

Facts, Fictions and the Future of Neuroethics

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Introduction

Cognitive Neuroscience, I will argue, has three main issues with respect to the current field of neuroethics. First, cognitive neuroscience can help with some current ethical dilemmas such as does the embryo have the moral status of a human being. Second, there are important ethical areas that neuroscientists are being asked to weigh in on, when, in fact, they shouldn't be. For instance, neuroscience has nothing to say about concepts such as free will and personal responsibility. And it probably also has nothing to say about such things as anti-social thoughts. Finally, and perhaps most importantly cognitive neuroscience is building an understanding of how brain research will instruct us on ideas like universal morals possessed by all members of our species. This fundamental development will find cognitive neuroscience becoming central to the modern world's view of ethical universals. I have written a book that explores these three areas of concern. (Gazzaniga 2005)

The term “neuroethics” was coined by William Safire, to refer to “the field of philosophy that discusses the rights and wrongs of the treatment of, or enhancement of, the human brain.” I would argue that it goes further. Neuroethics should not simply be bioethics for the brain. I define neuroethics as the examination of “how we want to deal with the social issues of disease, normality, mortality, lifestyle, and the philosophy of living, informed by our understanding of underlying brain mechanisms. It is not a discipline that seeks resources for medical cure, but one that rests personal responsibility in the broadest social context. It is—or should be—an effort to come up with a brain-based philosophy of life.” (Gazzaniga 2005; see Roskies this volume)

Neuroscience influencing ethical issues: The case of the developing CNS and the moral status of the embryo

Taking the first part of this definition, cognitive neuroscience has valuable information to contribute to the discussion of certain topics that have traditionally been taken up by bioethicists, namely those issues in which brain science has relevant knowledge that should impact the ethical questions being debated. There are several issues in the area of enhancement including possible selection of genes for intelligence, enhancing the brain to improve certain skill areas such as athletic or musical ability, or using “smart drugs,” to enhance brain performance. For the purposes of this chapter I will review one notable issue: when to confer moral status to an embryo.

The brain, specifically the frontal lobe of the cerebral cortex, is the part of the body that differentiates us from other species. The brain enables our body, our mind, our personality and, many argue, our personhood. Thus, being able to identify when the brain develops in the human embryo should have a significant impact on the question of when to confer the moral status of being human to an embryo. Conferring moral status is a different issue than “when life begins” and it is an important distinction--one that the neurosciences suggest should be made.

Biological life and growth of the human organism begins at the moment of conception. But when does *human* life begin? The answer to this question has important implications for debates on abortion, IVF, and biomedical cloning for stem cell research. Many neuroscientists and some bioethicists believe that human life begins when the brain starts functioning—we can’t have consciousness before the brain can operate. Consciousness is the critical function needed to determine humanness because it is a

quality that, in its fullness with all its implications for self identity, personal narrative and other mental constructs, is uniquely human. Following this argument, it would seem that neuroscience would establish the beginning of human life as the point of development when the embryo has a nervous system and brain that is able to support consciousness.

However, as with many ethical issues, once the brain is involved, things tend not to be so black and white. Our grey matter creates many grey areas and in the case of the embryo I would argue that there are different answers on this issue. The context of the question is everything when it comes to neuroethical questions. And there are several relevant contexts for this topic. First, for instance, if we ask when did Sally's life begin? The answer is at conception. But, again, when a specific human life began and when life begins are subtle but substantially different questions.

If you solely consider fetal development, here are the facts (Nolte 2002). The first signs of the brain begin to form around week four when part of the embryo called the neural tube starts to develop three bulges that will eventually become the forebrain, midbrain and hindbrain. While the first sign of electrical brain activity occurs at the end of week and five and beginning of week six (Baruch 1975). This is far from the beginning of conscious brain activity; it is primitive neural activity. (It is also worth noting that there is neural activity in brain dead patients as well. And yet throughout the world and across cultures there is no problem declaring such brain states no longer human.) It isn't until weeks 8-10 that the cerebrum truly begins to develop with neuron proliferation, anterior commissure development and a small first interhemispheric connection. Development continues: weeks 12-16 bring the frontal and temporal poles begin to grow; week 16 the corpus callosum begins to develop, which is responsible for

communication between the two hemispheres. Synapses start forming during the 17th week and multiplies rapidly around week 28—continuing at a rapid pace up until the 3rd and 4th months after birth. Still, in spite of all of this amazing and rapid growth and development, it isn't until week 23 that the fetus can survive—with major medical support—outside of the womb. Prior to this, the fetus is simply laying down the foundation for a brain—a very different thing from being a sustainable human brain.

Life Beginning

Now take all of these early fetal development facts and look at the arguments that are made for drawing a line regarding when life begins. The fact that the fertilized egg doesn't begin the processes that begin to generate a nervous system until day 14, is one of the reasons why those engaging in bio-medical cloning for stem cell research use the fertilized embryos only up until day 14. We have to jump all the way down the development time line to 23 weeks to reach the point where the fetus can survive outside the womb--and only with advanced medical technology helping it along. Thus one could argue that from the neuroscience perspective the embryo is not a human being –or deserving of the moral status of a human being—until week 23. And indeed this is when the Supreme Court has ruled that the fetus has the rights of a human being. But here is where the fully formed adult brain kicks in with its own opinions, sometimes drowning out the rational, purely scientific analysis. For instance, there is something about the look of a sonogram at week 9, or stage 23 of the Carnegie development stages of fetal development where I have a personal reaction as a father to the image of the fetus—when it starts to look human. In spite of what I know, this triggers a perceptual reaction that this forming ball of sensory-motor processes is one of us.

But before considering what to do with these different reactions, let's consider the main arguments on this question. There are the continuity and potentiality arguments. The continuity argument, that life begins at conception, views a fertilized egg as the point at which one's life begins, and therefore it should be granted the same rights as a human being. There is no consideration of any of the developmental stages for those who adopt this view. And there is no rational arguing with those who see it this way. The potentiality argument is similar, in that it views the potential to develop into a human being as equal in status to a human being. I've made the point in my book and elsewhere that this is akin to saying that a Home Depot is the same things as 100 houses because it holds that potential. The main problem, and one that neuroscience cannot ignore, is that they make no sense. How can a biological entity that has no nervous system be a moral agent?

This all leads into a third argument that most often comes into play with stem cell research: intention. There are two kinds of embryos used for stem cell research, unused IVF embryos and those created using biomedical cloning specifically for stem cell harvesting. In the case of IVF embryos, the argument is that the intention of creating several embryos using IVF is to create one or two viable ones for implantation. In natural sexual intercourse and selection, up to 80% of embryos spontaneously abort. Thus IVF is simply a high-tech version of what happens naturally. There was never an intention for each embryo created to be implanted, therefore those that aren't deemed viable should be able to be used for research. And in the case of biomedical cloning, the intention is solely for the creation of an embryo for research purposes only.

This brings us back to my sense that there are different answers to the question of when life begins, depending on the context. The markers I identified happen to be similar to those of the “discontinuity arguments” that some ethicists make. Discontinuity arguments take the view that an embryo is not due the equal moral status of a human being, but rather look for stages at which to grant it intermediate status. The stages tend to be 14 days (in these arguments, because this is the date after which twinning can no longer occur and so the zygote is cemented); and the formation of the nervous system. The problem you quickly see, however, is that there can be many different arguments made for when the nervous system starts to develop, from the 14 day marker, up to 23 weeks. And if you start to look at when consciousness begins, the parameters are even harder to pin down: the 23-week mark, or when you leave home for college?

Why Context is Everything

Context is everything—and this, quite simply, is the lesson of neuroscience. It is our brains, enabling our decision-making processes that allow us to reason, interpret and contextualize. Indeed, as we shall see, we are wired to do this. Looking at the facts I see the contextual answers thus: when a specific human life begins is conception. A 14-day-old embryo, a clump of cells, created for research, has no moral status. An embryo is not a person. And yet a parent may see the sonogram of a nine-week old fetus and see their future baby. What is worth noting on the question of the embryo, is that, like many issues, in spite of what science presents us with, we still have a “gut reaction.” Even though neuroscience tells us that a fetus cannot survive ex utero until week 23. Is this gut reaction an indication of a built-in sense of moral instincts that our brains seek to make

sense of with these various arguments? Cognitive neuroscientific research seems to be pointing towards this, as we shall see.

Defining Practical Boundaries for Real-World Neuroscience

The second area of importance are those areas where cognitive neuroscience should not be commenting because of its limitations. Ironically these tend to be the exact areas where our counsel is most often sought. Namely, the court of law. With new neuroimaging techniques, lawyers and investigators are excited by the possibilities of being able to identify areas of the brain responsible for everything from violent behavior to lying. If we can put someone in a scanner and see if they are lying, or identify brains that are angrier than others, can't this information be used to prove or defend against guilt in a court of law? In fact, the answer should be an emphatic no. While the advances in neuroimaging techniques are exciting, they are not reductive in this way. Being able to see an area of the brain light up in response to certain questions, or, say pictures of terrorist training camps, may reveal some fascinating things about how certain cognitive states may work, but it is dangerous and simply wrong to use such data as irrefutable evidence about such cognitive states. What we know about brain function and brain responses is not always interpretable in a single way and therefore should not be used as infallible evidence the way DNA evidence is infallible (Illes 2005).

For instance, take the example of recent work on whether there is a brain mechanism for prejudice. Work by Elizabeth Phelps and colleagues have used fMRI studies to examine responses of black and white undergraduates to pictures of known and unknown black and white faces. The results are that the amygdala (an area of the brain

associated with emotion) is responsive in white undergraduates when they are shown pictures of unknown black faces, while the amygdala is not activated when whites are shown famous black faces such as Martin Luther King, Jr. , Michael Jordan, Will Smith. They concluded from their study that “amygdala and behavioral responses to black-versus-white faces in white subjects reflect cultural evaluations of social groups modified by individual experience.” (Phelps et al. 2000)

What we have to be wary of, is how we interpret such data. It seems that we do tend to categorize people on the basis of race. But this does not mean that racism is built into the brain. The tricky idea here is that the brain allows us, indeed it is bound and determined to concoct stories and theories about sets of circumstances or data. But the stories, even when based on data, are not always incontrovertible. They are not fingerprints or DNA. For instance, we could say, well the fact that the amygdala lights up when whites see unfamiliar black faces shows that they are afraid of unfamiliar black faces. Therefore the Bernard Goetz’s of the world who stab a black man who approaches them are only reacting to a built in brain mechanism. And it is supposed blacks get angry when they see famous white faces. Thus the “black rage” defense—a black man who shoots a famous white person is only responding to his brain wiring. This is a leap that one could easily see happening in the court of law where we love to weave stories. But it is clearly a dangerous—and more importantly, inaccurate –leap to make.

This example of how a cognitive neuroscience finding can be interpreted and used to draw unreliable conclusions brings up another crucial area where the law and neuroscience should be kept apart: the “my brain made me do it” defense (see also Morse, Greely, this volume). Neuroscience simply does not have as much to say as

people would think or hope, on the issue of personal responsibility or free will. Cognitive Neuroscience is identifying mechanisms that help us understand how changes in the brain create changes in the mind. The concern arises then, that if the brain determines the mind, and determines our actions, independent of our knowing about it until after the fact, then what becomes of free will? Free will is still alive and well. As I have argued, even if an action taken can be explained by a brain mechanism or function or malfunction “this does not mean that the person who carries out the act is exculpable.” (Gazzaniga 2005) Personal responsibility is something that arises out of interacting with many human beings. In other words, we are still guided by social rules of behavior and choose to react and act to those, in addition to any determined brain mechanisms we may all have.

To more fully understand this idea, let’s first look at an example of research in the cognitive neurosciences that illustrates the automatic brain. The work of Benjamin Libet, in the 1980s, first brought this issue to the fore (for a review see Libet 1999). Libet conducted experiments in which he had subjects make voluntary hand movements, while measuring their brain activity using ERP (event related potentials). He noted that between 500 to a 1000 milliseconds before they moved their hands, there was a “readiness potential,” a wave of brain activity that seemed to indicate a lag between the time we get a command and execute it. He did a series of experiments to try to pinpoint the time in that 500 to 1000 millisecond window in which we make a conscious decision to move our hand (Dennet 2003). He devised an experiment in which a subject was told to look at a black dot that was slowly moving. After moving the hand, the subject reported what position the dot was in at the moment the subject made the conscious

decision to move his or her hand. Then Libet compared that moment, with the timing of when a readiness potential was recorded from the subject's brain waves.

What he found was that the brain was active even before the subject was aware of having made the conscious decision to move the hand. There was about 300 milliseconds between the brain activity and the conscious decision. Thus it seems the brain knows our decisions before we do—or before we become conscious of them. Such data seem to imply that free will may be an illusion. But Libet himself noted that there is still a 100ms window for the conscious mind to allow the decision, or to veto it, calculating that it is 500ms from the beginning of the readiness potential to the actual hand movement, and it takes approximately 50-100ms for the neural signal to get from the brain to hand to initiate the movement. Thus he argued that free will is in the vetoing power (Libet 1999).

Such research (and there is much more) that indicates that our brains may be responding automatically is gold to defense lawyers, looking for a biological basis for defective reasoning that could explain myriad criminal behaviors. But this is not the lesson of neuroscience. Neuroscience seeks to determine how the nervous system functions. The brain is a highly complex system that interacts constantly with environment. It works automatically. But it also adapts and learns as it goes along, responding to learned rules, social rules, as well as its own built in rules.

As I have argued in an earlier work:

'But,' some might say, 'aren't you saying that people are basically robots? That the brain is a clock, and you can't hold people

responsible for criminal behavior any more than you can blame a clock for not working'? In a word, no. The comparison is inappropriate; the issue (indeed, the very notion) of responsibility has not emerged. The neuroscientists cannot talk about the brain's culpability any more than the watchmaker can blame the clock. Responsibility has not been denied; it is simply absent from the neuroscientific description of human behavior. Its absence is a direct result of treating the brain as an automatic machine. We do not call clocks responsible precisely because they are, to us, automatic machines. But we do have other ways of treating people that admit judgments of responsibility — we can call them practical reasoners. Just because responsibility cannot be assigned to clocks does not mean it cannot be ascribed to people. In this sense human beings are special and different from clocks and robots. (Waldbauer and Gazzaniga 2001)

Although cognitive neuroscience continues to show us how the brain is an automatic machine, and that many of our actions are predetermined by our brains and our mind often concocts the rationale for the action after the fact, that does not mean that human behavior is predetermined and automatic. We still have personal responsibility. Not all schizophrenics are violent and not all people raised by bad parents are criminals. “My brain made me do it” is not an excuse.

Cognitive Neuroscience: Building towards the future

The single most important insight the cognitive neurosciences can offer neuroethics, however, is the understanding of how the brain forms beliefs. When you begin to understand how the brain works, how it forms beliefs, and moral judgments, you must begin to question how certain long-held beliefs may be influencing our ethical and moral judgments, and often wrongly so.

A powerful example of the brain's drive to form beliefs comes from observing "split brain" patients in my own research, as they struggle to form an explanation for actions that their non-verbal right side has been told to execute. These are patients who have had their corpus callosum severed for treatment of epilepsy, which prevents information from being easily communicated between the left and right hemispheres. If you have a person fixate on a point in space, everything to the right of the point is projected to the visual areas in the left side of the brain and everything to the left of the fixation point is projected to the visual areas on the right side of the brain. This is true of everyone, but in split brain patients, that information is now isolated in the two halves of the brain—in other words the left brain doesn't know what the right brain sees and vice versa.

Years of testing of such patients has revealed that there is a brain mechanism, which I call "the interpreter" that resides in the verbal, or left brain, which crafts stories or beliefs to interpret actions. For instance, because of the ability to isolate the verbal and nonverbal hemispheres, when the word "walk" is projected to the right hemisphere of a split brain patient, the patient will get up and start walking. When we ask the patient why he or she is doing this, the left hemisphere, which is the site of language for most people,

and which did not see the command “walk” starts to create a response, such as: “I wanted to go get a coke”.

Such examples abound in split brain research (REFs), and also in studies of neurological disorders. For instance patients who have suffered a stroke of the parietal cortex can suffer from “anosognosia for hemiplegia” a state in which they don’t recognize the fact that they have become paralyzed. The interpreter takes the information that it sees: that their limb is there, but not moving, and tries to reconcile it with the fact that the brain is receiving no message that the limb is damaged. (This is because the paralysis is caused not by damage to the limb, but by damage to the part of the brain that is responsible for operating the limb, so the brain is, in effect, getting no information at all about this limb that it sees but cannot feel or move.) The interpreter goes to work to find an explanation when the patient is asked why they cannot move their arm, and patients will answer: “it’s not mine”, or “I just don’t feel like moving it.”

Another exciting areas of research in cognitive neuroscience are Giacomo Rizzolatti’s work with mirror neurons. These are neurons that Rizzolatti and his colleagues have identified in monkeys that indicate that there is a built in mechanism for “mind reading” or empathy. When a monkey sees another monkey reach for something, the neuron responsible for the movement fires in the reaching monkey—and that same neuron fires in the monkey that is only watching, but not moving (Rizzolatti et al, 2001). In other words, it may be that when we see another person do something, the same neurons are triggered in our brains, creating the same feeling or response in us. It could be a brain correlate for empathy, or understanding another’s state of mind.

These are just a few powerful examples of how cognitive neuroscience is finding brain mechanisms that guide aspects of mind. Add to this observation about how we form beliefs, recent findings on how we make moral judgments, and the implications get even more interesting. Recent research indicates that moral reasoning may, in fact, be brain based. Joshua Greene has done fMRI work to look at moral reasoning questions and what parts of the brain they trigger. One important observation is that we choose to act on a moral judgment (rather than just have it or assert it), when the emotion centers of the brain are activated (Greene *et al.* 2001). And Marc Hauser and his colleagues have been surveying people from around the world on standardized moral reasoning questions that show that people from around the world have the same response patterns. Basically, we respond in similar ways to similar issues – the only thing that is different is our explanations about why we respond the way we do (Hauser, M. *Moral Minds: The Unconscious Voice of Reason*, forthcoming from Harper Collins. The theory is that these similar responses are due to common brain networks, or reward systems in our own brains—moral reasoning is built-in to our brains.

This growing understanding in the cognitive neurosciences of the brain mechanisms underlying the formation of beliefs, makes it difficult to accept an absolutist view about any and all belief systems. Belief formation is one of the most important areas where cognitive neuroscience needs to teach something to the ethicists and the world: the brain forms beliefs based on contextual information, and those beliefs are hard to change. If you know that, it is hard to accept the wars that rage and lives that are lost due to differences in belief systems. At another level, however, it should come as no surprise that people are behaving as they do. We are wired to form beliefs, to form

theories (using the interpreter); religious beliefs are basically a meta-narrative that explain why we should behave a certain way in society (see also Wolpe, this volume).

Cognitive neuroscience is revealing that the rationales we give for our actions are basically a social construct. Over time, people living in social groups develop a set of beliefs or practices – be they a form of government, religion, cultural practices or all of the above. Thus the explanation for the way of living together becomes institutionalized. If we could come to understand and accept that the different theories or interpretation of our actions the true source of different beliefs systems, then it seems to me we could go a long way in accepting differences as a difference of narrative, not a universal difference in how all human exist in the world.

Summary

The cognitive neurosciences have three important messages for neuroethics. One, there are many traditional bioethical issues that cognitive neuroscience should weigh in on. These include conferring moral status on an embryo, issues of aging, enhancement, and training. Any issue in which the brain or nervous system is involved, should now be taking the latest cognitive neuroscience findings into account. But it is time to accept that such ethical questions will never have black and white answers. Context is everything when it comes to neuroethics, and an understanding of how our brain forms beliefs and makes decisions can and should inform how we contextualize these important questions. Taking the embryo example, we can see that there are different answers to when to confer moral status depending on the question being asked. When life begins, when a life

begins, and the date at which an embryo created for research must be used by, are all very different questions and deserve different answers.

Second, there are many issues where ethicists long for neuroscience to provide answers. Everyone would love for us to be able to point to an fMRI image and be able to identify a pixel that determines guilt or innocence, or answer definitively questions of whether an individual's brain chemistry caused him or her to act in a certain way. In spite of a growing body of research that suggests that the brain does indeed determine the mind, this does not mean that there is no such thing as personal responsibility or that brain imaging will be able to deliver the same incontrovertible evidence that a DNA match does. Neuroscience has its limitations and these are crucial to understand.

Finally, the most important lesson of cognitive neuroscience is one that is still unfolding: that human beings may have a built in sense of moral ethics. Brain mechanisms for “mind reading,” or empathy—neurons and mechanisms that help us understand others' actions and react accordingly, that help us develop a theory of mind about others—are rapidly being identified. As we continue to uncover and understand the ways in which the brain enables belief formation and moral reasoning, we must work to identify what this intrinsic set of universal ethics might be. It is a revolutionary idea, to be sure, but looking at how the modern world clings to outmoded belief systems, fighting wars over them in light of this knowledge is, in a word, unethical.

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