Sci Eng Ethics (2012) 18:457–474
DOI 10.1007/s11948-012-9388-1

ORIGINAL PAPER

The Ethics of Neuroscience and the Neuroscience of Ethics: A Phenomenological–Existential Approach

Christopher J. Frost · Augustus R. Lumia

Received: 28 March 2008 / Accepted: 9 July 2012 / Published online: 28 September 2012

Abstract Advances in the neurosciences have many implications for a collective understanding of what it means to be human, in particular, notions of the self, the concept of volition or agency, questions of individual responsibility, and the phenomenology of consciousness. As the ability to peer directly into the brain is scientifically honed, and conscious states can be correlated with patterns of neural processing, an easy—but premature—leap is to postulate a one-way, brain-based determinism. That leap is problematic, however, and emerging findings in neuroscience can even be seen as compatible with some of the basic tenets of existentialism. Given the compelling authority of modern "science," it is especially important to question how the findings of neuroscience are framed, and how the articulation of research results challenge or change individuals' perceptions of themselves. Context plays an essential role in the emergence of human identity and in the sculpting of the human brain; for example, even a lack of stimuli ("nothing") can lead to substantial consequences for brain, behavior, and experience. Conversely, advances in understanding the brain might contribute to more precise definitions of what it means to be human, including definitions of appropriate social and moral behavior. Put another way, the issue is not simply the ethics involved in framing neurotechnology, but also the incorporation of neuroscientific findings into a richer understanding of human ethical (and existential) functioning.

Present Address:
C. J. Frost (✉)
Psychology and Religious Studies, St. Joseph's College, New York, 155 West Roe Boulevard, Patchogue, NY 11772, USA
e-mail: cfrost@sjcny.edu

C. J. Frost
San Diego State University, San Diego, CA, USA

A. R. Lumia
Psychology and Neuroscience Program, Skidmore College, 815 North Broadway, Saratoga Springs, NY 12866, USA

Keywords Neuroethics · Neuroimaging · fMRI · Critical neuroscience · Neurohumanities · Neuroskepticism · Existential-phenomenological approach to consciousness · Neural correlates of consciousness · Humanities and neuroscience · Humanities and technology · Perspectivism · Neuroscience and volition · Process approaches to consciousness · Neuroscience and human agency · Neuroscience and the "two cultures" · Social neuroscience · Philosophy of mind · Internalism · Authenticity

Introduction

Knowledge in the neurosciences continues to advance on numerous fronts. As researchers intently (and by definition) focus on the *biological* stratum of reality, they increasingly advance specialized knowledge that readily translates into neurotechnological achievements. Public discussion about the ethical implications of these achievements tends to involve questions of how they might change us all—when (and on whom) such technologies should be used, and when their use is inappropriate. A more fundamental, yet subtle, set of ethical questions concerns how such achievements are framed. Will the findings change individuals' perceptions of themselves? And what of the role that context plays in the emergence of human identity (and shaping of the human brain)? Conversely [and as Gazzaniga (2005), argues], it is also the task of neuroethicists to apply what we know about how the brain works to more precise definitions of what it means to be human, including definitions of appropriate social and moral behavior. Put another way, the issue is not simply the ethics of neurotechnology, but also the incorporation of neuroscientific findings into a richer understanding of human ethical functioning.

Broadly defined, neuroethics is concerned with the social, ethical, legal and policy implications of neuroscience. It also addresses issues such as the content and application of neuroscience research (Illes and Bird 2006), and it includes the neurobiological underpinnings of ethical thought and behaviors such as moral development, moral reasoning and decision making, and self-control (Bird 2005, 2009). From the vantage point of the humanities, neuroethics has an even broader frame (Marcus 2002; Kalichman et al. 2012).

The Center for Ethics in Science and Technology, San Diego,[1] promotes deliberate dialogue that explores and examines the intersection of science, technology, and the humanities (inclusive of, but not limited to, neuroscience). From the outset, the Center's vision has been to include voices across multiple disciplines, from scientists, engineers, and social scientists to humanists, artists, and novelists. Why this insistence on including this integrative perspective? At a more abstract level, bridging the two cultures—science and the humanities (Snow 1959)—remains a goal, of course. Now, however, the debate is more pressing. As social critic Neil Postman puts it, modern Western culture deifies technology, which "…means that the culture seeks its authorization in technology, finds its

[1] The Center was the host/sponsor/organizer of "Neuroethics Week" in 2007, the event from which this essay springs (Kalichman et al. 2012).

satisfactions in technology, and takes its orders from technology" (Postman 1993, p. 71). The bottom line, for Postman, is that technology may not simply contribute to an understanding of the world or of humanity itself, but may actually monopolize that understanding.

In *Technology and Religion*, Herzfeld (2009) argues that the influence of religion on human understanding remains significant. The technological worldview stands in dynamic tension with religion (and by extension, with other worldviews beyond the religious). The challenge, as she sees it, is the "undeniably greater role" that technology plays, greater than "any previous time in human history" (Herzfeld 2009, p. 9):

> That greater role is … seen in the power to create something new, a quest that was less prominent in ancient *techne*. To create the new is to go outside of nature. In his essay "The Question Concerning Technology," the German existentialist Martin Heidegger observes that the ancient craftsman certainly made something new when he constructed a chair. A doctor might bring new health to a patient. However, neither imposed a new form on nature; rather each worked with what is already implicit in the word or the body…. In contrast, a genetically engineered human or a chimera that is half sheep and half goat is outside of its natural order. By its genetic alteration, the "geep" will never again produce a sheep or goat. Humanly extracted plutonium never returns to the uranium from which it was derived. The new products of modern technology do not simply "disclose" or shape nature but transform and replace nature. In this way, modern technology gives us heretofore undreamed of power. (Herzfeld 2009, p. 9)

The "undreamed of power" with which this paper is concerned is the power that accompanies self-understanding (and collective understanding) of what it means to be human in response to advancements within neuroscience (e.g., confirmation of neural activity that occurs prior to activation of neural processing in brain centers associated with conscious awareness). In particular, the focus is on the implications of neuroscience (more realistically, a subset of findings within that much larger domain) for notions of the self, the concept of volition or agency, questions of individual responsibility, and the phenomenology of consciousness. These themes resonate with those of existentialism, and there is at least the possibility of congruence between the findings of neuroscience and the tenets of existentialism.

In exploring a possible congruence, it is important to note that the authors consider existentialism as a sensibility—a worldview or frame of reference—not a formal movement delineated by doctrine. In fact, individual existentialists insisted that their approach was not a "movement," and they often repudiated identification with other thinkers so identified (Jean-Paul Sartre, Martin Heidegger, and Albert Camus, for example). More generally, we have in mind a "phenomenological-existential" perspective, inclusive of the work of William James and the humanities as a whole. A number of existentialists were informed by the work of Edmund Husserl, and some originally considered themselves "phenomenologists." The language of existentialism is intentionally used here, however, because we think that both the "ethics of neuroscience" and the "neuroscience of ethics" can be fruitfully

explored by way of the classic existentialist themes: choice, responsibility, and freedom—all yoked to a locus of control assigned unequivocally to the individual.

Selection of Perspective and Levels of Analysis: Framing the Findings of Neuroscience

For many persons, some of the most worrisome concerns about neurotechnology revolve around "peek-a-boo" technologies. The assumption that "peeking" into the brain allows one to see what is "really" going on there—whether evidence of a mental disorder, confirmation of criminal intent, verification of truth-telling, or compliance with cultural orthodoxies and doctrines. This assumption becomes especially problematic given one particular trend within the history of ideas (c.f., Robinson 1981): When researchers identify a biological process that correlates with a psychological process, it is often assumed that the former causes the latter; there is less frequent questioning of the direction of that assumption, or concern with causal arguments being advanced from correlational data.

Phenomenologically, peek-a-boo technologies are particularly seductive because they parallel what humans have *always* been able to do: observe each other's behavior and draw inferences about another's internal states (setting aside the question of accuracy or appropriateness of those inferences). At a more abstract level, the Western traditions of the psychological novel and psychotherapy invite individuals to read, or monitor, *representations* of the interior thoughts and emotions of characters and patients. Even the canons of jurisprudence have evolved with explicit attention to intentionality; one is held accountable not simply on the basis of behavior, but on the basis of inferred intention that underlay or accompanied those actions. And the first chapters of the Old Testament, the Pentateuch, repeatedly distinguish between crimes based on inferred intentions and command Israelites to monitor and manage internal dispositions and intentions. All of this "inferring," mind you, has evolved biologically and culturally even though direct observation of the human brain has been shielded from view.

With the development of a technology that allows the direct viewing of the human brain in action the veil drops. For some, this drawing back of a physiological curtain culminates in hopes (or fantasies) that now individuals *really* will be able to participate directly in the consciousness of another; one need not infer, but can now confirm, the reality of the other. The original *Star Trek* series (1960's), for example, featured a concrete representation of this fantasy—the Vulcan Mind-meld, a state that required physical contact with a subject and produced direct experience of another's thoughts and emotions (consciousness). But, the fundamental question here is this: *Do these peeks into the brain really give a direct "reading" of the consciousness of another person?* Has neuroscience, in fact, made a down payment on delivering in reality what *Star Trek* promised in fiction?

Although it is doubtful that any serious neuroscientist would knowingly confuse inferences based on observation of brain behaviors with representations of consciousness, it is arguable that this is a first step toward a romantic period in which the lifting of the veil—wonderment over direct access to brain functioning in

real time, and the wide range of possibilities for correlating various stimulus conditions and contexts with neural firing—will be presented as a way of attaining direct access to consciousness.

In a markedly different time (decades prior to the current revolution in the neurosciences), process philosopher Charles Hartshorne offered an intriguing thought experiment: "Imagine someone to read aloud an eloquent poem, in the presence of: (A) a glass of water, (B) an ant, (C) a dog, (D) a human being unacquainted with the language of the poem, (E) a human being knowing the language but insensitive to poetry, (F) a person sensitive to poetry and familiar with the language." (Hartshorne 1948, pp. 48–49) Hartshorne argued for a "successive superiority" in understanding along this continuum, without having to postulate separate "metaphysical levels" of reality to account for the differences in sensibility (i.e., a "perspectival pluralism").

Now Hartshorne's challenge can be extended: "Imagine someone to read aloud an eloquent T.S. Eliot poem in the presence of a person sensitive to poetry and familiar with the language while the relevant neural cluster was actively monitored by brain imaging technology." Were one to carry out precisely this experiment, as current technology would easily allow, exactly what would be explained? Could one claim that the mystery of poetry has been unlocked? That one has discovered the way in which poems are understood? Has a look at the neural substratum of the phenomenon of "hearing and experiencing a poem by way of a particular sensibility" advanced knowledge of the person so engaged? Unlocked the puzzle of consciousness? Solved the meaning of poetry in general, or T.S. Eliot in particular? And if one monitored 100 randomly selected subjects being read randomly selected poems, can neuroscientists actually translate the ensuing brain scans into knowledge of the poem, or into the subjective renderings of the listener? *Again, is a peek into the brain synonymous with experiencing the consciousness of another?* If the answer is "no," then one is led to a fairly an immediate ethical consequence. Neuroscientists have a responsibility not to misrepresent or countenance misrepresentation of the current state of their art or its prospects in ways that will lead to unrealistic expectations. This is important both for the general public and for experts in disciplines that are particularly concerned with inferences about intentions, motives, awareness or other interior aspects of human experience. Such misrepresentations, even when unintentional, could have deleterious effects on the body politic. For example, if inflated claims about the validity of "peek-a-boo" technologies as a means of inferring intentions or honesty were to capture the public imagination, one might see an extension of the widely-recognized "CSI effect," in which public understanding of the evidentiary value of crime scene investigations (CSI) has been distorted by romanticized notions of scientific probity and certainty.

To portray the neural firings of the brain as the essence of human experience may not be false, as much as it is incomplete. Yes, science is making terrific (and exciting) advances into uncovering the neurochemical and anatomical substrates that modulate consciousness, reasoning, ethical processing, and so on. But to suggest (whether directly, or more often, implicitly) that understanding the neurological substrate will "solve" the human equation (and unlock the

phenomenological reality of consciousness) is philosophically as untenable as the inverse, that is, to contend that computers "understand" what they are doing, that chemicals in a test tube can "solve" a problem, that an iPod "appreciates" the music that it is rendering audible.

In fact, human society is not a "society of human brains" (Greely 2007); rather, it is a society of conscious human beings who communicate via cultural symbol systems that are quite different from and irreducible to the language of the brain. The distinction here is not merely semantic, but permeates everything from what it means to understand the self, life, and the world, to human identity. For example, neuroscientists challenge notions of the cognitive science metaphor of "mind as computer" (MAC), because they contend that the physiological mapping of the brain does not yield confirmation of algorithmic processing. Even theorist Gerald Edelman's view of degeneracy (Edelman and Gally 2001; Edelman 2006), for instance, suggests that different clusters of neurons can perform an identical function, and a neuron (or groups of neurons) can function differently depending on the larger cluster within which it fires. However, it is clear that "mind as brain" (MAB) metaphors do not adequately fit the evidence, either. The contention here is that both metaphors contribute to an understanding at one level of analysis, that is, from one perspective, but that neither leads to an integrated, coherent understanding of the totality of conscious experience. Among other limitations, both MAC and MAB "characterize mind [brain] as separate from the environment and as information processing bound within individuals" (Duffy and Cunningham 1996, p. 177).

An example is in order here. In what is an otherwise thoughtful book on the interrelatedness of neural functioning and consciousness, neuroscientist Ramachandran (2004) postulates that "90 % of the variance seen in art is driven by cultural diversity … and only 10 per cent by universal laws that are common to all brains" (Ramachandran 2004, p. 41). Then, citing Nikolaas Tinbergen's research on young chicks who peck at a "long yellow stick with three red stripes, which looked nothing like a beak, … [and] preferred it to a real beak," he arrives at the following conclusion:

> All of which brings me to my punch-line about art. If herring-gulls had an art gallery, they would hang a long stick with three red stripes on the wall; they would worship it, pay millions of dollars for it, call it a Picasso, but not understand why—why they are mesmerized by this thing even though it doesn't resemble anything. That's all any art lover is doing when buying contemporary art: behaving *exactly like* those gull chicks. [Italics added] (Ramachandran 2004 p. 47)

This conclusion confuses *how* events are processed in the brain with the *intentional contents* of consciousness (as another example see philosopher Patricia Churchland's *The Engine of Reason, the Seat of the Soul* [1995]). In fact, Tinbergen focused on *fixed action patterns*, and included such attributes as universality, triggering of the response by a fixed stimulus, and independence from experience to those fixed action patterns. Although one might join Ramachandran in

acknowledging that the "allure" of a work to the art lover cannot fully be accounted for, one should still call into question Ramachandran's neuroaesthetics.

Given his level of erudition and insight, Ramachandran's failure here clearly is not one of faulty intellect; instead, following the lead of Hartshorne (as quoted above) and philosopher Simone Weil, this deficiency can be described as a matter of perspective. Weil noted that "the massacre of one hundred thousand Chinese hardly alters the order of the world as [people] perceive it, but if instead a fellow worker has a slight rise in pay which they have not, the order of the world is turned upside down!" (Weil 1957, p. 133) By focusing so much of their attention on the neurochemical substrates of consciousness, neuroscientists make it possible to generate viable and testable models of brain behavior interactions. However, when that sustained focus fails to recognize both the emergent properties of that neural activity, as well as the broader context within which neural functioning occurs, the result is a skewed understanding of what it means to be human. The defect lies not in the facts, nor exclusively the logic, but in the perspective. Beyond the consequences of perception, it becomes a question of ethics.

The plot thickens when one considers that not only is neural functioning not synonymous with consciousness, but that consciousness itself constitutes a multidimensional phenomenon. Although philosopher-psychologist William James penned his description over a century ago, scientific advancements have yet to repudiate (or explain away) his careful phenomenological description:

> Our normal waking consciousness, rational consciousness as we call it, is but one special type of consciousness, whilst all about it, parted from it by the filmiest of screens, there lie potential forms of consciousness entirely different … definite types of mentality which probably somewhere have their field of application and adaptation. No account of the universe in its totality can be final which leaves these other forms of consciousness quite disregarded. (James 1902, pp. 305–306)

Following James, how is one to regard the multi-layered phenomenon of consciousness?

Recent data from both non-human and human brain scans demonstrate rather nicely that the brain of a primate can view another organism engage in an activity and many of the same brain areas will light up as when they are personally engaging in that activity. The identification of these "mirror neurons" is being heralded as a "revolutionary" discovery, a key to specific emergent properties that contribute to sophisticated social relatedness and the emergence of culture.

> I suspect that [mirror] neurons are at least partly involved in generating our sense of "embodied" self-awareness as well as our "empathy" for others. No wonder children with autism—who (I conjecture) have a deficient mirror-neuron system—are incapable of constructing a theory of other minds, lack empathy, and also engage in self-stimulation to enhance their sense of being a self anchored in a body. (Ramachandran 2004, p. 106)

Though the neuroscientific work here is laudable, and there is tremendous potential for further learning (and prospects for therapeutic application), do congruent scans

of neural pattern activity *constitute* the experience of empathy? More broadly, do mirror neurons do for psychology what DNA does for biology (as Ramachandran positions the discovery)? Do they predict how the observing organism will respond, regardless of what the other organism is up to? Or, is this the point at which "intentionality" enters the equation? Asked another way, does the identification of mirror neurons and activation of a congruent pattern in another explain the diverse, multifaceted phenomenon of human empathy? Or, just as instinct theories of human aggression fail to account for human and cultural patterns of violence, is one left with an observation rather than an explanation? (Just as, for example, to say that humans have an "aggressive instinct" does nothing to explain the difference in aggression between Ghandi and Genghis Khan.) If one disregards intentionality, however, then one could speak at the level of a fixed action pattern (or practicing solipsist) and bypass mentalist categories altogether.

To be fair-minded, neuroscientists typically would not claim to explain empathy, knowing the complexity involved. The discovery of mirror neurons perhaps implies a deeper connection between brains than an (especially Western) understanding has tended to suggest. Further, it begs for better questions about the intentionality (or not) of imitation, especially because the mirror neuron effect is seen in less complex brains. Seen from another vantage, mirror neuron research may be another piece of evidence, an additional perspective, which guides investigations into the types of influences that people have on each other.

Continuing with James' notion of the layers of consciousness (and multiple selves, a facet of his thought that can only be referenced here), to what extent do multiple layers of consciousness allow for contradictory cognitions? There are already claims that functional Magnetic Resonance Imaging (fMRI) can serve as a "lie detector." But then one must ask: if a person consciously believes that he or she is telling the truth, but in fact is engaged in self-deception (cf. Frost et al. 2001), what type of scan will this produce? Or, if an individual is "prejudiced and aware of that prejudice" (explicit prejudice), but nonetheless *refuses to act* in a prejudicial manner, exactly how is a brain scan indicative of that prejudice to be adjudged? Is the person to be condemned for the neurological evidence of prejudice, or commended for refusing to act in a prejudicial manner in spite of those neurological underpinnings? To the extent that *everyone* harbors "implicit prejudices and exclusionary principles that escape easy detection"—the "tyranny of hidden prejudices" (Gadamer 1960, p. 270; Hulsey and Frost 2004, p. 4)—precisely what might brain scans reveal here?

Levels of Analysis and the Role of Context: Framing the Immediacy of Experience

As argued thus far, the nexus of neural functioning and consciousness is intricate, and best approached with a keen sense of perspective—a recognition of the multiple levels of analysis from which to view a multi-layered phenomenon. Complex as the issue already is, there is still more. The social dimension of human existence presupposes context; neuroscientific methodology does not. Therein lies another

dimension to the problem, and to the broader frame within which ethical questions arise.

Value questions emerge from attention to context, to the environment, and to perspectival levels of analysis. This recognition suggests that human experience can never be explained fully (and certainly not explained away) by referring only to the activation of neural substrata associated with a phenomenon. Given the sophistication of neuroscientific research carried out in the (purportedly) uncontaminated environment of the research lab, one can follow (and perhaps even appreciate) the logic of such conclusions as: "Human society is the society of human brains. Of course those brains are encased in, affected by, and dependent on the rest of the body, but our most important interactions are with other people's brains, as manifested through their bodies." (Greely 2007, p. 533) The fact is that it does not matter how many brains you have floating in vats of formalin. There may be a collection of brains, or a population of brains, but certainly no *society* of brains. Without the body, autonomic nervous system, sensory system—all activated and integrated within a physical environment and sociocultural context—there is no conscious experience. Simply to argue that brains do not act in isolation, but incorporate information from the senses and from memory, fails to move the discussion from multiple brains to the phenomenal reality of a *society*.

Philosopher and novelist Umberto Eco offers a metaphor intended to move beyond MAC and MAB models, a notion of mind as "rhizome" (1984, p. 81). Literally, a rhizome is a horizontal, underground stem that can produce new shoots and protuberances and that can develop into new plants. According to theorists Duffy and Cunningham, "the metaphor of rhizome specifically rejects the inevitability of such notions as hierarchy, order, node, kernel, or structure," and suggests "a form of mind" with these characteristics:

- Every point can and must be connected with every other point, raising the possibility of an infinite juxtaposition. There are no fixed points or positions, only connections (relationships).
- The structure is dynamic, constantly changing, such that if a portion of the rhizome is broken off at any point it could be reconnected at another point, leaving the original potential for juxtaposition in place.
- There is no hierarchy or genealogy contained as where some points are inevitably superordinate or prior to others.
- The rhizome whole has no outside or inside but is rather an open network that can be connected with something else in all of it dimensions. (Duffy and Cunningham 1996, p. 177)

As Duffy and Cunningham note, it is not easy to imagine all that this metaphor attempts to convey, and "any attempt to view it as a static picture risks minimizing its dynamic, temporal, and even self-contradictory character" (Duffy and Cunningham 1996, p. 177). Yet, that caution is precisely the point: MAR (mind as rhizome) may capture more successfully the complexity of consciousness (along with its neural underpinnings), and the personal, social and cultural contexts within which consciousness (mind) is inextricably embedded. According to these authors, it may even be more accurate to consider "minds as distributed in social, cultural,

historical, and institutional contexts" (Duffy and Cunningham 1996, p. 177), rather than to speak in terms of an individual mind.

Indeed, the latest (and greatest) findings of neuroscience actually come closer to a confirmation of existential philosophy than to the establishment of a tableau of interacting brains. To grasp the importance of the environment, the role of environmental contingencies (and their interaction with genes), the concept of neuroplasticity (e.g., Doidge 2007), and the phenomenological experience of consciousness is to rediscover the importance of human life *as lived*—what the existentialists, and specifically Heidegger, refer to as "Dasein," or "Being-in-the-World." From this vantage point, what is seen is not a picture of brain-based, neural firings as the "first cause" of all action (and interaction). Rather, one can envision a human being whose brain has been "self-written" (or perhaps "co-written" with the self emerging as protagonist) within the crucible of the individual's life experience and within the boundaries of genetic predispositions.

Consider, for example, the orphans of Romania. In one orphanage, where the facilities were inadequate and the physical needs (feeding and clothing) of the children were not met, an image comes into focus:

> The kids in this Romanian home got one meal a day—a bowl of watered-down broth with pieces of bread in it. They bathed once a month, in dirty water with no soap. There were too many children to each bed and too few caregivers: Some children, starved for stimulation, beat their heads against the wall…. The children were, in every sense of the word, forgotten. Slapped with the label "irrecuperable"—meaning lost cause—they were destined to remain institu-tionalized for life. Most died young from easily treatable medical problems—not just those they came in with, but also problems contracted from malnutrition or the filth. (in Hulsey and Frost 2004, p. 119)

From one of the "better" orphanages, here is another view, from direct observation:

> A young child, twelve months old, who has been fed well and clothed, but who has received less than three minutes of human stimulation per day. As we walk into a room where 12-15 babies are housed, we see many of them on all fours, rhythmically rocking themselves as they attempt to fall asleep. We turn to see one twelve-month-old, already developmentally-delayed, begin to forcefully pound his head against the side of the wooden crib.[2]

An ongoing study of post-institutionalized orphans by pediatrician, neurologist, and radiologist Harry Chugani and colleagues confirms that the brain scans of the children reflect the early environmental deprivation of the orphanage:

> We previously reported that children who were subjected to early socioemo-tional deprivation in Romanian orphanages showed glucose hypometabolism in limbic and paralimbic structures, including the orbital frontal gyrus, infralimbic prefrontal cortex, hippocampus/amygdala, lateral temporal cortex,

[2] This excerpt is from the lead author's personal journal, written during years he and his spouse lived and worked in Romania as Fulbright Scholars. For more on their experiences in the orphanages, see, Frost and Frost (2002, 2012).

> and the brain-stem. The present study used diffusion tensor imaging tractography to examine the integrity of white matter tracts that connect these brain regions…. [The present] study demonstrates in children who experienced socioemotional deprivation a structural change in the left uncinate fasciculus that partly may underlie the cognitive, socioemotional, and behavioral difficulties that commonly are observed in these children (Eluvathingal et al. 2006, p. 2093).

Neuroscientist Charles Nelson and colleagues further confirm the findings of Chugani and colleagues and support the role of the environment, the importance of human interaction, and the significance of context in brain development (Nelson et al. 2007). The picture that many neuroscientists paint, a "society of brains," conveys a one-way causality of neural firing giving rise to all else, with even the property of consciousness receiving short shrift. Edelman (2004), for example, offers a remarkably nuanced portrait on many counts: levels of consciousness affirmed; acknowledgement of the extreme variability of human consciousness; versatility of the brain, what he terms "degeneracy," duly noted; recognition that consciousness is a selecting agency; and acknowledgement of the fundamental role of attention. Still, even Edelman cannot escape some defect of perspective, and despite having acknowledged the unitary nature of neural firing and consciousness, he nonetheless seems to feel compelled to crown the neuron as king. He designates any conscious process as C, and the underlying neural activity as C′, concluding:

> Given the causally closed nature of the world, it is C′ that is causal, and not C. But given that it is a property entailed by C′, C is the only information on C′ available to a subject… (Edelman 2004, p. 116)

If Edelman is claiming that C = C′, then C must be causal, if C′ is. However, it appears that he hedges on the issue of fundamental equivalency, and essentially has resorted not to a scientific explanation, but a theological one, akin to arguing for a "monotheistic Holy Trinity" (only his is more of a holy duality, i.e., there is two, but only one, but they are distinct, but only one is causal, and so on……). Although Edelman then attempts to cover himself by arguing that his position is not "metaphysical," not "epiphenomenal," not "dualistic," not "mysterious," his argument reflects elements of all. Our position is that separating C and C′ makes less sense than recognizing them as co-existent (neural activity is consciousness and consciousness is neural activity).

The inadequacy of Edelman's position on this count might best be advanced by pushing his logic further, to the subatomic level—designating neural activity as N, the underlying action of sub-atomic particles as N′, and concluding that it is N′ that is causal, and not N. Such a statement ultimately is not "true or false," but "depends" upon one's perspective, the level of analysis, which is the point of Hartshorne's perspectival pluralism, the pluralism of William James, and the intentional move by process philosophers away from "thing language" and toward the language of process.

Consciousness is a process—an activity (or set of activities)—as James noted over a century ago, and by definition it does something. Further, all human action

occurs in a time–space continuum, in a particular moment and in a specific place. Life is lived in the particular and in the immediate, not in general or in the abstract (whether a mystical abstraction or the abstraction of brains in vats). As Chugani's research, and the early experience of Romanian orphans confirm, brains are sculpted not just by "environmental stimuli," but also by an *absence* of stimuli (by "nothing"). As developed in the next section, even selection of stimuli reflects the perceiver (not just the brain), embedded within a context. To reduce what it means to be human to a formula, "biology/brain + environmental stimulus," falls woefully short of the mark.

"This Is Your Brain 'on' Experience:" Emergence of Self, Agency and Responsibility

Michael Polanyi noted that "if we decided to examine the universe objectively in the sense of paying equal attention to portions of equal mass, this would result in a lifelong preoccupation with interstellar dust … [and] not in a thousand million lifetimes would the turn come to give man a second's notice." (Polanyi 1958, p. 3). As human beings, we simply cannot pay attention to life objectively, and indeed, must "select out" a tiny fraction as worthy of notice. It is consciousness (even when construed as an emergent property of neural functioning) that allows the human being some elasticity to the selection process, and the notion that what one pays attention to in life is defined, in advance, by innate neural processing, is patently absurd. Ironically, it was scarcely 50 years ago that the "scientific lens" for self-definition was the black box behaviorism of John Watson, B.F. Skinner, and colleagues. Perhaps an interesting study would be to conduct fMRI imaging of both environmental and neurological determinists, and see if the areas of the brain involved in processing opposing determinisms are neurologically congruent (are processed in the same region of the brain, confirming the existence of a "determinism module" that accounts for the varieties of deterministic arguments!). Lest this observation seem facile, simply compare behaviorist Clark Hull's banishment of consciousness from the human lexicon over 70 years ago (1937) to the current biological assault:

> But what of consciousness, of awareness, of experience—those phenomena of which the philosophers and theologians have made so much and upon the priority of which they are so insistent? [My] inspection… certainly shows no trace of any such phenomena. (Hull in Hilgard 1978, pp. 312–313)

Once one acknowledges the virtually (if not literally) infinite set of objects from which human beings can choose to attend, one need not buy into either environmental or biological reductionist renderings of what it means to be human. Nor is it necessary to move into the realm of the "supernatural" that so frightens much of the scientific community. Instead, one need only perceive through something akin to an existentialist lens: an organism with a particular body and genetic predisposition enters into a specific place, at a specific time—an initial crucible of life. As this new "life form" develops, attention is directed to certain

stimuli at the expense of competing stimuli. The neural processing that accompanies the attending will aid in shaping what is attended to, but individual, indeterminant differences are embedded within perception, and the environment as attended to will also give shape to neural connectedness—give shape to the brain (as exemplified by the children in the Romanian orphanages described above). The ensuing experience, a phenomenological reality, cannot be reduced to neural events alone, or to environmental stimuli alone, or to a simple correspondence between the two. This leads to the "hard problem" of consciousness, as Chalmers puts it (Chalmers 1995). Yet, the underlying reality may be no more mystical than the need to speak of the reality of neural processing as "real" and "causal," without denying that neurons "depend upon" their atomic components.

This position emphasizes that biological determinism is as theoretically unsound as its strictly environmental counterpart. There is something, make that someone, that connects biological and environmental contingencies, and when that someone is an entity possessive of consciousness, there is a world of difference from a something constructed of the same biological goop—but lacking consciousness. The origin of the word experience captures this relational truth. Its root "poros," means "passage," or "to pass through," and the words "portal" (that through which something passes) and "expert" (one who has "passed through" a body of knowledge) are etymologically related. As William James put it, a thing may be present to a person a thousand times, but if it goes completely unnoticed by the individual, it cannot be said to enter his experience. A person's "empirical thought depends on the things he has experienced, but what these shall be is to a large extent determined by his habits of attention" (James 1890, p. 286). James correctly concludes that all consciousness—the sense of meaning, the very sense of self—must be constructed from material to which an individual has attended. The meaning derived from the experience of life (selectively), the consciousness that is a stream of this ongoing experience, and the self that one constructs as a personal representation of consciousness all depend on habits of attention.

Because there are both genetic and environmental constraints, James argues that the issue of free will is not all that difficult: In some ways one is free, in others one is not—a conclusion also reached by one of the early pioneers of cognitive psychology. "No choice is ever [completely] free of the information on which it is based. Nevertheless, that information is selected by the chooser … [conversely] no choice is ever determined by the environment directly. Still, that environment supplies the information that the chooser will use." (Neisser 1976, p. 182) And who is this "chooser?" In shorthand form, an entity that possesses neurons, but is not reducible to them.

Given the framing of some of the broader findings of neuroscience, one can now vividly see that the human brain is embodied and is always embedded in a particular context. Therefore, any theory of human action, ethical or otherwise, must account for the diversity of action, as well as for its regularity, and a context with a virtually infinite range of possibilities. The brain does not operate by logical rules, nor is its function the mere acquisition of knowledge. Rather, the human brain is a selection system, not an instructional system (Edelman 2006). What one calls "ethical" behavior is, in fact, a "selected" response predicated not only on past actions in

similar circumstances, but also on the ability to engage in a *totally novel* response—an action that has never been displayed previously, and especially on the capacity to hypothesize consequences and implications of that totally novel response (Mumford 2012; Stenmark et al. 2010). From a neurological standpoint, what this demonstrates is that human consciousness (in general) and its intentional expression of ethical actions (in particular) are based not only on brain *structure*, but on the brain's dynamic nature and the brain's embeddedness.

It may be instructive, therefore, not only to examine the ethics of neurotechnology, but also to co nsider how neuroscientific findings might inform the understanding of human ethical functioning. The issue of the neurobiological basis for individual responsibility, for example, has been addressed in detail with regard to ethical conduct and its relationship to the legal consequences that arise (Sapolsky 2004). Typically, the M'Naughten Rule is applied to establish whether an individual knew right from wrong, and/or could perceive the consequences of his actions, rather than adjudicate by way of a simple determination of commission of an act. The precise point here is whether, as a result of a mental illness or incapacity at the time of the behavioral act, an accused was incapable of distinguishing right from wrong, or of knowing what he or she was doing. In response, other standards for establishing legal responsibility have been advanced as alternatives to M'Naughten, including "irresistible impulse," Durham test, and the American Law Institute test (see Smith 2012).

These competing models for "defense by insanity" hinge on subtle distinctions between cognitive and volitional elements of human action; they attempt to differentiate approaches to responsibility that require deliberate control (or, at least, some sort of "rational" control) for agency from approaches that require only some sort of relative volitional control. Either way, and this point is critical, these seemingly disparate models for legal insanity suggest that the actor could not have done anything other than the historical act of record (e.g., even had there been "a policeman holding his elbow"). The corollary here is that the sequence of events is a strictly linear, one-way path, from origination to culmination; no other sequence of events (neurological, psychological, moral, volitional, or social) was even possible.

In contrast, emerging neurological evidence suggests that the job of the prefrontal cortex (PFC) is to "bias an individual towards doing the harder, rather than the easier thing" (Miller and Cohen 2001)—what Sapolsky (2004) suggests is metaphorically the closest thing that humans possess akin to Freud's Superego. It should be noted that refraining from doing something does not necessarily imply that it is ethical, nor does having a neurologically intact prefrontal cortex immunize an individual against unethical behavior. More to the point, the use of neuroscientific imaging techniques to address ethical conduct becomes problematic, because there is ample empirical evidence to confirm that persons may indicate (via scanning technology) a normal prefrontal cortex, yet engage in actions that are easily viewed as despicable, horrific and morally bankrupt (Churchland 1995; Sapolsky 2004; Gazzaniga 2005). Indeed, individuals may do so even though they are *not impulsive*, nor lacking the necessary ("rational") understanding that their actions will adversely affect another. To the contrary, these actions are deliberate and often calculated with regard to their negative consequences, intentionally

directed towards another. The possession of a neurologically-intact brain mass does not confer ethical prowess on an individual any more than having prefrontal cortical damage necessarily guarantees unethical (albeit impulsive) conduct.

The work of Rodolfo Llinas and Urs Ribary (1993; Llinas et al. 1998; Llinas 2001) dramatically illustrates that the neural connections of the human brain are reciprocal and the interactions constant. To conclude succinctly: a *linear approach* to brain functioning is wrong-headed, even from a biological perspective! The constant interaction of neuronal systems has led to the notion of "reentry" (Tononi et al. 1992), repeating neural signals across multiple, interconnected brain regions, with the thalmocortical system playing an important role in human consciousness. It is also important to note the adaptive qualities of the human brain, such as neural plasticity—attributes that allow the brain to develop new dendritic connections, and even new neurons, that are responsive to environmental stimulation. This neural plasticity is found to occur in adult brains, as well as those of young children. As documented in the prior section, the potentially toxic impact of neural plasticity is shown in the case of Romanian orphans and abused children. Teicher et al. (2003) have confirmed that early trauma was particularly associated with damage to the prefrontal cortex, hippocampus and cerebellum. In short, researchers have documented an experiential impact on the brain, and the direction of influence can be traumatic, benign, or beneficial. In addition, and following Edelman (Edelman and Gally 2001; Edelman 2001, 2006), brain elements that are structurally different can perform the same function or yield the same output as other neural clusters ("neural degeneracy"). Considering the constructs of reentry, plasticity and degeneracy within the human context (the "brain on experience") leads to an inescapable conclusion: *the brain can always do something different from that which it has done before*.

In *Moral Cruelty*, a book on ethics as translated into action, Hulsey and Frost (2004) advanced the notion of "meaningful" versus "ameaningful" moral reasoning, an approach anchored in the humanities (in general), and existentialism (in particular). The theory is summarized here, and connected to neuroethics. First, following Polanyi, Weil, James and Neisser (above), "morality begins at the moment of perception. What individuals choose to attend to, or fail to attend to, of itself constitutes a moral dimension of life" (Hulsey and Frost 2004, p. 25). Meaningful moral reasoning operates in a distinctly different direction from a moral-codes perspective, that is, from the typical view of morality as the "internalization" of moral prescriptions that could be applied, algorithmically, to life. Indeed, the title of this work, *Moral Cruelty*, followed from the assertion that, to the contrary, much of the damage done to others is perpetuated by those who see themselves as "morally good." Adherence to a specific moral code has done precious little to buttress humanity against intentional harm.

This paper argues about the ethics of framing the findings of neuroscience, and concludes with something of an ironic twist—an assertion that a careful framing of those findings can, in fact, refine the way in which one perceives self, moral agency and individual responsibility. A non-linear view of the brain—always open to new ways of responding, and characterized by such concepts as reentry, degeneracy, and plasticity—aligns beautifully with the existentialist view of human "thrownness"

(Heidegger). In particular, "thrownness" refers to the idea that, at birth, individuals are tossed into a world at a time and place not of their own choosing, and they face a virtually infinite range of possible life events, each of which may be perceived from a multitude of perspectives. Yet individuals must choose, and choose they do, with each act of perception inevitably an act of selective attention. "[B]ecause this infinite variety of life events cannot, even in principle, be specified in advance, a simple correspondence between a formalized rule and a concrete event can never exist" (Hulsey and Frost 2004, p. 26).

The brain is a selection system, not a computational nor a logical system, and the most appropriate metaphor for mind (thus far) is rhizome (MAR). Consciousness is personal and cannot be directly examined by others from a first person perspective, but only in the third person. Consciousness arises from (but is not reducible to) the "reentrant activity" of groups of neurons. Reentry is only one of the ways in which one can think of the brain as conscious in its most authentic sense, i.e., "in the movement," or as Edelman metaphorically puts it, the remembered past. Put another way, consciousness at the core level is always *in the present*, the existential-phenomenological now. It does not matter if an individual is alone, or sitting in front of a screen viewing the neurological alterations of his or her own brain in the act of reading a poem. In either case, the individual is the observer, and in the latter instance the very private, phenomenological and affective aspects of the reading are never to be found on the screen.

The fact that one can observe the neurological activity of her or his own brain affords no more of a "first person perspective" than does having a neurologist examine the same scans. The electrochemical alterations and patterns of brain activity that can be seen in the scans are necessary, but not sufficient, to understand or perceive conscious experience (cognitive and emotional) *as it is lived*—in the first person—in the present, phenomenologically, personally and privately. In short, there are experiential aspects of consciousness that the scans can neither decipher nor convey. Neuroimaging (and other techniques) can reveal that there is a mass in the prefrontal cortex that may account for a person's loss of speech, or for specific aberrant behaviors. Can scans convey an image of a cortical lesion? Yes. Can neuroimaging yield a first person account of despair, grief, envy, jealousy, love, hope, persistence, resilience, or joy? According to the evidence marshaled thus far: no. The neurology of the "individual in the world" cannot be woven together from biochemical cloth or understood by simple reference to its neurochemical or neuroelectrical threads. The tapestry of self (with consciousness, volition, and agency) is "different than" the sum of its threads (not "greater than," as the gestalt psychologists are often, and erroneously, quoted).

Clearly neither we (the authors), nor the existentialists, are denying constraints, biological or otherwise (freely acknowledging, for example, that human beings are "thrown" into a time and place with absolutely no choice over the when or where). Rather, we are arguing that it is in the elasticity of attention, the reality of intention, and the choice of actions that individuals define themselves (from a virtually unlimited set of possible responses, though certainly the range of that set is bounded by biological and environmental criteria). Ultimately, people are responsible for the individuals they become. We contend that individuals are not pre-assigned a destiny

by a supernatural being, consigned to respond to environmental stimuli in a fixed action sequence, nor reducible to neurological firings. Indeed, one may just as easily (and accurately) say that each person's choices shape his or her brain as argue that neural functioning determines those choices. At rock bottom, the present moment of consciousness is the existential moment of "passing through"; it is *experience*. Moreover, an individual's experiences are much too rich, multidimensional and variable to be explained away by descriptions of neural underpinnings. Or to put it more eloquently, perhaps a poem (to be read aloud, even if in the absence of scanning technology) is in order.

> They said, "You have a blue guitar,
> You do not play things as they are."
> The man replied, "Things as they are
> Are changed upon the blue guitar."
> —*Wallace Stevens* (1937)

References

Bird, S. J. (2005). Neuroethics. In C. Mitcham (Ed.), *Encyclopedia of science, technology, and ethics* (pp. 1310–1316). Detroit: Macmillan Reference USA.

Bird, S. J. (2009). Neuroethics. In L. Squire (Ed.), *Encyclopedia of neuroscience* (Vol. 6, pp. 385–391). Oxford: Academic Press.

Chalmers, D. (1995). Facing up to the problem of consciousness. *Journal of Consciousness Studies, 2*(3), 200–219.

Churchland, P. M. (1995). *The engine of reason, the seat of the soul*. Cambridge, MA: MIT Press.

Doidge, N. (2007). *The brain that changes itself*. New York: Viking.

Duffy, T. M., & Cunningham, D. J. (1996). Constructivism: Implications for the design and delivery of instruction. In D. H. Jonassen (Ed.), *The handbook of research for educational communications and technology* (pp. 170–198). New York: Simon & Schuster Macmillan.

Eco, U. (1984). *Semiotics and the philosophy of language*. Bloomington, IN: Indiana University Press.

Edelman, G. M. (2001). Consciousness: The remembered present. *Annals of the New York Academy of Sciences*, *929*, 111–122.

Edelman, G. M. (2004). *Wider than the sky: The phenomenal gift of consciousness*. New Haven: Yale University Press.

Edelman, G. M. (2006). *Second nature, brain science and human knowledge*. New Haven: Yale University Press.

Edelman, G. M., & Gally, J. A. (2001). Degeneracy and complexity in biological systems. *Proceedings from National Academy of Science, 98*(24), 13763–13768.

Eluvathingal, T. J., Chugani, H. T., Behen, M. E., Juhász, C., Muzik, O., Maqbool, M., et al. (2006). Abnormal brain connectivity in children after early severe socioemotional deprivation: A diffusion tensor imaging study. *Pediatrics, 117*(6), 2093–2100.

Frost, C. J., Arfken, M., & Brock, D. (2001). The psychology of self-deception as illustrated in literary characters. *Janus Head: Journal of Interdisciplinary Studies in Literature, Continental Philosophy, Phenomenological Psychology, and the Arts, 4*(2), 331–354.

Frost, C. J., & Frost, K. M. (2012). Adoption: Homeward bound. *Phi Kappa Phi Forum, 92*(2), 12–14.

Frost, K. M., & Frost, C. J. (2002). On loss and melancholy: An autobiographical essay. *Journal of Loss and Trauma, 7*, 185–201.

Gadamer, H. (1960). *Truth and method*. New York: Crossroad/Continuum.

Gazzaniga, M. J. (2005). *The ethical brain*. New York, Washington, DC: Dana Press.

Greely, H. (2007). On neuroethics. *Science, 318*, 533.

Hartshorne, C. (1948). *The divine relativity: A social conception of god*. New Haven: Yale University Press.
Herzfeld, N. (2009). *Technology and religion: Remaining human in a co-created world*. West Conshohocken, PA: Templeton Press.
Hilgard, E. R. (Ed.). (1978). *American psychology in historical perspective: Addresses of the Presidents of the American Psychological Association (1892–1977)*. Washington, DC: American Psychological Association.
Hulsey, T., & Frost, C. J. (2004). *Moral cruelty: Ameaning and the justification of harm*. Lanham, MD: University Press of America.
Illes, J., & Bird, S. J. (2006). Neuroethics: A modern context for ethics in neuroscience. *Trends in Neuroscience, 29*, 511–517.
James, W. (1890). *The principles of psychology* (Vol. 2). New York: Dover.
James, W. (1902). *The varieties of religious experience*. New York: Collier Books.
Kalichman, M., Plemmons, D., & Bird, S. J. (2012). Editors' overview—neuroethics: Many voices and many stories. *Science and Engineering Ethics* 18, this issue.
Llinas, R. R. (2001). *I of the vortex: From neuron to self*. Cambridge, MA: MIT Press.
Llinas, R. R., & Ribary, U. (1993). Coherent 40-Hz oscillation characterizes dream state in humans. *Proceedings of the National Academy of Sciences*, 90.
Llinas, R. R., Ribary, U., Contreras, D., Pedroarena, C., et al. (1998). The neural basis for consciousness. *Philosophical Transactions of the Royal Society of London. Series B, Biological sciences, 353*, 1841–1849.
Marcus, S. J. (Ed.). (2002). *Neuroethics: Mapping the field*. San Francisco: The Dana Foundation Press.
Miller, E. K., & Cohen, J. D. (2001). An integrative theory of prefrontal cortex function. *Annual Review of Neuroscience, 24*, 167–202.
Mumford, M. D. (2012). *Handbook of organizational creativity*. Waltham, MA: Academic Press.
Neisser, U. (1976). *Cognition and reality: Principles and implications of cognitive psychology*. San Francisco: Freeman.
Nelson, C., Zeanah, C., Fox, N., Marshall, P., Smyke, A., & Guthrie, D. (2007). Cognitive recovery in socially deprived young children: The Bucharest early intervention project. *In Science, 318*(5858), 1937–1940.
Polanyi, M. (1958). *Personal knowledge: Towards a post-critical philosophy*. Chicago: University of Chicago Press.
Postman, N. (1993). *Technopoly: The surrender of culture to technology*. New York: Vintage Books.
Ramachandran, V. S. (2004). *A brief tour of human consciousness*. New York: PI Press.
Robinson, D. (1981). *An intellectual history of psychology* (Revised ed.). New York: Macmillan. (Originally published, 1976.).
Sapolsky, R. M. (2004). The frontal cortex and the criminal justice system. *Philosophical Transactions of the Royal Society of London. Series B, Biological sciences, 359*, 1787–1796.
Smith, S. R. (2012). "Neuroscience, ethics and legal responsibility: The problem of the insanity defense. Commentary on 'The ethics of neuroscience and the neuroscience of ethics: A phenomenological—existential approach.'" *Science and Engineering Ethics* 18, this issue. doi:10.1007/s11948-012-9390-7
Snow, C. P. (1959). *The two cultures and the scientific revolution*. Cambridge, UK: Cambridge University Press.
Stenmark, C. K., Antes, A. L., Wang, X., Caughhron, J. J., Theil, C. E., & Mumford, M. D. (2010). Strategies in forecasting outcomes in ethical decision-making: Identifying and analyzing the causes of the problem. *Ethics and Behavior, 20*, 110–127.
Stevens, W. (1937). *The man with the blue guitar & other poems*. New York: Knopf.
Teicher, M. H., Andersen, S. L., Polcari, A., Anderson, C. M., Navalta, C. P., & Kim, D. M. (2003). The neurobiological consequences of early stress and childhood maltreatment. *Neuroscience and Biobehavioral Reviews, 27*, 33–44.
Tononi, G., Sporns, O., & Edelman, G. M. (1992). Reentry and the problem of integrating multiple cortical areas: Simulation of dynamic integration in the visual system. *Cerebral Cortex, 2*(4), 310–335.
Weil, S. (1957). *Intimations of Christianity among the Ancient Greets* (E. C. Geissbuhler, Trans.). London: Routledge & Kegan Paul.