Consciousness and Morality: Recent Research Developments

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David Moursund, Editor

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In 2007, Moursund founded Information Age Education (IAE), a non-profit company dedicated to improving teaching and learning by people of all ages throughout the world. He is editor of the *Information Age Education Newsletter.* See http://iae-pedia.org/Main_Page#IAE_in_a_Nutshell.

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Information Age Education

Information Age Education (IAE) is a non-profit company in the state of Oregon that was established in 2007 by David Moursund. Its goal is to help improve worldwide informal and formal education at all levels. Its current list of free resources and activities includes:

- Free books published by IAE. See http://i-a-e.org/free-iae-books.html.
- Free IAE Newsletter published twice a month. See http://iae-pedia.org/IAE_Newsletter.
- IAE Blog. See http://iae-pedia.org/IAE_Blog.
- IAE-pedia. See http://iae-pedia.org/index.php?title=Special:PopularPages&limit=250&offset=0 for a list of pages ordered by popularity.
- Other IAE documents. See http://i-a-e.org/downloads.html.
- A major IAE initiative on math tutoring. See http://iae-pedia.org/Math_Tutoring_Project.

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Preface

When Francis Crick and James Watson described the organization of DNA in 1954, it revolutionized beliefs about genetics, the underlying molecular base of body systems. See http://www.chemheritage.org/discover/online-resources/chemistry-in-history/themes/biomolecules/dna/watson-crick-wilkins-franklin.aspx. Crick subsequently decided to take the next biological step. He thus spent the remainder of his distinguished career studying how our brain regulates behaviors that both support and override genetically-controlled systems.

Forty years after the discovery of DNA, Crick wrote a remarkable widely read book on cognition, *The Astonishing Hypothesis: The Scientific Search for the Soul* (1994). See http://en.wikipedia.org/wiki/The_Astonishing_Hypothesis. The book's basic point is that it's necessary to understand consciousness if we're ever going to truly understand how our brain can function both within and beyond genetics.

Consciousness had previously been the sole purview of philosophers and theologians who often considered it a disembodied essence. Further, they hadn't been able to determine how it functions. Crick argued that brain-imaging technologies had developed to the point at which scientists could now begin the long process of answering basic questions about the underlying biology of consciousness and the related issue of the base of moral behavior.

Knowing how to do something and deciding whether of not to do it are separate albeit related issues. For example, a hermit can do whatever is necessary to stay alive, but people who live together must also consider the effects of such survival behavior on others. Morality is about such social dualities as right/wrong, good/bad, and fair/unfair. Ethics is about the specific rules and laws that people should follow.

Morality is a human issue because we're a social species. Researchers thus wondered if morality emerged when social mammals discovered the values of cooperative behavior, or sometime after humans arrived. Two widely held historic beliefs are that moral behavior:

1. Is inspired by deities, and
2. Requires the rational level of mind that only humans have.

As might be expected, many scientists took up Francis Crick's challenge to investigate the possible neurobiological base of consciousness and morality. During the past two decades, a number of major related research laboratories have worked on elements of the issues. Whoever could solve either of these two great cognitive mysteries would certainly win a Nobel Prize. Brain imaging technology has materially advanced the research, and the recent U.S. Brain Initiative simply adds further support to the effort. See http://www.nih.gov/science/brain/.

When DNA was discovered, most people without a science background didn't understand the biology, although enhanced understanding of DNA has become more common during the past 60

years as good non-technical explanations developed. Fortunately, many of the principal researchers into consciousness and morality have written their discoveries and interpretations in non-technical books for general readers.

This Book

Chapters 1-4 synthesize recent biological conscious research and chapters 5-6 biological morality research. Chapter 7 presents the alternate historical philosophical and theological perspective of consciousness and morality. The scholars whose work is synthesized don't necessarily agree with each other, but that's all right. Collegial disagreements tend to move a field forward.

The search for the base of consciousness and morality thus continues. The IAE Newsletter will report on subsequent developments (that you will automatically receive as a free subscriber. http://i-a-e.org/iae-newsletter.html).

Artificial intelligence is one area of consciousness only briefly mentioned in this book. Can a machine (such as a robot) develop consciousness? In New Scientist, Celeste Biever (2013) explores the possibility. We might think that our inability thus far to completely understand human consciousness and morality would preclude our ability to develop machine consciousness. Not necessarily. Developing machine consciousness could provide the clue to understanding human consciousness. Sometimes the best way to understand something that extends our brain's capabilities (such as a telescope or microscope) is to replicate the function on a machine.

What follows in this book is a sense of what we currently know. But exciting new developments are certainly to come.

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Chapter 1. Emotions, Feelings, and Consciousness

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The renowned cognitive neuroscientist Antonio Damasio attracted a lot of attention in 1994 with his ground-breaking book, *Descarte's Error: Emotion, Reason, and the Human Brain* (1994) on the underlying neurobiology of emotion and feelings. Other related acclaimed books that shortly followed include Joseph LeDoux's *The Emotional Brain: The Mysterious Underpinnings of Emotional Life* (1996), and Daniel Goleman's widely read popularization of emotion theory and research, *Emotional Intelligence: Why It Can Matter More than IQ* (1997). The result was widespread interest in emotion/feelings and their handmaiden, consciousness.

Emotion and Feelings

Our body and brain are obviously highly interconnected. Our brain has to know how our body is built and the extent of its normal behavioral capabilities. An abnormal challenge requires rapid awareness and an abnormal-level response.

The awareness and response begin with emotion. Emotion is an innate, unconscious, automatic, subcortical arousal system that alerts us to potential dangers and opportunities. It manifests itself internally through visceral and muscular changes, and externally through facial/vocal expressions and body posture. It's probably a good thing that emotions are genetically driven rather than culturally learned. An innate system gives humans a common set of fundamental preferences related to pleasure/pain, good/bad, etc.—plus the ability to recognize the universal body signals in others who are emotionally aroused.

Feelings are basically our conscious perception of what's occurring in our body during emotional arousal. Sufficiently aroused, emotion can activate conscious feelings about the challenge, and bias the direction of its resolution. Since feelings are basically our conscious perception of what's occurring in our body during emotional arousal, they allow us to rationally override the automaticity of emotion.

A thermostat is a useful metaphor for explaining this general system. A room thermostat is set at a specific thermal point. If the temperature suddenly drops, the thermostat will activate the release of more heat into the room, but the thermostat does not determine the reason for the temperature drop. If the cause is an open outside door, the response (to heat the neighborhood) is counterproductive. Mere awareness of an environmental shift followed by an automatic response is thus not sufficient, and so our brain adds additional systems.

Think of emotion as a biological thermostat that monitors and reports variations from normality. If we don't have an innate appropriate reflexive response for an imminent challenge, the emotional arousal will activate our attention system, which identifies and then focuses on the

location and dynamics of the challenge. This activates relevant memory and problem-solving systems that consciously and rationally respond to the challenge.

Emotional arousal thus drives attention, and focused attention drives memory, feelings, problem solving, and response. Almost everything that we do thus begins with emotion, a key cognitive process that was poorly understood for most of human history.

Damasio on Consciousness

What's especially intriguing for those who are interested in the underlying theory and research about emotion/feelings and consciousness is that during the past 16 years, Antonio Damasio has updated and extended his book *Descarte's Error* with three additional books as new developments occurred. This set of four books thus provides a sort of history of the recent development of our understanding of unconscious and conscious arousal. His newer books are *The Feeling of What Happens: Body and Emotion in the Making of Consciousness* (1999), *Looking for Spinoza: Joy, Sorrow, and the Feeling Brain* (2003), and *Self Comes to Mind: Constructing the Conscious Brain* (2010).

I recently read *Self Comes to Mind* and then also skimmed through *Descarte's Error* to see how our understanding of emotion, feelings, and consciousness has changed during the 16 intervening years. Wow! What seemed so new and exciting to me in 1994 seems today like things I've always known. Damasio is upfront about how some of the things he wrote in *Descarte's Error* were speculative. Neuroimaging technology can now report with a level of precision that couldn't even be imagined 16 years ago—and the neuroimaging potential is mind-boggling.

Descarte's Error focused mostly on case studies, observed behaviors, and cognitive speculations because we were then pretty much at the beginning of the neuroimaging era. *Self Comes to Mind* is full of neuroimaging research discoveries—an increasingly precise mapping of the brain regions involved in the systems and processes that Damasio explored in his earlier books.

What I found most interesting is that Damasio and other cognitive neuroscientists can now get down into the cellular level in ways that were unimaginable 16 years ago. Organisms composed of a single cell (such as an amoeba or paramecium) demonstrate a will to live in that they move towards food and away from danger. Now, fast forward over evolutionary time (well, evolution wasn't all that fast) and the aggregate of cells that we call a human has the same collective will to live. So something sensate and regulatory obviously exists within a cell, but does an amoeba have a brain?

Not really, but as multi-cell organisms evolved, the complexities of challenge and response led at one point to the introduction and subsequent development of an increasingly complex conscious brain—the localized specialization of affect and response, as it were.

The human brain has specific highly integrated systems. *Emotion* informs our body/brain of the existence of an environmental challenge. *Attention* identifies and focuses our body/brain on the nature and location of the specific challenge. *Memory/Problem-Solving/Feelings/Execution* determines if the challenge is novel or familiar. Our cortex includes reason/logic/preferences into the problem solving mix, chooses among (typically several) possible responses, and then moves us towards the opportunity or away from the danger—or decides to just hang around for awhile

to see what happens. This is the essence of emotion, feelings, and consciousness that define the book's focus.

Consciousness

Consciousness is an enigmatic state of mind that emerges out of the integrated behavior of specialized brain modules. It provides a conscious organism with a sense of self—a personal awareness of its own existence and that of the objects it confronts.

Consciousness abandons me when I go to sleep and magically reappears when I awaken. And when I'm conscious, I not only know something about myself and the environment, but I also know that I know it. So who is the "I" who is doing all this knowing? And how is it possible for purely physical brain activity to lead to subjective experience?

As indicated in the preface, the search for the meaning and mechanisms of consciousness has historically been the speculative purview of philosophers and theologians (who often considered it a disembodied essence), but neuroscientists have recently begun to explore the biology of consciousness via the remarkable observational capabilities of brain imaging technology. Giulio Tononi argues that it should be possible at some point to measure levels of consciousness with the same technological ease with which we can now measure blood pressure and body temperature (Zimmer, 2010). If he's correct, this development would provide a much better understanding of epilepsy, persistent vegetative states, the level of consciousness in various animals, and other consciousness issues.

The Biology of Consciousness

As indicated above, conscious thought and behavior emerge out of unconscious emotional arousal, which alerts us to potential dangers and opportunities and helps to activate an innate automatic response. If we have no innate automatic response to the challenge, unconscious emotional arousal can shift into conscious feelings, which activate relevant brain systems that can consciously and rationally analyze the challenge and develop a solution (albeit a solution often biased by the nature of our emotional arousal).

Since school and other educational activities focus principally on conscious learning and behavior, understanding the biology of consciousness will be essential to the development of credible 21st century theories of teaching and learning. Damasio's three-part theory of the sequential emergence of consciousness that follows would thus be useful for such educational applications.

Protoself

In Damasio's theory, the biology of consciousness begins with a stable neuronal arrangement that maps every part of an organism's body into various interconnected brain areas. This mapping is necessary because brain and body must constantly communicate in order to maintain a continuously revised unconscious sense of what's happening throughout the organism.

A collection of automated brain systems that Damasio calls the *protoself* use this continuous flow of information to manage various life processes, such as circulation and respiration. The protoself maintains the stability it needs across its lifetime by operating body systems within innate relatively narrow regulatory ranges.

Core Consciousness: The Present

But we're conscious of more than our own self. Our protoself is imprisoned within the geography of its body, but sensory/motor and related brain systems also allow a conscious organism to explore the world. A stable body thus confronts a constantly shifting and expanding external environment.

So not only does a brain contain a map of its body, but a conscious brain must also have a mechanism for mapping and connecting to the external world. Damasio believes that consciousness emerges when the mapped relationship between an organism and an external object (which may be another organism) has risen to the level of a feeling of what's currently happening.

Core consciousness (which we share with many animals) is the consciousness of the here-and-now. It's a non-verbal imaged running account of the objects an organism confronts in a series of successive instants as it moves through and interacts with its immediate environment. Think of being both actor and spectator in a movie within our brain—a film being a sequence of still pictures that give the illusion of movement as they quickly pulsate through our brain.

Many catch phrases in our culture speak to the importance of recognizing and respecting the here-and-now in the quickly moving stream of consciousness that defines much of life. For example: Stop the world, I want to get off; Slow down and smell the daisies; and Seize the moment. Core consciousness is primal in that it continuously focuses the organism on the immediate which, after all, is where we do live.

Extended (or Autobiographical) Consciousness: The Past and Future

We may live in the present, but we have lived in the past, and we will probably live into the future. Damasio suggests that organisms must have a large complex cortex in order to consciously move beyond the here-and-now to profit from past experiences and to avoid potential problems. The cortex must be sufficiently large to contain a vast and powerful autobiographical memory that can quickly identify information relevant to a novel challenge. Humans, and the great apes to a lesser extent, have such a cortex. See http://www-psych.stanford.edu/~knutson/bad/semendeferi01.pdf.

Intelligence emerges out of this ability to embellish and temporally extend core consciousness. It allows our brain to manipulate recalled information in the mental design and analysis of potential responses. The practical applications of conscious intelligence include imagination, creativity, and conscience—which led to language, art, science, technology, and a variety of cultural and political systems, such as the shared governance of a democratic society.

> The arts were an inadequate compensation for human suffering, for unattained happiness, for lost innocence, but they were and are compensation nonetheless, an offset to natural calamities and to the evil that we do. They are one of the remarkable gifts of consciousness to humans (Damasio, 2010).

Damasio's book *Self Comes to Mind* makes demands on readers, but those who have a basic understanding of brain systems and functions should have no real problem with it, and it's as good a book on brain organization and systems as I've read in some time. An excellent 18-page appendix on our brain's cellular and systems architecture provides very useful non-technical information for anyone who is teaching, writing, doing workshops, and/or making conference presentations in Educational Neuroscience. Unfortunately, the book doesn't have a glossary, and

a glossary would certainly be useful to many readers. It's thus a good idea to develop your own glossary of unfamiliar terms/definitions when they first appear in the book because they'll probably come up again later.

Consciousness in Computer Brains

The work of Damasio and many others provide an indication of the complexity of human consciousness. Science fiction authors have provided many examples in which humans develop increasingly powerful computers, and eventually a conscious computer. Such a computer is typically "evil" and the story is about the computer system's success or failure in taking over the world.

Researchers in Artificial Intelligence (AI) continue to make progress in developing AI computer systems. They tend to measure this progress in terms of developing computer systems that can solve problems and accomplish tasks that —if done by a human—would be an indication of human intelligence. Many people were quite impressed recently when a computer system defeated two humans in the TV game of Jeopardy. See http://i-a-e.org/iae-blog/game-of-jeopardy-computer-versus-humans.html.

However, such current AI capability is in no sense a sign of emerging machine consciousness. It does not tell us whether humans will succeed in developing a computer system that has "artificial consciousness" in the same sense that we have developed computer systems that have artificial intelligence.

The field of AI research includes a considerable focus on developing machines that have some type of awareness of their environment and their roles in the environment. As a very simple example, many years ago some AI researchers developed robots that kept track of the power remaining in their batteries and had knowledge of how to find a power outlet and plug into it. One might describe this as a type of consciousness relevant to survival.

Research in these aspects of artificial intelligence has led to the development of a field called affective computing. Quoting from http://en.wikipedia.org/wiki/Affective_computing:

> Affective computing is the study and development of systems and devices that can recognize, interpret, process, and simulate human affects. It is an interdisciplinary field spanning computer sciences, psychology, and cognitive science.

Over the next few decades we can expect considerable progress in the development of computer systems that have artificial intelligence and artificial consciousness. See http://www.consciousness.it/CAI/CAI.htm. Our informal and formal educational system will need to help people learn the capabilities and limitations of such systems and how best to work with them.

If these computer-related topics interest you, here are a few sources of additional information:

- Marvin Minsky (2006) was a pioneer in helping to develop the field of artificial intelligence. A prepublication copy of *The Emotion Machine* is available at http://en.wikipedia.org/wiki/The_Emotion_Machine. Quoting from that Website:

  > Minsky argues that emotions are different ways to think that our mind uses to increase our intelligence. He challenges the distinction between emotions and other kinds of

thinking. His main argument is that emotions are "ways to think" for different "problem types" that exist in the world.

- There is considerable current research on programming computers to recognize human emotions. For example, see http://spectrum.ieee.org/podcast/computing/software/teaching-computers-to-hear-emotions.

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Chapter 2. Consciousness and Free Will

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The human conceit, long fueled by theology, philosophy, psychology, education, and law is that we're basically independent agents. We function principally on the basis of consciously directed reason and logic—something we call free will.

Well maybe. But think back to last night or the night before when you needed but couldn't get a good night's sleep because your brain was having an extended inane conversation with itself. How successful were you in consciously telling it to "shut up already and go to sleep"?

Initial widespread public awareness of the shift in scientific opinion on the issue of free will was fueled by the publication of two widely read and acclaimed books, Jeff Hawkins and Sandra Blakeslee's *On Intelligence* (2004) and Malcolm Gladwell's *Blink* (2005). This chapter will focus on two books for general readers by internationally renowned cognitive neuroscientists who have now added to the growing scientific belief that we're perhaps not as consciously autonomous as we formerly believed: Michael Gazzaniga's *Who's in Charge: Free Will and the Science of the Brain* (2011) and David Eagleman's *Incognito: The Secret Lives of the Brain* (2011).

Michael Gazzaniga's *Who's in Charge?*

Michael Gazzaniga clarifies his basic position early. *We* are not the boss of our brain. If it wants to chat with itself when we really need to sleep, it will chat. Like the Internet, our brain doesn't have a boss. Further, who is the "I" who wants freedom of action? Are individuals in a mechanistic universe who are members of a social species really *free* to do whatever they want to do? And if I want that freedom for myself, am I willing to grant it to a cab driver who prefers to drive somewhere other than where I want to go?

Gazzaniga has written an often light-hearted book about a serious perplexing issue. The first half is an excellent non-technical functional introduction to our brain, woven into the story of the development of the cognitive neurosciences as only a true pioneer can tell it. He was a graduate student in Roger Sperry's lab when Sperry was doing the transformative split-brain research that would lead to his Nobel Prize. Gazzaniga designed many of the imaginative initial studies on the split-brain patients.

Brain Organization

The organizational perspective that eventually emerged is that our brain is composed of an enormous number of highly interconnected networks (or modules). Each processes a very specific task, such as to recognize a vertical line or a specific tone, or to bend the left index

finger. Initial fragmented sensory/motor information becomes integrated as it moves hierarchically through the relevant brain systems to produce emergent properties that are greater than the sum of the initial activations. Thus, shapes, colors, and textures combine to become a face; individual sounds become melodic sequences that then become a song that emerges from a vocal system and face.

The large deeply folded sheet of cortex at the top of our brain is divided into two hemispheres that are connected by a massive fiber tract (the corpus callosum) that was severed during split-brain surgery to reduce intractable epilepsy. Gazzaniga discovered that the two hemispheres process different kinds of tasks, and function differently.

Goldberg (2009) has proposed that the fundamental hemispheric difference is that our brain must of necessity use different strategies to process novel and familiar tasks, and that the right hemisphere (in most people) seeks to understand novel challenges and develop creative solutions, while the left hemisphere recognizes familiar challenges and activates established responsive routines. Language is processed principally in the left hemisphere because it's an efficient established communicative system.

Our conscious rational brain is thus equipped to recognize and respond to both the novel and familiar challenges that we confront. Although the constant chaotic sensory input into our brain is rapidly processed at a subconscious level, our (delay, avoid, or approach) response is unitary and feels conscious. Gazzaniga has proposed the intriguing concept of a left hemisphere *Interpreter* that creates a single, unified, coherent response out of the massive sensory input and memory retrieval. The narratives that emerge out of decision and action create our sense of self and the beliefs that bias our future decisions.

These discoveries intrigued many educators who then began to read the growing literature for general readers. Seeking practical applications, they often made claims that went beyond what the research had discovered. Well, scientists don't always get it right initially either, but by the beginning of the 21st century scientists and educators had developed a functional understanding of our brain and cognition, and educators were developing credible applications.

Sitze (2012) reported in an *Information Age Education Newsletter* that theology and other fields had ignored or even became hostile to what was occurring. Thus generally uninformed, they will now have difficulty in getting up to speed in interpreting and applying neuroscience discoveries that relate to their field—issues such as free will.

Free Will

The clean, crisp, authoritative exposition Gazzaniga presents in the first half of the book becomes tentative as he jumps into the murky waters of consciousness and free will, which weren't originally scientific constructs. As indicated in the Preface, the cognitive neurosciences began to seriously explore their underlying neurobiology towards the end of the 20th century when Nobel Laureate Francis Crick (1994) suggested that advances in research technology now made such explorations possible.

In a determinist era during which many deny the existence of free will, Gazzaniga argues that free will in humans is possible because the rules that regulate things at one level don't necessarily apply to subsequent levels. For example, quantum mechanics governs atoms and Newton's laws govern objects, and one set doesn't completely predict the other. That molecules don't exhibit free will doesn't mean that humans and societies can't.

Consciousness is a property that emerges out of the interplay of a constantly shifting multitude of specialized systems, and the thalamus seems to play a central role in this integration. Consciousness provides us with a unified sense of self, a personal subjective awareness of our existence and of the environment we inhabit. As suggested earlier, it abandons us during sleep and magically reappears when we awaken. And when we're conscious, we not only know something, but we know that we know it.

The issue of free will in conscious problem solving begins with the nature of problems. Many factual problems have a single correct response, such as 6 x 5 = 30 or Salem is the capital of Oregon. Many other problems permit alternative responses, such as what to order from a menu, how to travel from Portland to Seattle, and finding positive integers that sum to 17. And, there are problems that have no solution. For example, find two even integers whose sum is an odd integer.

Still other problems are ill posed. For example, consider "the" problem of homeless people in a city. This ill-posed problem consists of a great many problems (many different homeless people), and each homeless person is a unique problem situation. We tend to try to find a "one size fits all" solution rather than to deal with the specific problems of individuals. Problem solving is a very complex and challenging field of study. For more information about problem posing and problem solving see http://iae-pedia.org/Problem_Solving.

A major task of cognitive neuroscience research will be to discover how automatically processed sensory input morphs into conscious moral decision and action, and the innate and cultural constraints that bias the response. Is it a response to a factual problem that draws on learning and memory, or to a multiple solution problem that also draws on feelings and preferences? Scientists have discovered that initial subconscious processing has already biased our decision for up to ten seconds before conscious systems get involved.

What parts of this subconscious bias are innately and/or culturally determined? For example, we're born with an innate ability to acquire such properties as language and a moral code, but family and cultural constraints guide us to a preferred specific language and moral code.

Free will wouldn't be an issue if we were a solitary species. Social relationships are central to the moral/ethical elements of behavior. The concept of personal responsibility is meaningless unless others are present to be responsible to. Gazzaniga suggests that five universal moral rules exist that have precursors in chimpanzee behavior: Help rather than harm others. Be fair and reciprocal in relationships. Respect elders and those in legitimate authority. Demonstrate group loyalty. Be pure in body and behavior.

Gazzaniga ends his book with a thoughtful discussion of perhaps the most complex problem humans confront, and that's how to develop a legal system that recognizes the validity of societal needs, individual responsibility, and the biological factors that can limit a person's ability to behave in a culturally responsible manner.

He suggests that we're not a mindless machine, regulated solely by physically determined forces (or by a controlling deity). Rather, we are the product of all the life experiences that impact our emerging self. Responsibility is thus a contract between two or more people rather than a brain property—and pure determinism is meaningless in this context.

We've domesticated ourselves over evolutionary time by punishing and even killing those who don't follow the basic moral/ethical *rules* we've developed, and so we've become a

basically cooperative social species. Still, misbehavior continues, and the educational, theological, and legal communities will have to wrestle with how best to make us even more human than we currently are.

David Eagleman's *Incognito*

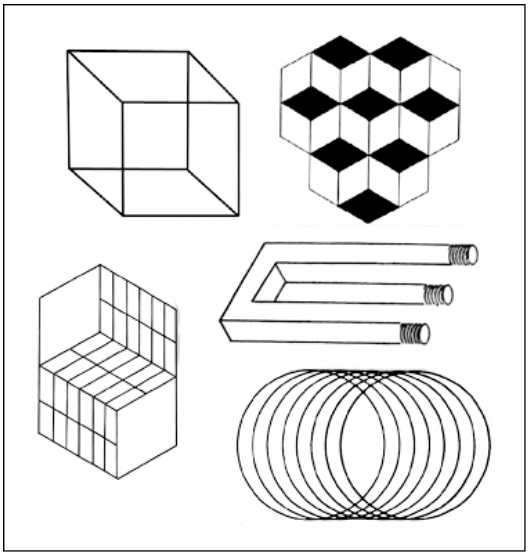
David Eagleman, who directs the Initiative for Neuroscience and the Law at Baylor University College of Medicine, has written an excellent non-technical book titled *Incognito: The Secret Lives of the Brain* (2011). The book deals with the issue of how to decide what changes (if any) our society should make in defining inappropriate and criminal behaviors, and in determining the appropriate societal response to such behaviors. Since social skills are central to human development and interaction, this issue is obviously educationally significant.

In *Who's in Charge* (above), Michael Gazzaniga indicated that our brain is made up of an immense number of highly interconnected neural networks—each specialized to automatically process a very specific element of the external or internal environment. Related basic networks combine into more complex networks. Various line segments, colors, and textures can thus combine into massive networks that form the remembered image of an object such as a house.

We thus tend to think that we experience the totality of what's out there, but the reality is that we don't need to process every element of a familiar house in order to recognize it. All animals sample and act on only a small part of their respective environment. Honeybees, for example, access ultraviolet wavelengths and can manufacture honey, neither of which we can do. Conversely, we can gather their honey, place it in bottles, and use it in cooking—which they can't do.

The title of Eagleman's book indicated his belief that most of our brain's activity is hidden from conscious thought. Over evolutionary time we've been biologically programmed to automatically recognize/ignore, seek/avoid, resolve/fail to resolve most of the challenges that confront us. The automatic nature of conversation and jazz improvisation are examples. We have a conscious sense of the basic theme we're trying to communicate, but what comes out is principally the unconscious automatic flow of verbal or musical information.

Our brain networks occasionally confront competing information, such as in optical illusions that require a conscious resolution. Consider the common set of illusions (below) in which we consciously try to determine the orientation of the figure.



When a brain's challenges reach a certain level of complexity, it needs a relatively small but powerful conscious system to direct the huge number of evolved automatic systems. Think of consciousness as akin to the newly hired CEO of a company with a long successful history. Staff, technologies, procedures, etc., function automatically and efficiently for the most part. The CEO's basic job is to monitor the automatic systems, to identify immediate and long-term goals that the automatic systems will carry out, and to take over in emergencies when the existing automatic (rule-bound) systems can't resolve a challenge. Gazzaniga used the term Interpreter to identify this core capability of our conscious brain system.

Cultural Constraints

We're a social species, so although our conscious system plays an important role in controlling our individual behavior, our species survival requires cooperative behavior. We thus evolved deeply embedded cultural rules and policies that help resolve disputes quickly and peacefully, even if some rules seem arbitrary. These rules were codified in such moral prescriptions as the Biblical commandments to respect elders, and to not kill, steal, lie, covet, or misbehave sexually. This was later condensed into "Do unto others as you would have them do unto you," and still later into the scientific concept of reciprocal altruism. See http://en.wikipedia.org/wiki/Reciprocal_altruism.

We seem to function with parallel moral systems, such as that killing is wrong, but it's all right to kill to protect self/kin. And just as we have a conscience to adjudicate internal conflict, we have cultural mores and a legal system to adjudicate conflicts among individuals. We're thus not completely free to do whatever we want to do without fear of censure. The continuing dilemma is whether to follow one's own desires and needs or those of the larger group. Home and school instruction and interaction (and religion for many) help to develop the requisite moral/ethical competencies.

Scientists have been exploring this dilemma through studies in which participants are asked to settle hypothetical moral conflicts—such as whether it's OK to steal to get needed food or medicine for one's family, or whether it's OK to do something that will cause the death of one person in order to save the lives of several others.

One such classic study of moral behavior is the hypothetical case of a young adult brother and sister who are traveling together. Neither is married. After a pleasant day on the road they check into a motel room. They later decide on a whim and without any coercion that it would be fun and interesting to have sex. The sister is on birth control pills but the brother gets and uses a condom to be safe. Afterwards, they decide that it was enjoyable but that they'll keep it a secret and not do it again, resolutions they follow.

When asked if the sibling behavior was OK, study participants overwhelmingly deemed it immoral and/or disgusting, but few could give a logical reason why. Are some moral beliefs so deeply ingrained that they are beyond conscious awareness? When the incest taboo emerged, societies had only a primitive (at best) understanding of reproductive biology/genetics and contraceptive technology, and the taboo was reinforced by a seeming biological aversion to sexual behavior between close relatives. Although the adult consensual siblings in the vignette knew what they were doing, and the chance of a pregnancy was remote, the taboo still exists in the minds of most people. See http://en.wikipedia.org/wiki/Incest_taboo.

Similarly, the issue of same sex marriage is currently creating cultural confusion because our scientific understanding of the biological underpinnings of romantic attachment is ahead of our cultural ability to accept it.

Legal and Educational Challenges

Eagleman does an excellent job of explaining the issues confronting the criminal justice system as science is coming to grips with the reality that many criminal behaviors are more complex and biologically driven than previously believed. Our supposed free-will brain isn't the only player in determining our identity. It partners with our endocrine and immune systems, and the three are inseparable from the chemical systems (from nutrition to air pollution) that influence our development and behavior. Toss in the effect of our complex social system on identity and it becomes problematic just which part of our personal community is the principal perpetrator who should go to jail.

Eagleman doesn't suggest that we simply forgive criminal behavior, but rather that society should begin the torturous path of trying to connect culpability to neuroplasticity, societal response to biological reality. The goal, for example, should be to place young offenders with still maturing frontal lobes into an effective residential school that will focus on developing self-control, and to place those with frontal lobe or other damage that precludes social restoration into a humane setting that will also protect society from them. Costs and recidivism would eventually decrease, and social satisfaction would increase as punishment becomes only a part of the societal resolution, rather than most of it.

Schools (and possibly religious organizations) would play an important support role in reconceptualizing the criminal justice system, since it requires a society that understands our brain and its support systems and a willingness to question existing a priori assumptions.

Human biology and cognition must thus become embedded into the entire K-12 curriculum, so that students truly understand our social body/brain by the time they take on adult responsibilities such as voting. We now see political and marketing strategies succeed with deceptive and dishonest allegations. It's because of our low collective understanding of the underlying neurobiology of decision, behavior, and probability. The era in which our understanding of our brain and cognition was somewhat speculative is over. It's thus time to get serious about helping students develop the ability to understand their own unconscious/conscious

brain, and how to assess the credibility of allegations—to know and properly respond when they're being manipulated.

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Chapter 3. Consciousness and the Absence of Empathy

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To many people, the genesis of evil seems beyond scientific investigation. Simon Baron-Cohen is not one of the people who ascribe evil to malevolent spirits that enter into humans and direct their misbehavior. In *The Science of Evil: On Empathy and the Origins of Cruelty* (2011) he argues persuasively that morally cruel behavior related to the concept of evil is the result of specific brain system deficits and/or malfunctions that result from innate factors and perhaps also from poor childhood nurturing. He further argues that *absence of empathy* is a scientifically more accurate term than evil. He suggests that empathy is a universal solvent. Any problem immersed in empathy becomes soluble. It is as free and effective a way to resolve any interpersonal problem that one could imagine—from marriage and family problems to national and international political disputes.

Baron-Cohen brings strong research credentials to the task. He is widely recognized for his seminal work in exploring the underlying neurobiology of the autism spectrum (and diminished empathy is a characteristic of autism). The book will probably be both widely admired and roundly denounced. In either case, it will certainly help to set the agenda for how societies should appropriately respond to cruelty, given emerging scientific discoveries about brain development and cognitive processing. The excellent case studies that he inserts into the text provide a good sense of the complexity of the issues the book raises and discusses.

The Cognitive Base

Our brain's principal task is to plan, regulate, and predict behavior and the movement of objects. In order to do this, it must developmentally master two key forms of knowledge about the natural world that Baron-Cohen calls systematizing and empathizing.

Systematizing involves the ability to recognize, analyze, and manipulate predictably changing patterns—in effect, to figure out how things work and how to make them work better. Understanding repetitive patterns allows us to predict the future, and also to manipulate variables in order to modify and improve a function.

Empathizing involves the ability to understand other humans, who are a very important sub-set of the organic and inorganic world. Empathy occurs when we suspend our normal single-minded focus and instead adopt a double-minded focus of attention. It thus defines our remarkable ability to infer and appropriately respond to someone else's feelings, thoughts, and intentions. This ability is commonly called Theory of Mind. See http://en.wikipedia.org/wiki/Theory_of_mind.

These two capabilities exist along a low-to-high continuum. Baron-Cohen developed two online 60-question self-report tests: Systematizing Quotient (SQ) and Empathy Quotient (EQ). Links to the tests are provided in Baron-Cohen (n.d.).

SQ/EQ scores in a general population fall roughly into a normal distribution (a bell-shaped curve), with about 68% of the group within one standard deviation from the mean. Most of us function adequately in situations that require some empathy and/or pattern recognition and manipulation. Those who score at the very high end of either scale will tend to be exceptionally competent (even obsessed) with either regularity in the patterns they observe and seek (SQ), or with the feelings and needs of others (EQ). Those who score at the very low end of either scale exhibit incompetence in pattern recognition and manipulation (SQ) or in social skills such as empathy (EQ).

It's probable that functioning within the moderate middle levels of the ranges is the most adaptive for our species. For example, being too other-centered (on the EQ scale) tends to diminish our personal ambition and attainment for fear of diminishing others. Being too self-centered allows us to successfully (and even ruthlessly) pursue our ambitions, and so perhaps to achieve power and wealth, but also to make many enemies in the process. Although balance is much better for most of us, the outliers can be both helpful and hurtful to human society.

Zero Degrees of Empathy: From Discovery to Cruelty

Baron-Cohen indicates that a circuit of (at least) ten highly interconnected cognitive and affective brain systems regulates empathy. The book discusses each in detail. Recent neuroimaging studies have identified many of the circuit deficits and malfunctions that cause behavioral aberrations. Such behavioral aberrations are not necessarily negative.

For example, people with Asperger's syndrome score very high in systematizing (because of their intense focus on regularity) but they score low on empathy because they have difficulty with the unpredictability implicit in human emotion and behavior. They thus prefer to spend their time with whatever predictable systems interest them, and because of that they may make important discoveries in such highly patterned fields as mathematics, physics, and engineering. Although their social skills and interests are low, their behavior typically isn't harmful because they've developed a logic-based moral code out of their strong concern for regularity. In effect, they follow *the rules*.

The focus of Baron-Cohen's book however, is on the downside of empathy outliers—those who score at the bottom of the empathy scale and often engage in cruel immoral behavior. Baron-Cohen calls these Zero Negatives, and three major types of personality disorders characterize this condition: Borderline Disorders, Psychopathic Disorders, and Narcissist Disorders. All three exhibit deficits and/or malfunctions in one or more of the ten systems in the empathy circuit. People with these disorders are unable to recognize and respond appropriately to the feelings and desires of others, and are thus often emotionally and/or physically abusive. Less than 5% of the general population is beset with one of these disorders, but these people cause much social turmoil and account for a substantial part of the prison population:

- People with borderline disorders are characterized by self-destructive impulsivity, anger, and mood swings. Their verbal and emotional abuse is often very cruel. They view people they know as "all good" or "all bad" and can rapidly shift their assessment from one characterization to the other. They expect the "all bad" folks to apologize but often don't explain what the person had supposedly done.

- People with psychopathic disorders are similarly preoccupied with themselves, but they also exhibit a willingness to do whatever it takes to satisfy their desires – to charm, lie, cheat, assault, kill… They will often react violently to a minor real or imagined slight. They can also commit cold calculated forms of cruelty and seemingly delight in watching their victim suffer. They lack any sense of anxiety or guilt over their cruel behavior.
- People with narcissist disorders often boastfully say and do things that offend others, but are less apt to engage in the aggressively cruel behavior that borderline and psychopaths exhibit.

All of us temporarily lose empathy on occasion due to fatigue, anger, frustration, alcohol, or other factors, but our empathy returns. The absence of empathy in the above personality disorders is a trait, a typically permanent condition.

Cultural Challenges

The discovery that these forms of personality disorder share a common neurobiological substrate enhances the search for effective interventions, but doesn't immediately solve the problem. Genetics plays an important role in the development and maintenance of an effective empathy circuit, but environmental challenges trigger genetic expression. We can't currently do much about the genetics, but we can affect a child's developmental environment. Baron-Cohen views Attachment Theory as a good beginning, because of its sound explanation of the positive and negative effects of parental/family affection and rejection. See http://en.wikipedia.org/wiki/Attachment_theory. He argues that what a nurturing community gives children as they develop empathy is like an internal pot of gold, something more precious than any material gifts.

Students with empathy problems create difficult school problems—such as bullying, defacing, and various self-centered acting out problems. Autism similarly has developed a higher profile in cultural consciousness, and so schools struggle with the issue of how best to provide a compassionate school environment for autistic students. The criminal justice system similarly struggles with the issue of incarcerating people who medical research now argues are basically ill. The issue of Free Will adds yet another layer of complexity.

Baron-Cohen doesn't presume to provide a simple answer for these and other issues that are emerging out of this body of research, but he provides a very informed and informative platform where the discussion can begin—and it will probably continue for quite awhile.

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Chapter 4. The End of Consciousness

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I don't want to achieve immortality through my work; I want to achieve immortality through not dying.

I don't want to live on in the hearts of my countrymen; I want to live on in my apartment. (Woody Allen; American humorist; 1935–.)

This chapter focuses on a recent development that moves us into an intriguing emerging field called Neurotheology—the scientific study of areas that had formerly been the purview of theology. See http://en.wikipedia.org/wiki/Neurotheology. The chapter focuses on beliefs about the issue of the inevitable end of consciousness through death, and the thought of a celestial afterlife.

The Mysteries of Consciousness

As suggested earlier, we all intimately experience consciousness, but find it almost impossible to explain. Nicholas Humphrey, an Emeritus Professor of Psychology at the London School of Economics, is one of many renowned scientists who have tackled the enigma of consciousness. His latest effort is a very engaging and surprisingly light-hearted book, *Soul Dust: The Magic of Consciousness* (2011). Humphrey pretty much ignores specific brain systems per se—choosing rather to approach consciousness functionally, from the armchair of a philosopher.

Scientists who study consciousness differentiate between what they call the easy problem and the hard problem. The easy problem is to identify the neuronal systems that regulate conscious behavior (such as to focus attention and to discriminate/integrate/report information).

The hard problem is to explain how our brain, which is composed entirely of physical matter, can subjectively experience feelings (called qualia) that can't emerge out of matter alone and that can't be effectively communicated other than by metaphor. Think of the taste of apple pie, the beauty of a sunset, depth perception, and pain. It's obvious that the hard problem will be especially difficult to solve for those who believe that it will be possible at some point to develop a conscious computer.

As indicated earlier, consciousness as we commonly think of it disappears during sleep and under anesthesia, and reappears when we waken. Humphrey seems less interested in the underlying neurobiology of consciousness than in its purpose. He argues that it became biologically adaptive because it enhanced life—elevating it to a truly enjoyable almost

otherworld experience. It's a magical show that we put on for our self. Objective sensory input sparks a subjective response in our inner theater, where we transport our self into that other world we enjoy so much. And we love ourselves because we can do it. We can be with others at a social event, but we each experience it uniquely.

Drama doesn't replicate life but rather comments on it in order to educate, persuade, and entertain. That one part of our conscious brain might stage a show for another part to influence our judgment gets to the heart of what first person consciousness does.

Human beings (and *being* is what it's all about) who enjoy the feeling of existence develop a will to live that goes beyond a mere instinct to exist. Nature had to make sexual behavior pleasurable to encourage animals to engage in it, and it similarly made the feeling of existence pleasurable via consciousness to encourage us to behave in a creative and productive manner that extends the quality and length of our existence.

From Being to Not Being

And that creates a problem. We really enjoy being and want to continue to be, but our conscious intelligent mind has figured out that not being is our certain fate at some unpredictable point. Humphrey thus devotes much of his book to a fascinating exploration of the enigmas associated with the certainty of death. He suggests that our fear of death isn't that we fear being somewhere that we can't imagine, but rather that we fear not being somewhere that we can imagine and typically do enjoy—on the earth we inhabit. The prospect of death threatens to take away what's beautiful and enjoyable about our life while we're still living it.

We humans have developed three strategies for maintaining meaning and joy in life despite the inevitability of death:

- Live for and enjoy the known present rather than focusing on the uncertain future. As Walter Hagen (1956) famously put it. "You're only here for a short visit. Don't hurry, don't worry. And be sure to smell the flowers along the way."
- Identify with and focus on family and cultural entities that will survive us. These range from nurturing our own children to supporting cultural and environmental programs that will continue to enhance life in others after our death. The prospect of death loses some of its negatives if we know that the things we have come to value will continue on. We tend to see our familial and cultural world as stable, lawful, and protected from alien influences, and thus potentially eternal.
- Deny the finality of bodily death, and believe rather that the individual self (as transcendent soul) is immortal. Humphrey suggests that it should come as no surprise that spirituality and religion have become dominant forces in human life, because they reduce many of the conscious anxieties that most people have about death. Humphrey suggests that despite the doubts that even true believers have at one point or another about the reality and nature of a celestial afterlife, the vast majority of us at least want to believe in something like it, and so it's perhaps sufficiently adaptive biologically to persist.

Educational Implications

K-12 public schools in the United States are precluded from promoting religious beliefs about a spiritual afterlife, but it's important that they promote an awareness of and appreciation for the present in ways that enhance the lives of students and others. It's also important that

students begin to think beyond their own parochial needs and desires and thus to extend their typically very limited space/time boundaries.

Computer scientists interested in the field of artificial intelligence have long struggled with the possibility of developing a computer system that has consciousness. Most people who study and write about consciousness do so from the point of view that humans have consciousness. Can consciousness be defined in a manner in which a computer system might become conscious? Authors Isaac Asimov and Robert Silverman do a good job of exploring the question in their 1993 novel, *The Positronic Man;* the book formed the basis of the film *Bicentennial Man,* starring Robin Williams. If this topic interests you, you may also want to learn about Ray Kurzweil and his insights into this area. See http://www.kurzweilai.net/.

The English poet John Donne (1572-1631) famously wrote "No man is an island." Consciously we are individual islands—but perhaps the term archipelago is more descriptive for a social species. These archipelagos are just now beginning to include artificially intelligent robots and other devices. Sometime in the future these robots may have a type of "computer consciousness" that is related to but is different from "human consciousness."

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Chapter 5. Polyvagal Theory: From Physical to Social and Moral Response

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Stephen Porges is a renowned neuroscientist (Porges, n.d.) who has proposed the intriguing and educationally significant Polyvagal Theory (Porges, 2011a) of how basic body/brain survival systems emerged and how they relate to human social and learned behavior. The theory's title comes from: *poly:* many, and *vagal:* vagus nerve, the longest cranial nerve in the human body and a primary component of the parasympathetic nervous system. The vagus nerve begins in the brain stem and connects to and helps to regulate all body organs. The traditional conceptualization of the autonomic nervous system describes two subdivisions: (1) a sympathetic nervous system that promotes mobilization and is associated with flight/fight/freeze actions that occur during imminent danger or opportunity challenges, and (2) a parasympathetic nervous system that, primarily through the actions of the vagus nerve, slows down body functions towards rest and recuperation. Think metaphorically: sympathetic: a gas pedal; parasympathetic: a brake.

The Polyvagal Theory rejects the simplistic two subdivisions of the autonomic nervous system; rather, it defines three subdivisions, each with the capacity to support behaviors with a different adaptive function. Porges' theory is grounded in how the autonomic nervous system evolved in vertebrates. Basically, the autonomic nervous system progressed through three distinct evolutionary stages, each with a neuroanatomically defined circuit that promoted social behavior and health, mobilized defensive fight and flight behaviors, or immobilized death-feigning defensive behaviors. In humans, neural strands of the autonomic nervous system are manifested in our sympathetic nervous system and two components of the vagus nerve, which play key roles in how contemporary humans behave. In many respects, this unconscious system is more a matter of how our body controls our brain than the reverse.

The Polyvagal Theory explains three educationally significant issues: (1) how assertive freeze, flight, or fight physical actions can escape or defeat prey, (2) how residue from freeze, fight, or flight reactions can interfere with social engagement, and (3) how the mammalian branch of the vagus nerve in concert with other cranial nerves helps individuals heal from trauma and engage in social interactions. Let's begin by explaining how the evolutionary stages apply to human behavior, and how specific non-conscience and conscience behaviors can impact learning.

Stage One (Immobilization as Defense)

From an evolutionary perspective, the most ancient branch of the vagus nerve produces a reaction that conserves metabolic resources by slowing heart rate and lowering blood pressure, often to the point of unconsciousness. Extreme fear thus immobilizes animals so they can avoid being seen and thus harmed. A mouse will slow its physiological functioning when caught in the jaws of a cat that simply holds it without biting down. The frightened mouse appears dead and may even die if left in that immobile state. If released, the mouse will remain motionless until its internal organs once again function normally and oxygen fuels the brain, at which point the mouse will rapidly scurry away.

Fear may cause humans to faint or the mind to go numb and separate emotion and attention from the experience that produces amnesia of parts of the event (Scaer, 2001). When we're cornered or held down by a larger person (such as when beaten or raped), this immobilization mode tends to block some of the event's anguish and pain. Rapists often tell their victims that something terrible will happen to them or a loved one if they report the abuse, or else that they'll claim the victim had asked for the rape by acting "sexy." Consequently, the victim becomes afraid to tell, may not remember or dissociate, feels guilty, and may even believe the rape was her fault, because she could not fight back or escape.

Other traumatic events such as fighting in a war may have the same impact. When soldiers see their friends blown up, the freeze reaction unconsciously sets in and the viewer becomes immobilized and often psychologically dissociated. Guilt at not rushing to their friends' defense often plagues survivors even though they had no conscious control over their reactions. Survivors generally need help to understand and overcome the residue of immobilization reactions.

Stage Two (Mobilization as Defense)

Unconscious environmental stimulation can instantly trigger an automatic self-preservation fight or flight response. It's a kill or be killed, a flee or be eaten or beaten response. Awareness may shortly set in and we may wonder why we're running or fighting so ferociously. LeDoux (1996) describes how flight automatically occurs when a rattlesnake is about to strike–we run away before we consciously know what's happening.

Porges explains that a high level of sensitivity results as individuals' nervous system is continually processing and evaluating the risk of incoming challenges. He labels this process as neuroception to emphasize that it does not require conscious awareness and that it may detect danger before we are consciously aware of the nature of the challenge (Porges, 2004).

In school, mild forms of stage two behaviors occur when students "fight" with back talk or oppositional behavior in an environment they consider unsafe. They may avoid others with whom they feel emotionally or socially vulnerable or uncomfortable. When inactions are painful, students automatically avoid those who evoke such internal feelings.

Stage Three (Social Engagement)

In mammals, a unique branch of the vagus nerve evolved to link the heart's neural regulation to the regulation of facial and head muscles. In order for mammals to manage this functional shift, the Polyvagal Theory emphasizes that sensory information from both the environment and our visceral organs travels from our body to our brain, affecting how we respond to the world.

The information also travels from our brain to our body through the myelinated elements of the vagus nerve, and this influences how we feel–whether we feel safe or at risk.

"This intuitive bidirectional and interactive notion of how our nervous system regulates our internal organs in a complex social environment is neglected or minimized…" (Porges, 2011b). Porges states that "We get the signals, but we do not respect them. Denying our bodily reactions has much to [do] with our culture".

The Polyvagal Theory thus suggests that our human interactions with others influences our nervous system. Humans are a social species and so need others to survive. Reciprocal behavioral interactions regulate each other's physiological state. Basically, we create relationships to feel safe and to maintain our health by facilitating the regulation of our physiology. Our nervous system basically craves reciprocal interaction to enable a state regulation to feel safe. Behavioral problems occur when this is lacking.

The uniquely mammalian stage three vagus nerve can help us heal. Consciously engaging neural pathways from the human brain to the body can effectively dampen visceral reactions of fight or flight. Self-talk can thus calm our mind so it can assess a situation and determine if danger is or isn't present. Learning in an emotionally and socially safe school setting can thus calm our nervous system with components in the body and brain that relax and make social engagement possible.

The Polyvagal Theory emphasizes a hierarchical relation among the three evolutionary stages of the autonomic nervous system. According to the theory, the newer circuits (i.e., social engagement) inhibit the older (i.e., mobilized and immobilized defense behaviors). What's interesting and educationally relevant is that defensive mobilization strategies may actually keep an individual from reflexively recruiting immobilization as a defense. These mobilization strategies behaviorally shut down, dissociate, and possibly cause fainting.

This new way of thinking is perhaps the most exciting insight that Porges shares. Even though self-talk has been valued for many years (Luria, 1961), understanding why self-talk works is a cognitive breakthrough: (1) the mammalian strand of the vagus nerve and its branches are myelinated ("insulated"), which is unique to mammals; and (2) because the mammalian strands link to the muscles of the face and head as well as to internal organs, we understand that smiles suggest happiness, that voice rhythm, intonation, volume, etc. reflect types of communication, and that these are associated with affective experiences, emotional expressions, facial gestures, vocal communication, and contingent social behavior (Porges, 2009).

However, if mind and body fail to recognize the environment as safe, the systems will remain in flight-fight readiness. Social engagement will continue to be guarded, oppositional behaviors or withdrawal will be present, and the formation of relationships will only be superficial if they are formed at all (Porges, 2004, 2009).

Porges (in Eichhorn, 2012) states that unless we can turn off our evolutionarily programmed defense systems, we give up positive access to such social engagement components as benevolence, care, compassion, and shared experiences. This happens because we are now into a survival mode, mobilized for defensive states that result in "biological rudeness." The whole aspect of what is gained by being interactive with another person has disappeared. Even in the absence of danger, fear, or trauma, it is extremely difficult to shut off the residue from

immobilization trauma or the mobilization of fight/flight behaviors that influence our mind and body, such as seen in post-traumatic stress disorder (PTSD) of victimized adults and children.

From his study of HIV patients and autistic children, Porges (2011a) found that caregivers often feel unloved and frequently get angry, because the patient fails to respond with appropriate facial expressions, eye gaze, and vocal intonation. The caregivers thus feel rejected, disengaged, and emotionally disconnected. Their physiological responses functionally betray them and they feel insulted.

This insight may transfer to relationships between students and teachers, especially with students who look away rather than make eye contact or who fail to respond in meaningful ways that let teachers know they are engaged. Teachers may try to motivate such students without realizing that the students may be suffering from freeze/fight/flight residue that forces them to keep up their guard. Teachers may not like such students, and become angry or aggressive, and even ridicule and blame them for not caring about learning. Teachers may feel guilty and frustrated without realizing that neither the students' behaviors nor theirs were willful but were attempts by our nervous system to protect the student from further harm, and the teacher from feeling rejection and disappointment.

Social Engagement

According to the Polyvagal Theory the neural regulation of physiological functions, such as heart rate, breathing and intonation of voice are related to the evolutionary stages of the autonomic nervous system (Porges, 2001, 2003, 2009, 2010). In the face of potentially escapable fear, our heart races, breathing becomes shallow, our voice may tremble, and/or a sick feeling may occur in our stomach. A safe environment enhances even breath flow, and our heart beats without drawing attention to itself. Further, our voice is calm and steady.

Positive and negative life events unconsciously influence physiological reactions and those reactions influence social interactions. These, in turn, influence the nervous system. Porges argues that humans need social interaction to survive, because social interactions function as regulators of our physiological state. He notes that humans crave positive reciprocal engagement, because it enables a state regulation that makes us feel safe. Behavioral problems occur when positive social engagement and reciprocal interaction are lacking.

Teachers must provide an emotionally, physically, psychologically, and morally safe classroom environment in which positive interactions flourish. By doing so, this uniquely mammalian component of the vagus nerve is free to function and prompt pro-social behaviors while subduing activation of both the sympathetic nervous system that would promote flight or fight behaviors and the evolutionarily more ancient unmyelinated branch of the vagus that when recruited as a defense system produces immobilization, and can trigger fainting and defecation.

However, even in positive classrooms, Porges (2009) states that due to the residue of previous trauma such as abuse "some individuals experience a mismatch and their nervous system appraises the environment as being dangerous even when it is safe." He stresses that a mismatch in this direction results in "physiological states that support fight-flight, or freeze behaviors, but not social engagement behaviors." Porges thus emphasizes that "social communication can be expressed efficiently through the social engagement system only when these defensive circuits are inhibited." Therein lies the central educational value of the Porges Polyvagal Theory.

Educational Considerations of the Polyvagal Theory

Since students often conceal their emotions and act out without obvious provocation, it may be difficult for teachers to recognize trauma residue that interferes with learning. It is thus vitally important that classroom interactions are consistently positive and nurturing, and that teachers do whatever is necessary to create a feel-safe environment.

Porges offers tips for working with youngsters who suffer from trauma residue. Avoid blame, he stresses. To overwhelm a student with blame or negative feedback when the potential for fight or flight are present only serves to emphasize that something is wrong with the student. Consequently, the student moves further into a fight or flight physiological state typically reducing the behavior potential for social engagement (Porges & Buczynski, 2012).

Second, students need to be taught how their nervous system functions for self-protection without any conscious decision making. Students can be taught how to engage their brainpower—the third evolutionary stage of the vagus nerve—by employing self-talk narratives that reduce fear residue and guide them into positive interactions. Further, self-talk narratives can help them overcome inappropriate behaviors that result from trauma as they gain an understanding of self-preservation freeze, flight, or fight reactions over which they had no control.

Porges uses a traffic light metaphor to represent the three physiological states prompted by the vagus nerve: red (life threat; immobilization: fainting, or dissociation); yellow (danger; mobilization: fight or flight); and green (safety and social engagement). To the left of the traffic light illustration he writes an "S" for environmental stimulus. To the right he writes an "R" for responses that depend on the physiological state (traffic light colors) the person experienced. This metaphor can guide teachers (and students) to better understand why some students "misbehave" and how best to work effectively with them.

Porges (2011a) emphasizes the fact that "…once we can easily engage the social engagement system, we are free to mobilize without being in fight or flight. Rather than fight or flight, we can move and play. Although fight/flight and play behaviors both require mobilization, play turns off defensiveness by maintaining face to face social referencing. Play uses the social engagement system to signal that the intentionality of the movements is not dangerous or hurtful."

Porges (2011a) identifies two detrimental trends that can make prosocial interactions nearly impossible. The first is over-reliance on electronic devices that create a hyper-vigilant state; the second is sustained attention that fails to support health, growth, and restoration. He believes that heavy reliance on electronic devices is antithetical to social engagement behaviors necessary for meaningful social interactions.

Even though students may use texting, twitter, Facebook, or other forms of social media for communication, they are missing the critical need to see the other person's face; they are missing the opportunity to "read" facial expressions unless they are using Skype or some form of live camera production. Even then, they miss body language and context that send important messages needed to develop an efficient neural platform that supports social behavior and facilitates physiological state regulation (Porges & Buczynski, April 2012).

Porges and Buczynski caution that a second detrimental trend is treating students as if they are *learning machines* by placing an over-reliance on teaching *cognitive-centric* information

rather than exercising social engagement through music and play with others. They emphasize that the nervous system must be in a specific physiological state to foster bold ideas, creativity, and positive social behavior; otherwise, the information fails to register, and oppositional behaviors pop up. Porges and Buczynski agree that a focus on information rather than on the educational process and human development is naïve and at the expense of prosocial development.

Before the Polyvagal Theory, teachers were taught to interpret positive and negative behaviors from a psychological or behavioral frame of reference. Now, Porges tells us that we really need a physiological perspective. Without question, whether from a psychological or a physiological perspective, it is clear that safe classroom environments promote self-respect, respect for others, and a sense of well-being. Such classrooms do not just happen. Teacher actions and interactions must be carefully planned, monitored and refined to foster effective student engagement to help youngsters overcome trauma and develop social engagement skills.

In emotionally safe classrooms, on-guard defensive posturing is not necessary. Safe environments reduce unpredictability, instill a classroom code of citizenship behaviors, and build trust relationships among students and teachers. Safe classrooms honor student learning even when new learning is fragile and students are uncertain about what to do. Safe classrooms prevent freeze, fight, or flight student reactions and calm traumatic reactions to frightening situations that occur outside the classroom. Safety is essential for social engagement and healthy growth.

Conclusions

Porges' Polyvagal Theory provides a clear perspective of how our body reacts to fear and trauma with freeze, fight, or flight and how physiological reactions are out of one's conscious control. Even so, traumatic residue may evoke feelings of guilt, shame, and self-doubt that must be subdued before meaningful social engagement and meaningful learning can occur. That is, the human nervous system influences our mind and body, while reciprocally the brain influences our nervous system through self-talk and social interactions.

Educators now have a well-grounded scientific theory about why a positive, empowering feel-safe environment in which students know what to expect is essential for learning. We have known this intuitively for a long time, but now Porges provides powerful research evidence and a solid theory that support our intuitions.

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Chapter 6. The Search for Moral Behavior in Mammals

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Social Species

Patricia Churchland is a Professor Emerita of Philosophy at the University of California, San Diego. Among many other honors, she was awarded a MacArthur Fellowship in 1991. (See http://en.wikipedia.org/wiki/Patricia_Churchland). She began her career as a philosopher, but then realized that the emerging cognitive neurosciences were beginning to provide useful answers to questions that philosophers had deductively struggled with for centuries. She and her philosopher husband Paul thus took a leave of absence to study cognitive neuroscience, and their work now combines philosophy and neuroscience. *Brain Trust: What Neuroscience Tells Us about Morality* (2012) is her latest of several books.

A major exploratory focus of Churchland's work has been on the relationship between the organization and function of our brain's subcortical/unconscious level and its cortical/conscious level. Consciousness and morality are basically cortical/conscious level phenomena, but they also often draw on subcortical processes.

The principal hypothesis of *Brain Trust* is that morality originates within the neurobiology of attachment and bonding. It emerges out of the actions of selected mammalian hormones and neural networks that combine to get us beyond concerns for self and our juveniles into complex behaviors that manage an extended and appropriate social life.

We are a highly interactive social species, very dependent on the acceptance and support of others. Humans therefore must learn from childhood on how to behave appropriately in order to provide and receive such social support. Knowing how to do something and deciding whether or not to do it are two separate but seemingly related behavioral issues. They are central to understanding and responding to the true/false and right/wrong dichotomies that play such important behavioral roles in our lives. True/false questions tend to have only a single correct response (such as 1 + 1 = 2 in a base ten system), and right/wrong issues may have multiple responses that emerge out of personal preferences and resultant choices (such as what to wear to a party). For more information about fuzzy (multi-value) logic see http://en.wikipedia.org/wiki/Fuzzy_logic.

Most practical and social problems thus involve constraint satisfaction. This means that various values and probabilities interact to produce what is not necessarily the best solution but rather one that is suitable. Over time, early human tribes codified specific successful solutions into moral and ethical decisions. Morality focuses on the general culturally defined principles of right/wrong, good/bad, fair/unfair and so on, and ethics focuses on the development of specific

behavioral codes that folks should follow to act morally. Historically, a combination of parents, play, and interactions with others taught children such appropriate behaviors. Cultures that embodied these behavioral codes emerged over time (Sylwester, 2010).

Deities provided a sense of moral and ethical authority within a culture, and since certain kinds of tit-for-tat solutions seemed to resonate within the human brain, the various scriptural documents across the world often show remarkable social similarity. “Do unto others as you would have them do unto you” is a common example. However, even that has its complexities: Soldiers seek to kill their enemies while hoping that their enemies don't kill them. Churchland suggests that the belief that spiritual forces communicate appropriate moral and ethical decisions probably emerged from doubts that a biological body/brain can unilaterally care about or value someone else.

Churchland's book is focused on the biological base of morality. Is morality something central to how a human brain functions or is it a spiritually imposed metaphysical phenomenon? She argues that scientists actually now know a lot about how human cooperative behavior emerged. She thus considers our brain to be the biological platform that leads to moral thoughts and choices. We behave as our brain determines, and her book is about how our brain arrives at culturally acceptable and unacceptable moral decisions without the felt need for spiritual support. Morality is thus more about the biology of empathy than it is about following a set of theologically imposed rules.

Although 69% of U.S. adults claim to be moderately-to-very religious, only a declining 30% regularly attend religious services that are typically focused on moral issues (Worthen, 2012). Contemporary society thus seems similarly conflicted about the underlying base of morality.

Morality's Biological Platform

All 5,700 known species of mammals are social to the extent that they come together to mate. The mothers at least also care for the young, sometimes with assistance from fathers. Some mammals are considerably more social than others. Further, an abundance of resources usually reduces species competition, which generally increases cooperative behavior.

Two molecules play key roles in the social behavior of mammals. Oxytocin is a very ancient peptide that is central to complex adaptations involved in caring for others. See http://en.wikipedia.org/wiki/Oxytocin. It's found in all vertebrates, but mammalian brain evolution adapted it and several related hormones (such as vasopressin) to new tasks relative to caring for the young, and eventually also to wider forms of cooperative sociability. Similarly, serotonin probably had only a single assignment in ancient simple organisms, but it now helps to regulate human moods, many of which are associated with moral/ethical decisions. See http://en.wikipedia.org/wiki/Serotonin.

Two other interdependent evolutionary mammalian brain modifications also enhanced moral development. The first led to negative feelings from threats, plus the special motivation to take corrective action if offspring were in danger. For example, parents and offspring that were safely reunited experienced pleasure and relief. The second evolutionary modification was an increased capacity for learning to solve problems within the group; this was initially linked to pain and pleasure, and eventually to empathetic understanding of how others in the group feel about the problem.

Expanded memory led to both the anticipation of and the planning for the avoidance of trouble. These evolutionary modifications supported an awareness of appropriate social behaviors and the urge to want to be together. Mammals thus became motivated to learn appropriate social practices because social misbehavior typically led to the pain of exclusion and disapproval, while approval and affection resulted from appropriate social behavior.

Our growing understanding of mirror neurons seems to suggest a powerful biological link to the development of the neurobiology of morality. See http://en.wikipedia.org/wiki/Mirror_neuron. Mirror neurons in the premotor cortex and elsewhere activate when we carry out an action and also when we observe someone else carry out the action. For example, think of the tendency to yawn when we observe someone else yawning. Although many think this system helps to develop moral behavior, Churchland suggests that solid evidence is still lacking (although she does predict that the relevant neural systems will be located).

Are humans the only mammals with basic social behaviors that should be considered moral? Churchland suggests that other mammals care for their offspring, and some also care for mates, kin, and affiliates. They cooperate, punish, and reconcile after conflict. They may groom each other. Although bonobo morality is not human morality, and the behavior of other hominins (such as Homo erectus) might also differ from contemporary humans, Churchland argues that the evidence for the existence of a powerful non-spiritual biological base for mammalian and human morality is strong.

From Personal to Social Platforms

Our basic biological platform faced a new social behavior challenge starting about 10,000 years ago as many humans moved from the unpredictability of hunting and foraging to the greater predictability of agrarian life. Agriculture and tool making led to cooperation and bartering beyond immediate kin and tribe. The joint effort implicit in cooperation led to the concept of fairness and the social procedures to insure it. Shared religious beliefs may have advanced such social stability, since shared beliefs enhance predictable behavior. Those who behaved unfairly could anticipate an unwelcome angry response from those around them and also fear punishment from deities that were believed to become angry at immoral behavior.

Moral behavior is not necessarily biologically innate. Churchland suggests that much of it may also be just a generally accepted intelligent solution to a common problem. For example, truth telling is considered morally appropriate because false information often causes personal and social problems. Although no evidence exists that we are innately truthful (and most of us occasionally tell socially acceptable white lies) most people typically consider deliberately hurtful falsehood to be immoral.

The large and still ill-understood human prefrontal cortex (PFC) located behind our forehead has been called the organ of civilization. Its connections to our emotional and motor systems provide much of what we consider the intelligence that is implicit in predictive social behavior, such as the self-control of deferred gratification. To deliberately reject one's PFC advice could lead to behavior that most people would consider immoral.

So, to Churchland, morality is neither an illusion nor necessarily spiritual, but is rather firmly grounded in the biology of empathy. We have the biological capacity for compassion and the practical knowledge of how to figure out things. Some social practices and organizations are better or worse than others, and folks are equipped to make genuine assessments of how well or

poorly other folks are served. For example, consider the contentious issue of how to regulate stem cell research. We have to understand both human nature and science in order to have a reasonable belief about who is likely to be trustworthy on the larger and technical details of the issue. Democratic societies tend to take a free and open discussion approach to dealing with such complex problems.

Bonobos and Chimpanzees

Patricia Churchland argued (above) that basic elements of human moral behavior are observable in primates and other mammals. This section expands on that belief, focusing on the work of Frans de Waal, a world-renowned primatologist. In *The Bonobo and the Atheist: In Search of Humanism Among the Primates* (2013) de Waal discusses the evidence of moral kinds of behavior in bonobos and chimpanzees, our closest evolutionary ancestors with whom we share 98.7% of our DNA. "On our good days, we're as nice as bonobos can be, and on our bad days we're as domineering and violent as chimpanzees can be."

De Waal thus focuses primarily on observations of bonobos, since what we humans consider moral behavior is more evident within the socially cooperative life. Further, bonobos have long legs, narrow shoulders, and compatible arm to leg ratios, and so are shaped more like humans than chimpanzees. For an extended discussion of bonobos, see http://en.wikipedia.org/wiki/Bonobo.

De Waal argues that the evidence is very strong that bonobos demonstrate such morally-related behaviors as understanding what other bonobos know and do not know, fairness, empathy, and the compassionate care of juveniles, the aged, and the infirm. Bonobos do not know who their fathers are, nor do adult males know which young ones are their progeny, yet adult males commonly assist with juvenile care.

Bonobos tend to follow the fundamental moral concept of help and do not hurt. When fighting occurs, bonobos react the way spiders instinctively do to a torn web. They go into a repair mode. Bonobo reconciliation is driven by the importance of social relationships, typically associated with closeness, grooming, and sexual behavior. Bonobo society thus addresses the well-being of others and puts the community before the individual. It does not deny self-interest, but rather curbs its pursuit to promote a more cooperative society. The survival of the group depends on it.

Our evolutionary orientation through primates is thus towards empathy and cooperation. Aggressive behavior typically comes through effortful and often stressful cognitive determination. Altruistic behavior (such as maternal child care) certainly carries a cost but we do not necessarily consider that as painful. We humans evolved as a social species to live together, to need and care for each other, and to judge each other in moral terms. De Waal thus argues that this basic morality is not a cognitive veneer imposed from a deity, nor is it philosophically developed, but rather that it is an integral part of our evolutionary biology (and that of many other social primates).

Our innate ability to function along the good/bad continuum is what permits us to morally tell right from wrong. Unfortunately, we sometimes don't understand if our behavior was right or wrong until after the fact. Most of us thus apologize often as we go through life.

It is difficult to imagine that a basic perspective of sinful selfishness could lead to positive collaborative social interaction. Genes do not create the psychology of behavior but rather

develop body maintenance and survival systems. That does not mean, however, that a survival system such as reproductive sexual behavior cannot also be used for enjoyment, as it does with both bonobos and humans. Nature associates pleasure with most of the survival/maintenance things we need, such as the pleasant smell of food and romance with sexuality.

Humans have many of the same basic psychological wants and needs as our close primate relatives. We have developed complex tools that enhance our capabilities, but our basic makeup remains that of a cooperative social primate. The media continuously report on crimes, but crimes are the exception rather than the rule on a given day. Most homes are not burglarized, most people are not assaulted. We are more like bonobos, mostly good and helpful to each other. When we are not, it is reported as unusual during the evening news.

Religion and Government

De Waal realizes that it is almost impossible to define religion to everyone's satisfaction. Although not personally religious, he views religion and its symbols, rituals, and worship as the shared reverence for the supernatural, sacred, or spiritual. Within that context, he sees a value for religion as a widespread diverse phenomenon that will probably continue to have more adherents than does atheism. He is, however, wary of those who believe that externally imposed belief systems are the only thing standing between them and repulsive behavior.

A sense of *faith* in success against perhaps insurmountable odds seems evident in the behavior of humans, primates, and some other mammals. For example, a human invests a dollar in the lottery or prays for healing from a seemingly incurable disease. An ape jumps from one limb to a distant limb or ritualistically exhibits wonder at natural events beyond its control. Although the underlying neurobiology of such behavior is yet to be discovered, the expectation that things will go well drives behavior that (at least in humans) expects success.

Like children, juvenile bonobos play with the equivalent of dolls (such as small logs). They seem to mimic the nursing behavior of older females. They (and we) trust and mimic the supposedly superior knowledge of authoritative elders. The concept of deities might have grown out of this kind of trusting behavior. We do tend to think of deities as being elderly and very successful.

The development of human frontal lobes allowed us to weld imagination and reason together to forge science and technology, but our evolutionary roots of imaginative wonderment are still reflected strongly in our art, culture, and religions. A de Waal puts it, "To enrich reality is one of the delightful capacities we have, from play in childhood to visions of an afterlife when we grow older."

Bonobos live in small tight groups of a few dozen. It is basically a matriarchal society and the individuals are almost continuously in contact with each other. The basic *help but at least do not hurt* social system is constantly monitored by all in the tribe, and those who do not follow it are loudly criticized and shunned by the others. Appropriate behavior is thus the norm, and bonobo infants (like human infants) are taught how to behave. De Waal argues that this behavioral social predisposition also exists in humans.

The shift (some 10,000 years ago) from human hunter-gatherer groups to larger agricultural societies led to the loss of continual face-to-face interactions, and to a more complex society in which cheating could be hidden. De Waal argues that it became helpful to have invisible observant deities and consequent fear of punishment by the deity to insure appropriate moral

behavior. Human religion could thus have emerged from the prior need for societies to function morally. Social primates and humans have deeply ingrained moral expectations, and morally powerful human religions could have emerged from that. A religion thus is not about whether the religion is true or false, but rather about how it helps to shape our lives, and various religions do this differently. It is, however, common for religious adherents to meet periodically to affirm their acceptance of their religion's moral code, and to meet as a socially affirming group.

The development of cities and nations made human moral life even more complex. Governments emerged to assume control of its secular side, imposed philosophically based laws, and instituted various punishments to insure compliance with the laws.

Democratic nations emerged within the past 200+ years, and have grown exponentially within the last 100 years. When a group of bonobos gets upset about something, they gather together and scream at each other until they get things worked out. Not a whole lot different than what happens in the legislative bodies of democratic nations.

From Bonobos to Humans

A recent January 2013 article by Abigail Tucker in *Smithsonian Magazine* focuses on the possible very early development of moral behavior in infants. The article reports on intriguing research being carried out at the Yale University Infant Cognition Center. The article is titled "Are Babies Born Good: New Research Offers Surprising Answers to the Age-Old Question of Where Morality Comes From." It provides a good transition from the studies on primates and mammals to that of humans, the focus of the next chapter:

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Chapter 7. Philosophical/Theological Perspectives on Consciousness and Morality

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The previous chapters in this series reported that neurobiology continues to explore the intricacies of the human brain in its search for a further understanding of such higher functions as the genesis of morality. Their basic argument is that scientific evidence suggests that morality gradually evolved from basic elements of physics into complex neuronal networks that process consciousness, social awareness, and moral behavior.

This chapter takes an alternative perspective, that human morality is sufficiently different from related mammalian behaviors so that human versions should be viewed as basically separate phenomena. It will argue this perspective from the basis of traditional philosophical and theological studies of the phenomena.

Patricia Churchland's Book

A major focus of chapter 6 is the materialist worldview presented by Patricia Churchland throughout her book, *Braintrust: What Neuroscience Tells Us about Morality* (2012). She and her husband Paul have long advocated a philosophical theory called "eliminative materialism" (Palmer, 2011). In this perspective, common prescientific "folk psychology" explanations of conscious mental phenomena (as in "James is possessed by 'demons'") can be reduced either to neurobiological explanations or can be shown to refer to nothing (as "it" in "it is raining"). Churchland maintains that neurobiology can provide the more fruitful answer to such issues.

She suggests that morality originates within the neurobiology of attachment and bonding. It emerges out of the actions of selected mammalian hormones and neural networks that combine to get us beyond concerns for self and our juveniles into complex behaviors that manage an extended and appropriate social life. She thus argues that strong evidence exists for a powerful non-spiritual biological base for mammalian and human morality (Churchland, 2012).

It is significant that Churchland juxtaposes a "non-spiritual" base for morality over (against) traditional "spiritual" foundations. In her dichotomy, morality is either part of how the human brain functions, or it is a spiritually imposed metaphysical phenomenon. She acknowledges that religion has provided moral authority within various cultures, but that the religious belief that spiritual forces communicate appropriate moral decisions arose from human doubts that the brain can biologically care about or value someone else. She thus "eliminates" the spiritual answer by reducing it to neurobiological processes; we behave as our brain determines. Her book explicates how the brain arrives at acceptable and unacceptable moral decisions without any need for

spiritual support. Morality is thus about the biology of empathy rather than about a set of spiritually imposed codes.

Problems with Churchland's Approach

A number of problems are inherent in Churchland's approach to consciousness, spirituality, and morality. First, the issue of "consciousness" (or mental self-awareness) has recently experienced a renaissance in the philosophy of mind. Although most philosophers of mind agree with Churchland that some form of materialism must exist, not all agree that some form of materialist or physicalistic reductionism is necessary. The most attractive theory explaining the phenomenon of mind without positing a substance dualism seems to be "functionalism," an approach growing out of the field of cognitive science, which synthesizes philosophy, computer science, and neurology (Palmer, 2011). Taking advantage of the insights of all three fields, this model views mental functions somewhat like computer software programs. The mind in this model is not an independent substantive "thing" but rather a system, an assemblage of parts with a function. The function is the job that the system accomplishes. In this model "minds" mainly do computer-like computations. According to this approach not only humans, but other lower animals such as jellyfish, can have "minds" and are capable of thinking. The brain relates to its mental events in the same way that a computer relates to its computations.

But some philosophers and scientists are convinced that mental properties are irreducibly distinct from physical brain properties, even though these mental properties depend upon the physical brain for their continued functioning. The individual neurons, with their dynamic interaction and networking, are the base for conscious thought, self-awareness, and intention. At the same time, these subjective thoughts and intentions have a certain "autonomy." They practice "top-down causation," or mental downward causation, understood as "the effects on components of organized systems that cannot be fully analyzed in terms of component-level behavior, but instead require reference to the higher-level system itself" (Templeton, 2010).

The distinguished philosopher Thomas Nagel in his classic article "What Is It Like to Be a Bat?" (1974) argues that the subjective mental state of self-consciousness of what it is like to be human is not reducible to brain states, though it is dependent upon those material brain states. Philosophers like Nagel, Colin McGinn, and David Chalmers contend that we have yet to see a meaningful theory of consciousness and the psychophysical laws that bridge between the mental properties, such as intentionality, and the physical brain (Palmer, 2011). McGinn even questions whether an adequate theory can be found, or whether we are dealing with an irreducible mystery (McGinn, 1999).

In chapter 5, Barbara Given proposes the Polyvagal Theory as the way the evolution of the vagus nerve impacts human behavior. The third evolutionary stage moves beyond the freeze, fight, or flight responses of the first two stages, providing for positive social interaction without traumatizing fear. She proposes that third-stage self-talk is indeed effective in overriding the more primitive first and second stage responses. This would seem to corroborate the top-down nature of non-material self-talk modifying physiological responses.

David Eagleman's *Incognito* (2011) similarly concludes that reductionist materialism cannot explain the phenomenon of "emergence," where the whole becomes something greater than the sum of its parts. He uses the example of the many parts of an airplane; the individual parts certainly cannot fly, but what emerges from them properly fit together is the reality of *flight*. Likewise the many neurons and synapses that make up the brain do not individually possess

anything like "mind," but from them compositely emerges the phenomenon of self-conscious thought and intention. Eagleman's book stresses the huge significance of neurobiology for understanding human behavior, yet he does not conclude that our conscious deliberative choices are only a matter of biology and environment.

As for evidence of animal "morality" existing already in the social-empathic behaviors of chimpanzees and bonobos (humanity's closest relatives), naturalist scientists such as Churchland and Frans de Waal posit a fundamental continuity between primate social-empathic behavior and human empathy, which they consider the basic root of morality. This supports their contention that human morality has evolved naturally, with no need for spiritual input at the human level.

But humanly observed correlations between human and non-human empathy, fairness, and compassion still do not provide sufficient evidence for a fundamental continuity between bonobo behavior and human morality, nor for a purely materialistic explanation of moral causation. Philip Kitcher and Christine Korsgaard in response to de Waal (de Waal, 2006) argue for a sharp distinction between animal behavior motivated by emotion, such as empathy, and human morality based on rational self-consciousness, reflecting on the propriety of a possible course of action weighed against normative moral standards. Since this latter level of self-consciousness is uniquely human, so far as we know, morality in the proper sense is only attributable to humans.

Theology in the western religious tradition of Judaism/Christianity/Islam presupposes the basic goodness of the material realm as the creation of a good God—in contrast to much eastern religious thought, which views the material world primarily as an illusion (Hinduism) or as the source of pain and suffering (Buddhism). The western theological tradition maintains that human uniqueness lies in its "imago dei" or image of God, particularly the unique ability of humanity to comprehend the moral law of God and rationally to decide to obey or disobey it.

Humans may indeed be created originally "good" (de Waal, 2006), but whereas the other animals' "goodness" persists in their naïve, instinctive obedience to the creator's loving intent for them, humans alone among all animals can and regularly do choose to act contrary to their divinely intended goodness. Human brutishness equated with the survival behaviors of other animals actually dishonors the other animals. In this sense one might consider the other animals to be far more "moral" than humans, who are so inconsistent in living out their creator's intention for them, compared with the other animals.

Eliminative Materialism as a Metaphysical Faith

Churchland's investigations fail to recognize that an eliminative materialist philosophy, which holds that only the material is real and rejects any "spiritual" reality, is itself a metaphysical belief, not just a rational scientific assessment of the physical world. Evolutionary theory per se works strictly within the physical realm of secondary causations and begs the question of metaphysical beliefs regarding the totality of reality, the ultimate context within which evolution occurs.

Thomas Nagel, in his book *Mind and Cosmos* (2011), reflects the same misconception as Churchland. He sees Neo-Darwinism maintaining, or at least implying, that the origin of history and life can be explained completely by materialistic means. The history of biological life on earth was "shaped by a combination of random mutations and natural selection. This process has no foresight: natural selection responds only to the present environment and evolution cannot, therefore, be aiming for any goal. This, says Nagel, is 'almost certainly false'" (Orr, 2013).

Yet Nagel, like Churchland, fails to acknowledge that evolution is not atheistic per se; the metaphysical stance of atheistic evolution is a faith assertion regarding ultimate reality, just as the metaphysical stance of theistic evolution is a faith assertion regarding ultimate reality. Both beliefs go beyond the evidence to claim the superiority of their answers to the ultimate questions of reality over the alternative; neither can prove to the other's satisfaction that its belief is true and the other position is therefore false.

Creation through Evolution

Theistic evolution claims that evolutionary theory explains how the ultimate spiritual reality is working out its creative purposes in and through, not above and apart from, nature and history. This metaphysical position asserts that while chance and randomness characterize the evolutionary process, it is also possible to view these within an overarching divine intent or "telos." (Any suggestion that this injects an "interest" or "agenda" into "objective" evolutionary science is specious, since all human investigation involves some interest or agenda; see Habermas, 1971.)

A theistic evolutionist might answer the seeming contradiction between the predominance of negative mutations and extinctions in nature on the one hand (presumably evidence against an intelligent, designing creator), and the assertion of an intentional, designing creator God on the other hand, by suggesting the model of a creative writer or artist. Consider how many attempts are thrown away before an author or artist achieves a working concept. Creativity as we know it necessarily involves the possibility of failed attempts and false starts before a successful outcome is achieved.

This could very well be how God is creating through evolutionary processes. God certainly has an intention in his creative work, namely an ultimate fulfillment and completion of all things. Interestingly, Thomas Nagel, while an atheist, thinks that the materialist view espoused by science since the 17th century is radically incomplete, and must be supplemented by something else in order to enfold ourselves and our minds fully into our science. His best guess at that "something else" is "teleology," a tendency of the universe and nature to aim for certain goals as it unfolds through time (Orr, 2013). This accords with the theological position of Christianity (the dominant religious influence within our western culture) that claims that the provisionality of our present world and life implies an ultimate completion and fulfillment of all things, a "telos." This is the divine intent and final goal in the Kingdom of God—the subject and heart of Jesus' proclamation and action (Mark 1:14; Colossians 1:15-20; Pannenberg, 1998).

From this theological perspective there need be no disconnect between the findings of neurobiology and the spiritual character of morality. Continuing research can help us understand the neurobiological foundations for moral and even spiritual reasoning and behaviors. Western theology can accept God working through the processes of nature, preparing humans for their uniquely moral and spiritual experiences and functions. Their distinctive human capabilities (the"imago dei") set the stage for the history of their relationship to God and God's successive revelations, culminating within Christianity in the personal self-revelation of God in Jesus of Nazareth.

This Christian perspective thus argues that God used the human platform of Jesus to give the world the fullest revelation of his saving intention, namely the gift of salvation in the coming Kingdom. Through Christ God revealed human morality as living in anticipation for the Kingdom, the divine "telos," by doing now the things that are fitting for that coming Kingdom:

forgiving, healing, reconciling (Peters, 2000). Biology and spirituality are thus ineluctably interwoven, but morality is perceived as a uniquely human phenomenon.

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