren't I?
Examiner:	What's that in your hand?
Patient:	A toothbrush.
Examiner:	What do you normally do with a toothbrush?
Patient:	Brush my teeth of course!
Examiner:	Where are your teeth?
Patient:	Where are my teeth? (laughing) Well, my teeth are in my mouth presumably!
Examiner:	Show me how you would brush your teeth.

At this point, the patient again began to shave with the toothbrush. He realized he was not doing it correctly and said, 'Damn, I can't seem to do it.' (p. 99)

Obviously the patient can describe where his teeth are, but he has difficulty actually locating his teeth. The problem appears to be a lack of knowing the spatial arrangement of body parts rather than a difficulty knowing what is attached to what.

Self knowing

Perhaps the reader will have noticed that several of the cases described thus far share a common trait: many of the individuals lack awareness of their own deficit. This condition, common to many types of agnosia is called anosognosia.[2] While the exact nature of anosognosia differs from condition to condition, it has the effect of altering a person's self-image. Such an alteration in self-image obviously has profound implications for social interaction and for our deep-seated sense of who or what each of us is.

A drastic case of this condition is provided by Antonio Damasio in his book, *Descartes' Error*. Damasio describes the case of the late Supreme Court Justice William O. Douglas, who late in his career suffered a stroke that damaged the right side of his brain. In addition to creating eft-sided muscle weakness, the condition altered many aspects of his self-awareness. For example, he dismissed his left-sided weakness as due to a "minor fall" and he claimed that he was kicking 40-yard field goals with his left foot as part of his rehabilitation program. More serious for his career was the fact that he ignored many social conventions with colleagues and staff and was unable to realize that he could no longer make informed decisions. Even after being forced to resign, he acted as though he were still working as a judge. More on these social changes in the next section.

Perhaps the most obvious illustrations of a lack of self-knowledge are the cases of "split brain" patients. The so-called split brain patient has had the major connecting pathway between the right and left cerebral hemispheres severed in order to control severe epilepsy. The surgical procedure has little impact on overall thinking, mood, intellect, or any other obvious ability, but does completely disconnect conscious knowledge of events that register in one hemisphere from being shared with the other (Springer & Deutsch, 1997). Thus, when Roger Sperry had patients feel, with one hand, an object hidden behind a screen, the subject was unable to match the object by feeling a set of objects with the other hand (Sperry, 1986). In addition, the patient was able to name unseen objects placed in the right hand (which registers in the left hemisphere, where language control is also located), but could not name objects placed in the left hand. In fact patients will deny that any object has been presented to their left hand, even though they are able to draw the object with their left hand. Patients may also experience the "alien hand syndrome" where the patient will complete a task with one hand only for the task to be undone by the second hand (typically the left hand), seemingly against their "will" (or at least half of their will). Apparently, there is a complete lack of knowledge by each brain hemisphere of knowledge in the other half.

Social and Emotional knowing

According to Damasio (1994), the regulation of emotional and social knowledge appears to be very closely intertwined within various brain sites, so these aspects of knowing will be considered together. Cases of altered social and emotional regulation most frequently come from damage to the frontal lobes. The most celebrated case of frontal lobe damage and subsequent personality change is the case of Phineas Gage (Ogden, 1996). Gage was injured in a construction accident when a tamping iron was blown through his skull, severely damaging the middle areas of the frontal lobes. He survived the accident but was profoundly changed. The formerly mild mannered and polite individual became irreverent, profane, impulsive, impatient, and unable to restrain inappropriate social impulses. He also experienced bouts of depression, rage, and other emotional swings. He was severely disabled in personality and in everyday living, even though he had not lost any movement or speech.

Recent cases very similar to that of Gage have helped to enhance our understanding of the social problems experienced with damage to this area (Ogden, 1996). Phillipa was a teacher with a university degree in English literature before a violent assault by a burglar damaged the central frontal areas of her brain. Among other deficits similar to Gage's (disinhibition, emotional outbursts, inappropriate social behaviors), she had difficulty providing abstract definitions for proverbs—a skill she was proficient at as an English major. She also had difficulty thinking creatively or laterally in everyday conversations. Ogden (1996) provides a vivid example of her deficit:

> Asked about the support she was receiving from her family and friends, she replied that she did not see how they could support her when she was supported by the bed on which she was lying. When I gave her other definitions of support, such as caring, she replied, 'Well, caring means looking after and support means support and so they cannot be the same.' (p. 150)

Perhaps the most troubling case of frontal lobe damage is that of Elliot. As described by Damasio (1994), Elliot was a successful business manager and family man who was well respected in the community. However, a brain tumor in the medial frontal lobes drastically changed his personality. Elliot lost his ability to maintain focus and to remember his plans. More personally, Elliot lost the ability to make appropriate emotional judgements about social situations. Like Phineas Gage, he often would make very risky or socially unwise decisions, and he seemed unconcerned about his own predicament. When Damasio tested Elliot on a variety of perceptual, cognitive, linguistic, and intellectual tasks, Elliot scored above average on all of them. Even tests that measured knowledge of appropriate social responses in difficult social situations Elliot passed with flying colors. It appeared that Elliot had an intellectual and perceptual understanding of social situations but when it came to actually performing in a social situation he was truly disabled.

Anasognosia has profound implications for social interaction and for a person's self-image.

Damasio believes that Elliot's problem was primarily emotional rather than intellectual, or more precisely, his emotional self-knowing had been disconnected from his intellectual decision making. According to Damasio, it is in the prefrontal cortex where internal emotional responses to other people, or even to a person's own thinking, come together with reasoning and intellectual judgment. It is this area that helps us to formulate or define an appropriate social response that will be both logically correct and emotionally satisfying. Damasio suggests that this internal/external judgement process is as fundamental to our very survival as are aspects of perception, movement, and language. The title of Damasio's book, *Descartes' Error*, underscores the point being made, that knowing social and emotional issues in any context is neurologically and psychically interwoven with logic and reason—an idea that has often been suppressed from the time of Descartes.

Can such social and emotional knowing actually be embodied in brain tissue? If the answer is yes, what implications are there for our understanding of knowing? Is knowing—even

knowing of the subtle, sublime, and non-empirical issues of life—simply a mechanical, determined process that is dependent on the digital interaction of brain modules? While no person has a simple answer to any of these questions, I hope to develop a foundation for an answer in the following section.

The Mind/Brain as a system which is greater than the sum of its modules

What do we make of all of the case studies of brain damage? Are we, as strict localizationists and Cartesian philosophers have argued, nothing but modular machines? For example, the brain might be analyzing the world in much the same way a computer would by using a set of "parallel processors" that analyze and make simultaneous decisions about different components of information. Could brain modules be simultaneously and independently analyzing the face of a speaker, the sound of the person's voice, the meaning of a message, and the social context of the situation, and then allow some other unit to compute a final response? The answer, I believe, is no. More importantly for our discussion on ways of knowing is that, while the evidence favors the existence of semi-independent brain modules, the way in which we know something fully is much richer than the simple addition of ways of knowing completed by each sub-system.

Damasio summarized the importance of these modules, with their semi-independent ways of knowing, coming together to form a whole:

> Because of the brain's design, the requisite broad-based knowledge depends on numerous systems located in relatively separate brain regions rather than in one region. A large part of such knowledge is recalled in the form of images at many brain sites rather than at a single site. Although we have the illusion that everything comes together in a single anatomical theater, recent evidence suggests that it does not. Probably the relative simultaneity of activity at different sites *binds* [my italics] the separate parts of the mind together. (p. 84)

The suggestion that knowledge becomes "bound" together is echoed by neuropsychologist Marie Banich (1994), who has addressed this same issue in relation to the interaction of the two major hemispheres. She states eloquently,

> The binding problem is the conundrum of how the brain manages to integrate information from diverse brain regions, each of which appears to process the information in a different way. To illustrate, ...consider that when a visual item is processed, different attributes of the item appear to be processed by different brain areas. Some regions are specialized for processing the attributes of color, others shape, others binocular disparity, and so forth... . How the brain binds together different types of information so that we perceive, for example, a small red rose rather than a splotch of red dissociated from a quasi circular shape with multiple convexities is unclear. (p. 263)

She goes on to argue that the study of hemisphere interaction will be especially fruitful in understanding how knowledge is bound because of the qualitatively different ways that information is processed in each hemisphere.

Increasingly, neuropsychologists recognize that the answer to the binding problem is not to be found in the study of the brain alone. A truly higher level of analysis is needed. As Damasio states,

> Does this mean that love, generosity, kindness, compassion, honesty and other commendable human characteristics are nothing but the result of conscious, but selfish, survival-oriented neurobiological regulation? Does this deny the possibility of altruism and negate free will? Does this mean that there is no true love, no sincere relationship, no genuine compassion? That is definitely not the case.... Realizing that there are biological mechanisms behind the most sublime human behavior does not imply a simplistic reduction to the nuts and bolts of neurobiology. (p. 125)

Likewise, Roger Sperry (1994) comments that, "We do not look for conscious awareness in the nerve cells of the brain, nor in the molecules or the atoms in the brain processing" (p.10). Sperry also argues that conscious manipulation of ideas actually moves biological systems and that mind truly is more than the sum of neurological elements.

Malcolm Jeeves, a Christian neuropsychologist, has argued that we need to continue to focus on several levels of analysis to understand our mental life, even though we do not truly understand how these levels co-exist. He concludes that, "No amount of use of analogies...can for the time being, remove the sense of awe that we feel as we reflect on our own experience as embodied conscious agents with all capacities necessary to interact in dialogue with

other conscious agents. The sense of mystery, for us at least, remains untouched by any amount of brain science" (p. 59).

Implications for ways of knowing

How can any of this information help us make sense of our ways of knowing? First of all, I believe the evidence provided suggests that we have been created to experience life in many different facets. We come to know something at many different levels, simultaneously. As we perceive, analyze, reason, and judge, we rely on many aspects of knowing that come together in a way that is truly mysterious. Thus, if we are to make sound judgements and establish a reasonably correct view of reality, we need to rely on our emotional, internal, and other more sublime ways of knowing than those that are often promoted by western thinkers. The rationalistic approach is flawed because it underestimates the importance of emotional life, but it also fails to recognize that even if we wanted to divest ourselves of such emotional connections, our minds are created to interrelate these issues in our mind—even if our philosophies deny it. Our brains do not come with switches that allow us to turn off certain ways of knowing just because we believe them to be unimportant. Our minds/brains have been designed to produce as full and complete a picture of the world as possible. Therefore, since our brains will use all available information to complete the picture, emotional understanding will not suddenly be left out of that picture. Only in extremely rare cases of brain injury, such as Elliot's, do we clearly see the dramatic results when one aspect of knowing is eliminated from our knowing life. Unlike Elliot, we very automatically relate emotional and social understanding to logical and rational decisions. In order for individuals to make decisions that are correct or logical, they must weigh emotional and social consequences.

Such a conclusion concerning modernist thinking suggests that science, with its emphasis on empirical observation and rational thought, has always been and will always be dependent on the full complement of human judgement—simply because that is the way we are made. Scientific analysis, since it is conducted by human beings, is always subject to the interpretation, judgment, and the total perspective that the person takes to the enterprise.

Nevertheless, the current emphasis on "non-rational" or "non-empirical" ways of knowing is equally flawed in that it presumes that we are capable of divesting ourselves of rational thought. Again, no toggle switch allows me to think in some pure "holistic" sense at one time and at other times to think mechanically and empirically. Our Creator has endowed us with a thinking process that breaks perceptual experience down into more elementary parts, but then mysteriously begins to reconstruct and bind that experience together in a way that is truly our own. Post-modern thinkers who argue for a rejection of rational thought and any confidence in empirical observation have also failed to recognize the inherent character of these aspects of our thinking.

Full embodied knowledge supercedes the substance and the elements of knowledge.

A conversation I had recently with a colleague illustrates the debate over the inherent quality of rational knowing. This colleague suggested to me that many pre-modern thinkers would find our modern obsession with measurement a very odd and artificial thing. In essence, he was suggesting that some aspects of reality cannot or should not be measured because to do so is to compartmentalize an aspect of reality that was meant to be maintained as a whole. I suggested that the concepts of quantity and more-or-less judgments are embedded into the very fabric of the mind. Our application of precise units is the only human "invention" in the process. In every day thinking, the mind makes judgements of more or less without effort and perhaps even without our conscious will. Therefore, in art and science, in social situations and even in learning about God, many aspects of judgement, memory, perception, reason, emotion, etc., come together to help form our complete understanding. Even our "world views" and broader perspectives on life will shape simple everyday decisions—because that too is part of the entirety of our mind.

More practical applications are beyond the scope of the present paper, as are the many theological and philosophical issues raised by the discussion. At the minimum, I believe that we need to continue to stress the holistic nature of knowing and experience, and that we should regularly celebrate all aspects of knowing that a gracious Creator has made for us to enjoy.

ENDNOTES

1. The limited scope of this paper does not permit me to address related issues such as the Mind/Body/Soul question, or the issue of free will and determinism in an embodied mind, but several authors have addressed these issues in depth. (See Jeeves, 1997 for a comprehensive reding list.)
2. Derived from the Greek *nosos*, "disease," and gnosis, "knowledge"—which implies the inability to acknowledge disease in oneself.

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