DO SPLIT BRAINS LISTEN TO PROZAC?

by Gregory R. Peterson

Abstract. Cognitive science challenges our understandings of self and freedom. In this article, adapted from a chapter in *Minding God: Theology and the Cognitive Sciences* (Peterson 2003), I review some of the scientific literature with regard to issues of self and freedom. I argue that our sense of self is a construct and heavily dependent on the kind of brain that we have. Furthermore, understanding the issue of freedom requires an understanding of the findings of cognitive science. Human beings are constrained to be free; our biology in no small way determines the kinds of freedom that we are able to have.

Keywords: Antonio Damasio; emotion; freedom; Martin Luther; V. S. Ramachandran; self; split brains.

In the autumn of 1524, Desiderius Erasmus published a treatise on the freedom of the will. Erasmus was concerned with certain statements that Martin Luther had made on the subject that implied the will's bondage and human inability to do good. Erasmus had been a sympathetic supporter of many of Luther's reforms, but the latter's claim that the will was in bondage to sin and incapable of doing good without the grace of Christ seemed incomprehensible to Erasmus. How, Erasmus argued, can we expect God to judge us on our moral actions if we are not truly free to do both good and evil? If we are not free to either accept or reject the grace of Christ, in what sense is God's damnation of those who reject Christ just?

Luther's now famous intemperate response not only rejected Erasmus's arguments but insulted his character as well. Luther argued that to admit to any human freedom to do good was to admit that the grace of Christ is not necessary. Not only did such a position make the death of Christ on the cross cruelly meaningless, it made those who could not achieve such

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moral perfection all the more guilty. If some could achieve perfection, all could. Such a claim ran counter to Luther's own experience. It made the hope of salvation impossible for all but the elite few and undermined the foundation of church, scripture, and sacrament. For Luther, the question of freedom was not simply academic but an intensely personal issue that determined the state of one's own salvation. The vehemence of Luther's reply stunned Erasmus, with the result that their once cordial relationship soured as they went their separate ways theologically and politically.[1]

As the Luther-Erasmus debate shows, freedom is a profoundly theological category with significant implications for how we see ourselves in the world and for how we perceive our ultimate goals. Yet, freedom is not an abstract category of intellectual fancy but a lived reality that, for most of us, is experienced or frustrated daily. As such, freedom is the property not only of theology but also of psychology and biology. It is thus not surprising that, although freedom is not a subject per se of cognitive science, research in the cognitive sciences nevertheless touches on our understanding of human freedom. Such insights do not ultimately decide the issue between Luther and Erasmus, but they do show us that the freedom that we have is of a very special kind, profoundly shaped by our biology but profoundly open as well.

The Theological Subject

Luther's position is now unpopular. Freedom is the most cherished of values, enshrined in political documents and the basis of many of our cultural convictions. Certainly the value of political freedom laid the ground not only for democracy but also for racial and sexual emancipation. The claim of moral freedom underlies our ethical and legal systems. It even underpins much of the Western approach to education, for to study the *liberal* arts is to engage in a kind of study that makes one free.

Defining freedom, however, is a more complex task. Among other things, freedom implies a unified subject who does the choosing. It also implies the ability for real and substantial transformation. The path of freedom is typically nonlinear, revealing many twists and turns as life progresses. Freedom implies choice, the ability of the individual subject to select between alternatives without coercion. In many ways, the quest for freedom has been the quest of modern Western society.

Freedom has a theological dimension as well. The task of theology is to provide a framework for understanding the meaning and purpose of life. From this framework issues a soteriology, a path of salvation or liberation from the chains of sin and evil that bind us. In some ways, freedom is the most important of theological categories, for it denotes that which we value the most. The question of freedom ultimately addresses the most basic of questions: Who am I? A free person is presumably different from one who

is not. Those who can hope for freedom have a purpose in life that orients them in relation to their current situation. To the extent that freedom becomes the basis of such hope, it becomes one of the starting points of theology as well. This has certainly been the case in contemporary theology. As a theological category, freedom has loomed large for neoorthodox, existentialist, process, and liberation theologians alike. Although there are significant differences among these theological movements as to how freedom is understood, as a generalization the category of freedom is theologically important in two ways.

First, the category of freedom is important for understanding the human plight. To the extent that theology needs to develop a metaphysic, it requires an anthropology that situates human beings in relation to the world. Here, the theological question of freedom is in many ways identical to the philosophical one. Are my decisions based on my own volition, or are they controlled by outside forces, whether they be gods or demons, the billiard-ball particles of Newtonian physics, or the selfish genes of extreme neo-Darwinism? Freedom is here contrasted with determinism. Such freedom presupposes an autonomous, unified subject capable of making the decisions in question. Without the autonomous subject, the question of freedom in this sense becomes moot. This metaphysical conception of freedom has been a core issue in theological debates about predestination dating back to Augustine and was at the core of Erasmus's concern about Luther's position on the bondage of the will.

Second, freedom is important as a category for understanding our ultimate purpose and direction—that is, for soteriology. In Christian theology, freedom is important not only for understanding how we act now but also in defining what we seek ultimately. This conception of freedom is identified not simply with choice but with entering a new state of being. Soteriologically, freedom means freedom from sin and the evils of this world as well as participation in the spiritual community both in this life and in the next. This soteriological sense of freedom is not unique to Christianity. It has its version in many of the world's religions. Arguably, the debate between Luther and Erasmus on freedom hinged in part in their different usages of the word. Although Erasmus was concerned with freedom as a soteriological category, his attack targeted those issues most related to philosophical, metaphysical freedom. Luther, by contrast, was most concerned with freedom in the soteriological sense. Ultimately, the two are linked, but the Luther-Erasmus debate shows how the different emphases can lead to profoundly different perceptions about what it is about freedom that is so important.

Cognitive science poses provocative questions and possibilities for thinking theologically about freedom. Metaphysically, it poses questions about the kind of freedom we have and, in particular, the extent to which we can consider the self as a unified autonomous subject. Soteriologically, the

study of emotions may prove to be of some importance for thinking about personal transformation, orientation, and well-being. In both cases, we see a glimpse of the complexity of the human person.

One Body, One Mind?

I am. Such a statement seems unproblematic. Generally, I face the world as a unified individual, and I assume the same for others. This unity is the most basic of premises and often has served as the foundation of philosophical systems. Descartes' thinking self was the undoubtable core of his philosophy. Kant's transcendental subject played much the same role in his critical philosophy. The experience of unity is fundamental on a more prosaic level as well. We simply expect there to be one mind to one body, no more and no less. Such expectations allow us to assume considerable continuity among those with whom we interact. My colleagues in the English department may have their ups and downs, but I can expect them to have the same personality and roughly the same behavioral repertoire not only today and tomorrow but even across years and decades. What a great surprise it is when this is not the case. Of someone who has undergone a radical change in lifestyle and behavior, we may say, "She's not even the same person anymore!"

That we are unified subjects is central for traditional understandings of human freedom. Metaphysically, I am free because it is *I* who make the decisions, not someone else. Some of us do recognize the complexity of our inner lives. In his *Confessions*, Augustine perceptively describes the internal conflicts that he suffered on the path to conversion. Ultimately, however, Augustine rejected a radically dualistic understanding of the human person and held that such conflicts occur within the unified individual, who is thus responsible for both the good and ill deeds that he or she performs. Such an understanding of unity underlies our sense of personal responsibility and the legal system. To say that the devil made me do it, or my genes, or my environment, usually does not go far as a legal or personal defense. Ultimately, *you* did it, not someone else.

The easy unity that we experience, however, is not as easy to comprehend or as simple as it appears. The fact and physical roots of our consciousness may lie forever in mystery, but it is clear that our consciousness exists very much in context. The old dualist metaphor that the body is like a ship and the soul like a ship's captain seems exceedingly unlikely. Rather, we are conscious because it is necessary for the kind of complex beings that we are. Our conscious selves play an important and integral role in our day-to-day activities and, for much of the history of our species, in the basic struggle for survival. As such, our conscious life does not exist in the abstract but is intimately tied to the whole of our experience. Philosophers often have differentiated between the fact of consciousness and the

more holistically conceived self-conscious person, a distinction increasingly made by neuroscientists as well, who differentiate between core and extended consciousness.[2] A person is not simply a bundle of experiences but an intentional subject who thinks, feels, remembers, and interacts with the surrounding environment. Degenerative diseases that cause the loss of personhood without significantly impairing core consciousness are among the most tragic of maladies. Anyone who has seen the distressing toll that Alzheimer's disease or severe stroke damage can take can testify to the sheer devastation.

Loss or diminishment of personhood can occur in other ways. Damage to the hippocampus can result in anterograde amnesia, a condition that involves the total inability to establish new, declarative memories. This condition was first made famous by a patient known as H. M., who suffered catastrophic memory loss after removal of brain tissue in the hopes of ending his debilitating epileptic seizures (Scoville and Milner 1957).[3] The seizures ended, but H. M. was left in a world that consisted of only those memories he had accumulated before the surgery and an eternal present that could never be recalled. As a result, he could not remember for more than a few moments anything that happened to him. Each encounter, each individual, each event was new to him. Quite suddenly, he was forever unable to make new relationships or maintain old ones. Each time that he inquired about his uncle, he would grieve anew on hearing that the uncle had passed away. As he grew older, he even became unable to recognize his own face in a mirror, so different was it from the memory of his own face as a young man.

Despite the tragic results of the brain surgery, H. M. retained conscious functioning, expressed emotions, and showed no diminishment in IQ. For these reasons, most of us would grant him the status of personhood. But it was a significantly diminished personhood. Not only was he essentially cut off from the rest of the world, he also was in a significant way cut off from himself—unable to grow, mature, or tackle new challenges, which are functions of normal life. There was one exception. Although H. M. had lost declarative memory, it was eventually discovered that he retained procedural memory. He could not remember a new name or new face, but he could learn new skill tasks, such as drawing a circle. It was discovered that, unlike declarative memory, procedural memory does not rely on the hippocampus for proper functioning. Consequently, he could learn new physical tasks but could not remember when or how he had learned them.

Cases such as H. M.'s were among the first in cognitive neuroscience to clearly demonstrate that the *I* of my extended, reflective consciousness arises out of the complex interactions of a number of brain processes operating in parallel. When specific areas of the brain are damaged, we begin to see how much of the self is a construct of complex interactions. The unity that we experience appears to be the end result of a finely tuned and

ongoing process. The self is an emergent reality, blossoming out of the interaction of mind, brain, body, and environment.

The realization of this constructedness of the self eventually leads us to question how truly unified our self-conscious awareness is. We see a glimmer of this in H. M.'s case, for if his procedural learning is unconscious, in what sense is it truly *he* that is doing the learning? Is it H. M. that is learning, or is it his body?

Such a question emerges in a more prosaic form in the case of hypnosis. Usually classified as a parlor trick and tarnished by long association with such pseudoscientific practices as mesmerism and past-life regression, hypnosis is nevertheless a real phenomenon. Individuals in a hypnotic state appear for all practical purposes to lose consciousness. But if it is not the conscious self that is responding to hypnosis, who is answering the hypnotist's questions? The perplexity returns after the subject recovers from the hypnotic state. During the hypnotic state an individual may be given a task to perform after reawakening, such as to open the window immediately after hearing someone cough. Such suggestibility makes hypnotism a fun parlor trick. What is psychologically interesting, however, is not only that the individual has no memory of the suggestion planted by the hypnotist but that, if asked to explain why she opened the window, an alternative explanation ("It's too warm in here!") is readily and unself-consciously given. The conscious mind seems quite willing to confabulate (make up) an explanation that is perfectly consistent with the action performed but at odds with what the observer perceives to be the real motivation for the deed.

The impact of such behavior has been blunted by both its familiarity and the frequent suspicion that there should be a simple and straightforward explanation available. Similar kinds of disassociation between conscious intentionality and behavior have emerged in other contexts. One of the most famous emerged from the research of Roger Sperry and Michael Gazzaniga with epileptic patients who had undergone a commissurotomy, a splitting of the cerebral hemispheres. In a normal human brain the cerebral hemispheres are connected by a dense neural structure called the corpus callosum. Beginning in the 1940s, severing the corpus callosum began to be used as a last resort to treat severe cases of epilepsy. Separating the hemispheres prevented the development of grand mal seizures that affected the whole brain, and the procedure proved to be a clinical success.

While patients could by and large function normally after the surgery, later experiments began to suggest that the severing of brain hemispheres resulted not only in a split brain but also in a split mind. These experiments capitalized on the separation of function,[4] the fact that each hemisphere is responsible for most bodily functions on the opposite side of the body: the left hemisphere controls movement and hearing on the right side of the body as well as the right half of the visual field of each eye, and

the right hemisphere controls movement and hearing on the left, as well as the left half of the visual field. Requiring the subjects to stare at a central point in front of them, material was shown to the left and right portions of the visual field in such a way that it would not be present to the other half. Because language skills reside largely in the left hemisphere, any verbal response to a question would represent what the left hemisphere "saw." If the patient was asked to respond by pointing with the left hand, however, this could be understood as a response from the right hemisphere.

Surprisingly, when the two hemispheres were simultaneously shown different material, their responses were indeed different and appropriate to the information that each hemisphere alone would perceive. In one such series of experiments, researchers flashed composite faces before their subjects, in which the left half of the face (for instance) would be that of a man and the right half that of a woman (Levy, Travarthen, and Sperry 1972). When subjects replied verbally, they claimed to have seen a woman's face. When asked to point with their left hand (controlled by the right hemisphere), subjects instead pointed to the man's face. Even stranger, verbal responses indicated that the subject had seen the entire woman's face (both left and right halves), even though only one half was presented. Somehow, it appears, processes in the brain fill out the image in a way that is undetectable to the verbal self.

Another sort of confusion arose in other experiments. If the written command "Laugh" was flashed before the left visual field controlled by the right hemisphere, the subject would laugh. If asked to explain the behavior verbally (thus involving the left hemisphere), the subject would respond with a comment along the lines of "You guys come up and test us every month; what a way to make a living!" Similarly, if the command "Walk" was flashed, the subject often would get up and do so, giving an explanation for the behavior that seemed to be at odds with the actual cause. Patients shown frightening scenes became agitated, whereas those shown calming scenes, such as ocean waves, became serene—all the while invoking, if asked, causes other than those of the slides (Gazzaniga 1988).

This kind of confabulation was present across a range of experiments. But what do these results mean? The most straightforward interpretation would seem to be that after the surgery there are two persons present, one in each hemisphere. Each hemisphere seems to be able to understand the tasks asked of it and respond accordingly. Each hemisphere possesses distinctive functions, the left clearly better at language and the right at spatial abilities. Each hemisphere seems oblivious to the perceptions and motivations of the other. The implications of this conclusion seem bizarre. Am I one person who, if my hemispheres were split, would become two? Or am I two people all along and just have never realized that what I thought of as my body is not really *my* body after all but *our* body? This last conclusion

seems odd both philosophically and scientifically. What biological function could such a duality serve?

Because these experiments touch at the core of human identity, they have attracted considerable philosophical attention and thus a range of explanations. In some ways, functionalist, information-processing accounts seem best able to explain the results of the experiments despite their weakness in accounting for the problem of consciousness generally. On a functionalist account, the conscious self is a product of the activity of the whole brain. When the brain becomes divided, the self does as well. Where there was one person there are now two, albeit with truncated abilities. Because consciousness and personhood are not any one thing but a property of the overall system, there is no point in wringing one's hands over which self of the split brain is the real one, for it presumes a kind of continuity and identity that does not exist.

Daniel Dennett has put forth one of the more radical solutions to this problem, arguing that the mind is made up of a number of competing modules, each vying to become part of the master narrative that is consciousness. In this model, the mind is characterized more by its plurality than by its unity. In the end, the conscious self is understood largely as an epiphenomenon, a continually modified central narrative that is constantly shifting as lower-level modules compete to update and revise the narrative that make up the whole person. As such, it is certainly conceivable for a second center of narrative gravity to emerge under the right conditions (Dennett 1991). Similarly, Patricia Churchland (1986) argues that the results show the inadequacy of such folk-psychological terms as *consciousness*, *self*, and *person*—terms that do not denote real entities but are used only because we are so ignorant of how the mind actually works.

Others are not so willing to give up the idea of basic unity. Neuroscientist John Eccles, defending a dualist position, has argued that the experiments provide evidence that the conscious self is housed only in the language-rich left hemisphere. While the right hemisphere can occasionally show remarkable ability, there is "nobody there," and, consequently, it may be considered as a sort of independent automaton (Popper and Eccles 1977). Critics point out also that the results of the experiments are more complex than is usually indicated in popular accounts. Only a minority of the patients made any response when information was flashed to the right hemisphere alone; most made no response at all. Moreover, although direct connection between the cerebral hemispheres was severed, the hemispheres retained indirect connections via the brain stem and other areas. These and other complications make it difficult to say whether there are suddenly one or two selves in the brain. What can be said is that in some of these cases a fairly developed and strong level of disassociative behavior is displayed, even though the meaning and implication of such disassociation remains unclear.

This kind of disassociation, where either the unity of the person is called into question or the conscious mind seems prone to fabricate information when it no longer has proper access, is not unique to split-brain cases. Blind sight is a similarly intriguing case. Evidence for blind sight emerged from patients who had suffered significant damage to a portion of their occipital cortex, which is significantly responsible for visual processing. Such damage typically results in a large blind patch in the visual field, with patients suffering damage on the right hemisphere of the cortex unable to see objects on the left, and vice versa. Experiments led by Lawrence Weiskrantz (1986) established that, even though patients insisted that they could not see objects in their blinded area, they could nevertheless guess fairly accurately what was there. Thus, if patients were asked to guess whether a square or circle was present in the blind spot, they responded at a rate consistently better than chance. How do they know? The implication seems to be that visual processing and information occurs at several levels and in different brain locations. Some of these locations are responsible for the visual field that we consciously perceive. Others are capable of providing limited information but seem to be only indirectly accessible to consciousness. If I experience blind sight, *who* "sees" the square in the blinded area? I do, but only in a sense that goes beyond what I regularly think of as my conscious experience.

Even more unusual than blind sight are cases of anosognosia, also known as hemineglect, which typically occurs as a result of a stroke that impairs the right parietal lobe. Patients who suffer this sort of damage are suddenly unable to acknowledge anything that appears on the left side of their visual field. Sufferers will shave only on the right, dress only on the right, and eat only off the right half of a plate. The left half of the body remains paralyzed and, for the sufferer, is essentially nonexistent. If a sufferer of anosognosia is asked to move his left arm or to get up and walk, he, like split-brain patients, will confabulate, claiming that he does not feel like moving his arm or going for a walk right now. In some cases, the denial is even stronger, with subjects claiming that the limbs on the left side of their body do not even belong to them. In one extreme case reported by Oliver Sacks, a patient kept falling out of bed because, he claimed, someone had put a corpse in bed with him and he kept trying to push it off the bed. When he pushed the corpse off, however, he fell, too—for it was his own unrecognized arm that he was trying to push off (Ramachandran and Blakeslee 1998, 143).

What is unusual about anosognosia is not merely the fragmentation of the unified person or the confabulations that patients produce. It is the quite specific derangement of rational thought that seems to accompany it. How could people not know that they are totally unaware of the entire left side of their body and visual field? It is not only the fact that sufferers

of anosognosia have lost all representation of what happens on their left side but that they are oblivious that such a deficit exists.

V. S. Ramachandran argues that such deficits should not be understood merely as a form of neglect but that they reveal a particular impairment of reasoning. Building on a theory proposed by Marcel Mesulam, Ramachandran proposes that our left and right hemispheres are responsible for different kinds of rational operations (Ramachandran and Blakeslee 1998, chaps. 6, 7). Whereas the left hemisphere is responsible for more focused attention, the right is responsible for detecting global coherence and anomalies. When this area in the right hemisphere is damaged, the left hemisphere is left to its own devices. Unable to detect anomalies such as paralysis on the left side, it constructs a world in which such paralysis does not exist.

Ramachandran's theory needs further elaboration and analysis. What is clear from research on anosognosia, blind sight, and split-brain subjects is how much the self is a construction of a number of quite special abilities. The ease with which we perceive and act in the world is the result of many complex, interacting brain systems. More than this, my self is significantly shaped and defined by these interacting systems. When some are impaired, who I am may be radically changed in the process.

Whereas brain damage may reveal in rather dramatic ways our own constructedness, it should not be altogether surprising, for our own development from fetus through childhood to adulthood reveals the extent to which we are not born as whole and ready-made but are made up as we go along. Advances in neuroscience and developmental psychology have only accentuated what we already know on a personal level. Earlier generations of psychology placed great emphasis on the role the environment plays in psychological development; modern research indicates that childhood development is a complex interplay of biology and external stimuli. Throughout much of childhood, the brain is a work in progress. Not only are we born with virtually all of the neurons we will ever have, we are born with far more than we will keep. In the first years of childhood, brain development is characterized by massive neuronal death as the brain essentially wires and programs itself as the child interacts with the world. Far from being a bad thing, such die-offs are a necessary part of brain development. A child's brain can be understood as a massive evolutionary project. Mental development is also very much physical development.

Such findings accentuate the question, Who am I? Am I merely the conscious flow of experience? Or does the self include the various sophisticated, unconscious cognitive processes that often are hidden from my conscious ponderings? It is questionable whether we can even make the distinction so clear-cut. What appears to be the case is that the *I*, the self, the person, is a kind of ongoing process, developing across time and emerging as a result of a large number of brain and body processes. The relation of self and body resembles more a surfer on the sea than a ship and its

captain. A surfer can exert control on his or her direction, but it must always be done with a sensitive awareness to the actions of the water beneath. But even this metaphor is misleading, for it presumes that the surfing self and the sea of brain and body can be treated as completely separate entities. As cases such as anosognosia indicate, such separation is illusory. The *I* is itself composed of brain processes of which it is totally unaware.

Painful Pleasures: The Paradox of Emotion

Although we often feel in control of our thoughts and actions, such confidence frequently melts with respect to our own emotional states. On occasion, I am confronted in class with the eager libertarian student who claims to be completely free and in charge of himself or herself. On those occasions, I sometimes command the student, "Be happy!" or "Be mournful!" or "Fall in love!" Of course, it's impossible. It seems paradoxical, but the thing we have least control over is our own emotional state. I can no more *make* myself be happy than I can move a mountain. As a result, we all engage in elaborate behavioral patterns that, in one way or another, are designed to produce happiness and a sense of well-being and avoid pain and sorrow. It is going to dinner and a movie with friends and family that makes me happy, not any direct willing of the state of happiness on my own part.

This lack of control also seems paradoxical because our emotional states, more than anything else, are important to us. Human beings will do almost anything to achieve happiness and avoid pain and suffering. Our lives are defined in no small part by the fact that states of well-being are often so difficult to achieve on a regular basis. Early to bed and early to rise may indeed make one healthy, wealthy, and wise, but there is no guarantee that health, wealth, and wisdom consistently produce happiness. Indeed, the many celebrity biographies in books and on television suggest that, while wealth can make life easier, it does not guarantee happiness. And even though many reply on national surveys that they are content or happy, such sense of well-being stops short of the peak experiences that especially drive us and that tragically lead many to drug use.

Because emotions are intimately tied to our goals and aspirations, they are important theologically. It would be a mistake to reduce categories of salvation to emotional states, but it also would be a mistake to conclude that emotions are unimportant for our understanding of salvific states. Emotions define in no small way both what we wish to avoid and what we seek. There is much suffering in Dante's vision of hell, whereas eternal bliss awaits those who pass into the heavenly realms. Consequently, emotional states contribute to our freedom in the soteriological sense. Negative emotional states hinder our ability to achieve our desired goals; positive ones enable us to achieve such goals and indeed are part of the goals themselves. It is thus not surprising that popular psychology plays such an

important role in modern society, for it serves as a kind of secularized soteriology, promising to help us achieve the happiness we so desire but consistently fail to attain.

Despite its importance, emotion remains one of the least understood features of the human mind. Part of the reason for this is the research perspective of both behaviorism and early cognitive science. Behaviorists limited psychology to the study of behavior. Because emotion seemed to be an internal, mental quality, its study tended to be excluded from the behaviorist paradigm or understood as a form of behavior. Early cognitive scientists also tended to ignore emotion. Cognitive science was understood to be the study of rational thought processes, of which emotion seemed to be the opposite. Computers do not emote. This by no means meant that human beings do not, only that emotion lay outside the scope of early cognitive science.

This lack of research stemmed in no small part from such methodological blinders. It also resulted from the fact that emotional states have proven to be extraordinarily difficult to study. A primary problem is simply defining what we mean by *emotion*. Emotional states can be said to include not only pain and joy but also love and depression, which are somewhat more abstract. I can be joyful for a few minutes or hours, but I may be depressed for months and in love for years. More than this, describing emotional states is tricky. Steven Pinker observes that our experience of emotions is much richer than the language we use to describe them. One result of this is that languages vary in their ability to capture emotional states. Only Germans have a term for pleasure at the pain of others (*Schadenfreude*), but upon hearing it explained we instantly recognize what is being conveyed (Pinker 1997, 367). This primal quality of emotions also seems to render nonsensical those who claim that all experiences can be understood as linguistic constructs. Only a fool would trade the experience of love for a description of it.

Despite this lack of concern during much of the twentieth century, the importance of emotional life has prevented it from being totally neglected, and as our knowledge of the brain and mind has progressed it has become increasingly apparent how important emotion is to the proper functioning of the human self. This progress, in turn, has led to the development and discarding of a number of theories of what emotions are and how they work. Many current cognitive scientists trace the beginning of emotion research to William James (1884), who postulated that emotions arise out of bodily states. The reason we feel fear upon seeing a bear, for instance, is that we suddenly undergo significant bodily changes. Our heart begins to race, our breathing quickens, and, in most cases, we run. James saw emotion arising out of the interplay of mind and body, with the body bearing the causal responsibility.

James's approach eventually came under criticism, and exploration of emotions went primarily in two directions. Cognitive psychologists came to understand emotion primarily in terms of cognitive function. Early theorists proposed that emotion served as a kind of appraisal system that evaluated experiences. The link to the body was kept, but the cognitive role of emotions was emphasized (Schacter and Singer 1962). Pinker, a contemporary example of this functionalist approach, understands emotions primarily in terms of evolutionary function. We have emotions because they help us survive, and they help us survive by urging goals and priorities upon us. The person who stands in front of an angry bear deciding between alternatives will likely perish; the person who runs in terror has at least a chance of surviving (Pinker 1997). Disgust functions to help us avoid foods that are poisonous, lust makes sure that our genes do not die with us, and our love for our children ensures their survival into adulthood. For Pinker and other functionalists, emotions serve as a kind of brain within the brain, orienting our goals and desires relatively independently of our conscious self.

While cognitive psychologists were developing functionalist accounts of emotion, neuroscientists were, not surprisingly, attempting to understand the brain structures involved. Early on, the most influential model was that of Paul MacLean's triune brain (1970). MacLean understood the brain as a kind of evolutionary layer cake, with different brain structures identified with reptilian, mammalian, and distinctly human stages of development. In his analysis, the oldest areas of the brain derived from early reptiles. This reptilian brain was responsible for those most basic of emotions tied to survival: fight, flight, food, and sex. Because mammals need to cooperate in large groups and nurture their young, portions of the mammalian brain developed to promote such prosocial behavior. The areas responsible for emotion came to be called the limbic system and involved the amygdala, the hippocampus, and surrounding brain regions. MacLean's claims regarding the existence of a limbic system were partially borne out by a number of experiments. For example, epileptics who suffered seizures in the area of the limbic system experienced intense emotional sensations.

Recent work on emotion has begun to integrate psychological and neurological approaches and has revealed a more complex picture than is portrayed by either approach alone. Emotions do appear to be universal rather than culture-specific, although the expression of emotions depends heavily on cultural circumstances. Paul Ekman (1980) has proposed that there are six basic emotions that we all share and that are tied to specific kinds of facial expressions. Regardless of culture, individuals can differentiate between facial expressions of surprise, happiness, anger, fear, disgust, and sadness. Thus, Japanese individuals watching a film will display the same emotional range as Americans, although their display depends on whether or not other people are present.

Our emotional responses, in turn, are mediated by a number of brain structures, some of which occur in the area traditionally denoted as the limbic system. Work by Joseph LeDoux, in particular (1996), has highlighted the role that the amygdala plays in fear responses. LeDoux built on work that indicated that damage to the amygdala and surrounding regions leads to impairment of fear conditioning, and his research revealed the complexities involved in even this most basic of emotional responses. The importance of the amygdala for fear, however, does not extend to other emotions, and LeDoux argues that the limbic-system model for emotion is too simplistic. Emotion is more complex and likely involves several regions of the brain.

The complexity of emotion and its integration with other cognitive processes is revealed in the work of Antonio and Hanna Damasio. Their work has focused on the role that emotion plays in reasoning processes, highlighted by what is now the famous case of Phineas Gage. Gage, a nineteenth-century railroad foreman, suffered a devastating brain injury when a dynamite blast propelled an iron spike up through his cheekbone and forebrain and out through the top of his skull. To the astonishment of all, not only did Gage survive, he could still communicate and, after a short while, was able to move under his own power. Yet it eventually became apparent that something dramatic had happened. Formerly, Gage was one of the best and most trusted workers in the company. After the accident he became unreliable and unpredictable. Once of good character, he now used profanity with such indiscretion that women were advised to stay away from him lest they be offended. No longer able to keep a steady job, he drifted from employer to employer until he ended up in a carnival freak show and finally died destitute and unemployed. Gage's reasoning faculties seemed fully intact, but his personality had wholly changed. In the eyes of his friends and acquaintances from before the accident, "Gage was no longer Gage" (Damasio 1994, 8).

Gage's skull and the tamping iron that caused the injury were preserved at the Harvard School of Medicine, and research by the Damasios found that the blast caused significant injury to the prefrontal cortex at the very front of the brain. Today, patients who suffer damage in the same area exhibit conditions very similar to Gage's. These patients seem able to reason in a perfectly normal fashion, typically retaining average or above-average functioning on standard intelligence tests. Experiments also show that their moral reasoning is sound as well; patients can distinguish between socially accepted norms of right and wrong and, if given a list of alternative scenarios, can identify which sort of behavior is appropriate and explain why.

Strangely, however, these patients cannot consistently apply their perfectly sound reasoning abilities to decisions in their own lives. They typically have lost their jobs because of their inability to perform in a dependable

and predictable manner. After their injury, spouse and friends find them difficult to get along with, prone to unpredictable outbursts and socially inappropriate comments. Antonio Damasio has found that these patients also seem to suffer from an almost total lack of affect. Except for the occasional outburst of short duration, patients display a lack of emotional attachment. One patient even complained that things that once inspired him now no longer did so. Typically, sexual drive is lost as well.

Research by Damasio and his colleagues suggests that the two deficits are in fact linked: poor decision making is in no small part a result of being unable to attach emotional significance to events and proposed alternatives. Effective decision making requires what Damasio calls "somatic markers." Our reasoning by itself is unable to make us *do* anything. Reasoning processes must also be connected to an emotional evaluation. In a series of experiments, this was demonstrated by having normal subjects and subjects with prefrontal cortex damage play a kind of gambling game. Subjects were allowed to select from four decks of cards. Drawing a card from any given deck resulted in either a monetary (play money) reward or punishment. Some decks gave on average better rewards than others, but the subjects were not told this beforehand. Over the course of playing the game, normal subjects learned fairly quickly to draw from the decks that rewarded better, and skin-conductance responses (used in lie-detection tests and usually a reliable indicator of emotional arousal) indicated that they developed a learned emotional response to drawing from the decks that punished most severely. Subjects with prefrontal cortex damage showed immediate emotional responses to reward and punishment, but they failed to demonstrate the kind of learned emotional response that normal subjects did. Consequently, the brain-damaged subjects performed quite poorly and quickly drove themselves into "debt."

Damasio's work with these subjects is remarkable for the way that it integrates emotion and reasoning and connects them in turn to bodily states, much as James did more than a century before. Emotion is not simply an add-on component, an epiphenomenon on top of rational processing. It is integral to the proper functioning not only of the organism as a whole but to basic rational decision making. Such research also shows, again, the extent to which our personhood is a construct and the extent to which it relies on the integration of body, brain, and mind. The impact of emotional disconnect is, if anything, even more profound. It is in some ways easier to acknowledge that our reasoning and perceptual abilities emerge from the constructs of the brain. While such abilities are indeed important to us, we do not generally consider them as central as emotional dispositions are for defining selfhood and personality. Emotions touch at the core of who we are. To lose most of our emotional associations, as subjects with prefrontal damage apparently do, seems virtually inconceivable and, to many, hellish.

But even this may not be as striking as how brain damage can cause such a complete change in personality. We prefer to think that our personality is to some extent under our own control. I may not be able to achieve happiness on command, but I can determine my own outlook on life and thereby exert control over the type of person I will be. If I have made a mess of my life, or if I suffered through a horrible childhood and grew up in a negative social environment, the power is within me to turn around. If only Hamlet had resolved to put away his infirmity of character, things might have been different. Shy, emotionally straitjacketed Laura in Tennessee Williams's *The Glass Menagerie* draws our pity at the same time as it evokes the thought within us, "I would not put up with that kind of life!"

But is the choice really ours to make? Persons with prefrontal damage indeed suffer a huge loss, but their subsequent behavior is not out of the realm of ordinary human experience. We know many who consistently have made poor choices and thus wasted their lives. To what extent is this simply a matter of choice, and to what extent is it a matter of biology? Was Phineas Gage free before the spike blew through his brain but less so afterward? In what sense was he responsible for his own decisions after the accident, and to what extent can they be blamed on the damage to his brain?

These questions have emerged in a quite different way with regard to our growing knowledge about the role that neurotransmitters play in brain functioning and particularly to the emergence of a significant pharmaceutical industry that modifies their production and absorption. When a typical neuron fires, it releases neurotransmitters at the axon, which then bind to receptor sites on the dendrite of the neighboring neuron. This binding creates an electric potential in the neighboring neuron, causing it to fire in turn. The neurotransmitters are then typically released and taken up again by the originally firing neuron. There are more than forty neurotransmitters in the brain—likely many more. Not all neurons respond to all neurotransmitters equally, and some neurotransmitters serve not to transmit as such but to encourage or inhibit transmission. Furthermore, neurotransmitters are produced only at certain sites in the brain, and the supply of neurotransmitters affects the rate and manner in which neurons fire.

The role of neurotransmitters in the brain is highly complex and in some ways one of the strangest features of brain functioning. Although the firing of a neuron often is compared to the binary state of a logic gate in a computer, there is no computational analog for neurotransmitters. This is not only because of the way that neurotransmitters affect the firing of neurons but also because of the way in which they connect the state of individual neurons to the global state of the organism. As is now well known, exercise can result in the release of endorphins. Endorphins affect neuron firing, which in turn can create an elevated mood, sometimes resulting in a "runner's high." Physical, cognitive, and emotional states af-

fect the release of neurotransmitters, which affects the firing of neurons and thus future physical, cognitive, and emotional states.

The connection between these comparatively simple molecules and our emotional states is, on the face of it, perplexing. It is not at all clear why their impact on neuron firing should affect us the way they do. That such chemicals do affect us in precisely this way, however, has been known, at least on a folk level, since the dawn of recorded history and likely before. Alcohol and drug use is hardly a modern phenomenon, and their mood-altering capacity has been used over the millennia for a variety of social and religious purposes. Psychoactive substances typically work by either mimicking neurotransmitters or inhibiting their proper functions in nerve transmission. That such substances can temporarily transform personality hardly needs mentioning.

Only recently have we begun to understand the role that natural neurotransmitters play in mental health and self-regulation. This has been brought to public attention particularly by the success of Prozac and similar drugs that work by blocking the re-uptake of the neurotransmitter serotonin, effectively increasing the amount of it in the brain. Originally designed for such conditions as manic-depressive disorder, these drugs have also been widely used to treat clinical depression, sometimes with striking effect. In many cases, not only does the drug cure the depression, but patients experience a subtle but significant shift in their personalities. As observed by clinical psychiatrist Peter Kramer in *Listening to Prozac* (1993), such patients sometimes describe themselves as "better than well." Individuals who have struggled all through life with shyness or low self-esteem find themselves for the first time willing to be active in social situations and take risks. Marital and sexual relationships are transformed as individuals marvel at what they had been willing to put up with. Prozac users sometimes find themselves more successful at work as well. In the eyes of some, Prozac and thereby serotonin seemed a kind of cure-all, all the more because it was not thought to be addictive and usually did not have any significant side effects.

Such exuberance has sometimes given drugs a bad name. They do not work equally well for everyone or in all contexts. Indeed, they seemed most effective with what Kramer calls "penumbra" patients, those borderline cases who are not clearly clinically ill. Although such accounts are anecdotal, the effect seems to be real, and troublingly so. It seems strange that a single chemical could have such a global effect on personality. Is changing personality really as simple as taking a pill? Are we entering, frets Kramer, a new era of cosmetic pharmacology, when we can use drugs to change our personality if we do not like the one that we have?

These concerns are perhaps overwrought, at least so far. However, as with the case of Phineas Gage, they do reveal the extent to which the criteria by which we define who we are are affected by the mechanisms of the

brain and biology. More than this, the ability of fairly simple chemicals to alter our sense of well-being touches on the issue of soteriological freedom discussed earlier. A significant element of the Christian tradition has been the promise of personal transformation. The fullness of Christ's love is not something that is postponed until the afterlife but is, at least to some extent, experienced now. In the months leading to his conversion, Augustine experienced considerable pain, confusion, and internal turmoil. Afterward, these disappeared. Confident in the promise of God's grace, Augustine seems to have never looked back. Newly assured and transformed, he thereafter led a celibate life and assumed significant leadership in the church.

Would Augustine's spiritual crisis have been better dealt with by taking a pill? Hardly. Although serious consideration of our biology may give us pause, brain chemistry alone does not eliminate anguish or set our priorities in life. But Augustine's sense of well-being after his conversion cannot be understood as only a spiritual change but not a physical and biological one, for the simple reason that such neat divisions no longer make sense. Our spirit, however we may define that, emerges out of the activities of the mind/brain, which in turn are intimately connected to the body. A spiritual transformation, therefore, is also in some sense a biological one. Soteriology must therefore include the whole person. This would seem to imply that, while salvation is not limited to brain chemistry, any full concept of salvation must include it.

This seems like a strange thing to say. The sphere of religion is usually understood as separate from and above other considerations. Human biology belongs to medical doctors, psychology belongs to psychologists, and spirit is the province of pastors and theologians. Such a hierarchy presumes that these separate levels are independent of one another. They are not. This has significant implications for soteriology. If theological claims about personal transformation are correct, any account of mental health that relies on psychological categories alone is incomplete, for mental health must include the whole person, which presumably includes the kind of spiritual orientation that participation in a life of faith implies. Likewise, theological claims about soteriology are incomplete unless they take the whole person—body, brain, and all—into account. A religious transformation is also a psychological transformation and a biological one.

This may seem a novel and foreign idea, but perhaps it is not. The ministry of Jesus was notable as much for his healings as for his teachings. The coming of the kingdom of God involved not only a spiritual transformation but in many ways also a physical one. While two millennia and countless technical achievements separate us from the time of the Gospels, it appears that in some cases old insights still can surprise.

CONSTRAINED TO BE FREE

Are we free? The question is deceptively simple, for freedom implies many things. To be free implies that there is someone, a subject, who can act on that freedom. Cognitive science does not deny such a subject, but it does show that the kind of freedom we have is dependent on the complexities of our mind/brain. These are revealed startlingly by extreme forms of brain damage but also in our still-limited understanding of our emotional lives. Such complexity suggests that the kind of freedom we have is itself complex. It is not simply a matter of whether we can do anything or nothing but of what we are enabled to do.

For some, this may not seem to answer the question directly. Freedom, in the metaphysical sense, is opposed to determinism. In asking whether we are free, the metaphysical theologian wants to know whether my actions are fully determined by my environment or whether they in some sense originate from inside myself. If a person turns to a life of crime, is it as a result of personal choice, environment, or neural chemistry?

Freedom in this sense can take us beyond the cognitive sciences and, indeed, beyond the realm of the sciences altogether. The sciences by themselves cannot tell us whether the world is fully deterministic. Dominant interpretations of quantum physics in fact suggest that it is not; the world has some indeterminism built in, even though in most physical processes this indeterminism largely disappears at the level of living organisms. But even here there is always the gap between empirical evidence and ultimate claim. One can interpret the physics differently, as unlikely as that now seems to many.

One might do better to draw a contrast between ourselves and our immediate environment. Environmental determinism seems quite difficult to sustain, and our current understanding of cognitive science does little to support it. Behaviorist psychology presupposed environmental determinism and foundered precisely because it provided no straightforward way to account for complex human behavior. Our environment conditions and constrains us more than we probably realize. But the sheer complexity of the human mind and the logic of its internal workings render meaningless any environmentally deterministic position. For any given environmental input there typically are many behavioral outputs, because the actions we take depend crucially on our own history and personality.

One might go further and observe that our behavior is significantly constrained by our genes and by the particular wiring and architecture of our brain. Indeed, many of the experiments cited above are sometimes taken to support just this point. But such observations work only if we assume that these features of my biology are separate from the "me" that decides. This line of thought falls into the trap of assuming that "I" am separate from my body and brain in such a way that I can say that it is my

brain doing the action, not I. But it is precisely my body and brain that are integral to my normal functioning. It is as if a follower of Descartes said that I am not free because all of my actions are fully determined by the proper functioning of my soul. Because my soul determines everything I do, I must not be free. Such an argument makes the mistake of assuming that, in a Cartesian dualist framework, the soul and "I" are distinct and separate things.

Owen Flanagan observes that this kind of mistake is frequently made with a famous experiment conducted by Benjamin Libet (Flanagan 1992; Libet 1985). In the experiment, Libet had individuals watch a clock as they flexed a finger. The subjects were asked to occasionally flex their fingers and to observe on the clock the precise moment at which they decided to do this. At the same time, Libet had the individuals hooked up to an electroencephalograph that measured brain wave patterns and, in particular, a pattern that Libet designated the "readiness potential" that indicated the onset of an action. Libet found that the conscious intent to flex the finger took place approximately 200 milliseconds before the actual flexing, but the readiness potential registered at about 350 milliseconds prior to the conscious willing. The implication seemed to be that the conscious willing is the result of a prior unconscious process, making the conscious intent causally inert.

While the experimental setup does allow differences of interpretation, Flanagan notes that the conscious mind can be considered causally inert only if one presumes no prior history to the experimental setup. In order for the experiment to proceed, however, subjects had to previously agree to do the experiment and, presumably consciously, listen to and understand the instructions given to make the experiment work. The mistake is to separate consciousness from the rest of the person and its history; when this is taken into account, the simple claim for determinism and the irrelevance of consciousness becomes harder to make.

In many ways it is the very determinate structure of our brain and biology that enables the kind of freedom we do have. This may not get us fully to a metaphysical freedom, but it is at least empirically consistent with it, which is the most we can ask from the sciences on such an issue. It also suggests that our freedom is developed out of quite specific kinds of constraints. Human beings are, for instance, quite good at recognizing and remembering faces, and certain kinds of brain damage can result in prosopagnosia, the inability to recognize individual faces while otherwise being visually unimpaired. We do not remember names as well, however, and most of us are familiar with recognizing the face but forgetting the name—only rarely is it the reverse! Our ability to recognize and remember faces provides a degree of freedom and is important in social communication and relationships. Language provides another degree of freedom. The ability to empathize and to think about one's thoughts (an ability that

individuals with some forms of autism may lack) provides another (Baron-Cohen 1997).

We are, then, both bound and free, and it is because of the particular form of our bondage that we have the kind of freedom that we do. Such an observation by itself does not resolve the Luther-Erasmus debate, in part because their understandings of freedom were so profoundly different. But it might provide a starting point for considering the issue afresh. Metaphysically, one can at least affirm our own empirical freedom, a freedom that means that the self is not simply a product of its environment but is formed by its own decisions and choices. At the same time, our freedom is enabled by the particular, embodied constructive character of our mind/brain/body. Almost paradoxically, we are empowered by our limitations. Out of this comes the need for soteriology. Luther argued that our nature is so bound that we are unable on our own to truly will the good. For him, true freedom meant a transformation brought about by Christ, which could be achieved only through God's action. Here, theological claims transcend what can be ascertained by cognitive science, but the border between the two can be significant. Cognitive science cannot speak of the true freedom that Luther and so many of us seek, but it can at least remind us that such freedom is not merely a freedom of the mind but of the whole person. Recognizing this can correct what has sometimes been an escapist trajectory in the Christian tradition as well as provide new insights into the kinds of freedom worth having.

NOTES

1. The treatises by Luther and Erasmus are reprinted in Rupp, Watson, and McNeil 1995.
2. Antonio Damasio (1999) uses the terms *core* and *extended consciousness*. Gerald Edelman (1992) distinguishes between primary and extended consciousness, but the meanings are essentially the same.
3. H. M.'s case has been extensively studied and analyzed in the psychological and neuroscientific literature. Cf. LeDoux 1996.
4. This research has been reviewed in numerous places. See, for example, Gazzaniga and LeDoux 1978; Churchland 1986, 172–93.

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