Sci Eng Ethics (2012) 18:423–432
DOI 10.1007/s11948-012-9398-z

EDITORIAL

Editors' Overview: Neuroethics: Many Voices and Many Stories

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Received: 6 August 2012 / Accepted: 20 August 2012 / Published online: 29 September 2012

Abstract Advances in neuroscience continue to enhance understanding of the brain and provide new tools to take advantage of that understanding. These changes are poised to profoundly alter society. Given that the impact will be felt not only by neuroscientists, but by diverse members of society, it is imperative that conversations engage all stakeholders. Doing so will allow for the sharing of diverse views and perspectives to understand and frame the science, better educate and prepare the public for new developments, and provide a shared approach to identifying and resolving ethical challenges. These were the goals of *Neuroethics Week*, staged in 2007 by the Center for Ethics in Science and Technology in San Diego, and are the basis for the contributions to this special issue of *Science and Engineering Ethics*.

Keywords Education · Ethics · Multi-disciplinary · Neuroethics · Neuroscience · Public engagement

Neuroethics

Two areas of modern neuroscientific inquiry include the mechanistic roots for ethical decision-making and behavior and the ethical, legal, and social challenges that accompany an increased understanding of brain function. Sometimes summarized as the "neuroscience of ethics" and "ethics of neuroscience," these kinds of studies have come to be defined collectively as neuroethics (Bird 2009; Roskies 2002). This issue is devoted broadly to this conception of "neuroethics."

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The extent to which mind and affect are synonymous with brain is for many a debatable proposition; however, few people would argue that brain anatomy and function have *no* role in determining character or identity. A classic demonstration of this relationship is the anecdotal case of Phineas Gage (Campbell 1851) who was reportedly changed from model employee and citizen to disreputable character by an accident that had caused a tamping iron to impale the left side of his face, thereby causing damage to his left frontal lobe. More recently, another noteworthy case was an individual in whom a brain tumor seemed closely linked to uncontrollable pedophilia (Burns and Swerdlow 2003). However persuasive these anecdotes might be, and however consistent with various studies and other anecdotes, they remain only anecdotal. That is changing, particularly during this past decade, characterized by a rise in imaging and genetic studies that provide compelling evidence for predictive associations for, respectively, activation of selected brain regions (e.g., Cabeza and Nyberg 2000) and certain gene variants, with particular attitudes and behavior (e.g., Alia-Klein et al. 2008). The implication that it might be possible to "read" someone's character in the anatomy of their brain or in their genes has potential for dramatic societal impact.

The urgent need for public conversation about new developments in the neurosciences is defined not only by what is already possible, or even what will be achieved, but also by aspirations that may ultimately be out of reach. Modern developments in science and technology are unquestionably impressive, but they are also inextricably linked to a larger community beyond the few scientists and engineers who are privileged to make those inroads. That larger public, often credited with lacking scientific literacy (e.g., National Science Foundation 2012), is diverse in its composition. Many have called for enhanced engagement with this diverse public (e.g., Leshner 2003) including, but not limited to lawyers, business leaders, healthcare providers, regulators, and legislators, and many more non-professionals who may be characterized as blue collar workers, service providers, and people who subscribe to a particular religious tradition (or none at all). Collectively, these diverse groups are unfortunately characterized by a common feature: the failure to communicate with one another about their distinctive perspectives, understandings, goals, hopes, and fears. At the same time, these groups collectively define public policy based on how they do or do not vote, or otherwise make their voices heard. Those decisions in turn define regulatory and funding boundaries for future research as well as decisions about whether and how to apply new technologies. While it is unrealistic to expect those decisions to always be ideal, it is perhaps reasonable to aspire to more informed decisions based on robust conversations not only within, but among, these various stakeholders.

Center for Ethics in Science and Technology

The need for public engagement to address the challenges of new developments in science and technology was the impetus for creating San Diego's Center for Ethics in Science and Technology in 2004.[1] A central premise for the Center is that

[1] The Center began with a primary focus on stem cell research, a highly controversial topic in California because of a then pending statewide proposition, ultimately approved by the voters, to commit $3 billion

dialogue involving all stakeholders has value for increased public understanding and buy-in, but also increased academic understanding and appreciation of public concerns, and increased likelihood of jointly identifying challenges and possible solutions.

The Ethics Center's first foray into neuroethics, in 2005, consisted of several activities designed to focus on the case of Terri Schiavo (Hook and Mueller 2005)[2] . This culminated two years later in a weeklong series of public and private conversations on the topic of neuroethics. *Neuroethics Week* consisted of a wide variety of events designed so that diverse stakeholders could hear from one another on the subject of ethical challenges in the domain of new neuroscientific developments. The approach was eclectic, if not comprehensive. Events were held in diverse academic locations throughout San Diego. Six focus group discussions were convened representing, respectively, neuroscience, medicine, law, religion, humanities, and social science, and at the end of the week selected representatives from each of these groups participated in a cross-disciplinary roundtable discussion. Outcomes of these various focus groups were shared with subsequent focus groups as well as in public events in which speakers and panelists could both speak to and hear from the public. These discussions repeatedly highlighted the need for the many different participants, with their diverse perspectives and expertise, to hear from one another.

Five years after convening Neuroethics Week, it seems more important than ever to re-visit this cross-disciplinary approach. The premise then, as now, is not to simply air different viewpoints, but for diverse audiences to also engage one another in conversation. With that in mind, it quickly became clear that creating a special issue on this topic would require editorial and review processes that incorporate cross-disciplinary conversations. First, the co-editors of this special issue include people who have had careers in neuroscience (SB, MK) and social science (DP), but also all of whom have a longstanding interest in both research ethics and public engagement. Second, peer reviews of all primary manuscripts were assigned nominally to one reviewer in the same disciplinary domain as the author(s) and a

Footnote 1 continued
for human embryonic stem cell (hESC) research over a period of 10 years (Proposition 71 2004). The Center convened a variety of public meetings, including multi-disciplinary representation of diverse voices on the topic of stem cell research. Based on those conversations, the Center published a collection of papers expressing strongly held, divergent views, and introduced by a summary and consensus statement agreed to by all parties (Kalichman and Hinman 2005). One important outcome of this exercise was the willingness of scientists, who held no moral qualms prohibiting them from conducting hESC research, to respect the views of their opponents sufficiently to pursue alternative sources of pluripotent stem cells (PSCs). Arguably, conversations like these helped foster research that ultimately produced the technology to reprogram adult cells so as to produce PSCs without the need to harm or destroy human embryos (Takahashi et al. 2007; Yu et al. 2007). To date, this line of research has exemplified the principle that a willingness to address ethical challenges can also result in important scientific advances (Zacharias et al. 2011).

[2] In 1990, Terri Schiavo suffered a severe incident of cardiac arrest at the age of 26. After hospitalization, initial therapeutic attempts, and eight years in a vegetative state, Schiavo's husband requested removal of her feeding tube in 1998. Because of opposition from Schiavo's parents, the definition of brain death was widely debated in the courts and public arena. Schiavo's feeding tube was briefly removed in 2001, and then permanently in early 2005. She died in March of 2005.

second reviewer with a very different background. Finally, most of the commentaries on the original articles were solicited from people who would have distinct and potentially very different perspectives from the original articles. This multidisciplinary approach sometimes resulted in confusion, communication challenges, and conflicts, but always in a richer understanding of the topic of neuroethics.

Overview of Contributions

Contributions to this special issue of *Science and Engineering Ethics* were invited from participants in the Ethics Center's *Neuroethics Week*, as well as others who might provide complementary perspectives. The result is very different from typical collections of academic papers. Participants were drawn from diverse perspectives and disciplines, many of which have distinctive discourse, both in form and content. These differences are part of this story. This collection is comprised of nine original papers, each of which is paired with a commentary. The purpose of the comment pieces is not to directly critique or respond to the original papers, but rather to provide additional, and sometimes highly contrasting, perspectives on the various topics. The authors are diverse including but not limited to neuroscientists, biomedical scientists, social scientists, theological scholars and practitioners, lawyers, and humanists. Although each manuscript typically touches on multiple issues, the sequence of papers is framed around five thematic domains: (1) *Reductionism:* reflections on reductionist interpretations of neuroscientific developments; (2) *Humanity:* the significance of those developments to the question of what it means to be human; (3) *Religion:* three different religious perspectives on new developments in the neurosciences; (4) *Ethics Education:* consideration of possible implications of neuroscientific understanding to enhancing ethics education; and (5) *Social Science:* a variety of social scientific perspectives on the promise offered by neuroscientific research.

Reductionism

From its earliest foundation, scientific research has aspired to a better understanding of the natural world and those who live here (Bacon 1620). While typically viewed as beneficent, the fruits of scientific success have frequently displaced accepted wisdom about the planet, its location in a vast universe, and its distant origins (Boorstin 1983). Further, science has increasingly informed an understanding of the contingency of human origins based not on special creation, but on an evolutionary narrative augmented by innumerable genetic, epigenetic, and environmental causes for previously unexplained characteristics and disorders (Rosenberg 2006). The trajectory of science has been to introduce more and more proximate explanations for human origins and attributes. It is perhaps not surprising, then, that some have speculated that continued success will lead to ever more perfect knowledge such that no mystery will remain. This view of the future is offered by Thomas Scott (2012) in the opening article, and is answered by a case from Henry Greely (2012) that such speculation is at best premature. Ralph Greenspan (2012) provides an

argument strongly grounded in neuroscientific findings to suggest that brain function is so plastic, between and within individuals, as to preclude definitive conclusions about how any one individual might actually behave. In commenting on Greenspan's conception of biological indeterminacy, Ann Pirruccello (2012) takes a philosophical approach in making a case against reductionism.

Humanity

Christopher Frost and Augustus Lumia (2012) introduce a thoughtful examination of risks as well as opportunities for how studies and findings of science are framed. Recognizing the possibility of profound changes in the way humans view themselves, Frost and Lumia argue for more than a passive reception for neuroscientific advances. Rather they encourage the neuroscience community to be attentive not only to how neuroscience research findings are framed, but to take advantage of the resulting findings to better understand what it means to be ethical. One specific implication of the challenges presented by Frost and Lumia is the legal basis for the insanity defense. With that in mind, Steven Smith (2012) dissects that defense as it now exists and considers how, if at all, neuroscience might help resolve this historically fraught legal argument.

Religion

In selecting the religious perspectives to be included, two difficulties were clear from the outset. First, even if limited only to the most widely known religious traditions, this entire issue would be insufficient to do justice to all. Second, the presumption that any one individual can be representative of a given religious tradition is clearly suspect given the wide range of world views found among the believers from any one faith tradition. Respecting these two difficulties as caveats, the goal was to hear from different religious voices without attempting or pretending to be comprehensive. With that in mind, the possibility that physical measurements might reveal consciousness, thoughts, intentions, or the roots of morality serves as a lens to view selected Catholic (McGoldrick 2012), Islamic (Al-Delaimy 2012), and Buddhist (Tsomo 2012) perspectives. In each case, commentaries from others speaking from the same religious traditions further enrich those perspectives (Cho 2012; Miller 2012; Moosa 2012).

Ethics Education

Not surprisingly, cases of misconduct in business, law, teaching and learning, medicine, and science often result in calls for new or better ethics education. This is notably the case recently with a new requirement from the National Science Foundation (NSF) calling for responsible conduct of research teaching for all undergraduates, graduate, and postdoctoral trainees supported by NSF funds (National Science Foundation 2010). While the success of these efforts might be debated, it is clear that there is still room for improvement. In this respect,

neuroscience may provide insights into the neuroanatomical, neurophysiological, and cognitive mechanisms behind ethical decision-making. If that promise is met, then it may be that ethics education could be better constructed and implemented. This is the core argument made by Marc Lampe (2012) and some of the implications are further considered in a commentary by Philip Langlais (2012).

Social Science

The road to a better understanding of the brain leads not only to implications for individuals, but more likely implications for society. Darren Schreiber (2012) views this question from the perspective of scientific endeavors designed to better understand *how* individuals make social judgments. As for much of research along these lines, it is important to note that although studies to localize and understand such judgments are still in their infancy, ethical questions remain. How, if at all, should imperfect information be used by individuals, by groups, or by government? What actually is possible to ever say about individuals given serious questions about biological indeterminacy (cf. Greely 2012; Greenspan 2012; Pirruccello 2012)? And even if such technology were to achieve near perfect predictive power, how should it be used? In his commentary, Sanjay Nigam (2012) cautions that such scientific findings provide only one of many possible stories (narratives), none of which is sufficient, but all of which are needed. Stuart Henry and Dena Plemmons (2012) take these questions in a different direction by challenging the neuroscience field to incorporate an awareness of the existing power differences that leave too many individuals disempowered and without a voice. They bring the conversations in this special issue full circle by underlining the need to include everyone in the decision-making process, presumably, not only for how the findings of neuroscience are applied, but also how research is framed and conducted to produce those findings. Finally, given the potential impact of how research studies are framed, Stephanie Bird (2012) examines the risks of researcher bias, both conscious and unconscious, and its broader implications.

Common Themes

The contents of this issue are clearly not comprehensive, but it is hoped that they are sufficiently eclectic and illustrative to highlight the complexity of the factors to be balanced in thinking about new directions in neuroscience. It is nonetheless noteworthy that a number of common themes can be found among these writings. These include the importance of thinking about both specific cases and general principles, the debate about whether a complete understanding of the brain would be sufficient to explain all aspects of mental functioning, the use of animal behavioral studies to infer similarities and differences between cognitive function in humans and non-human animals, and the importance not just of scientific study but also of many other kinds of perspectives, experience, and stories, to generate a better understanding of the human brain.

Particular and General

Nearly all contributions to this issue were placed in a context of general questions: Can all of cognitive function be reduced to scientifically measurable components (e.g., Greely 2012; Greenspan 2012; Pirruccello 2012; Scott 2012)? Should neurotechnologies be used to look into or infer the thoughts of individuals (e.g., Al-Delaimy 2012; Cho 2012; McGoldrick 2012; Miller 2012; Moosa 2012; Tsomo 2012)? What will be the implications for education and society as a whole if scientific aspirations become technological realities (e.g., Bird 2012; Henry and Plemmons 2012; Lampe 2012; Langlais 2012; Nigam 2012; Schreiber 2012)? These are all important questions, and have to varying degrees entered popular culture, but the reality remains that these long-term projections are at best possible and by no means certain. Nonetheless, the contributions included here appear to be unanimous in the belief that it is important to think intensely about these questions prospectively, rather than wait to respond retrospectively after problems have occurred. One reason for this perspective is that these challenges will present themselves not just if a given technology is perfected, but perhaps even more seriously if that technology is applied when still imperfect. Questions like this are best addressed by moving from the general questions to consider particular applications such as functional magnetic resonance imaging (fMRI) to detect deception (e.g., Bles and Haynes 2008; Davatzikos et al. 2005).

Brain and Mind

The question of whether brain and mind are synonymous is one that has been asked by many philosophers, including Aristotle (350 B.C.E.) and René Descartes (1641), and even leading neuroscientists such as Charles S. Sherrington (1951) and John Eccles (Popper and Eccles 1977). While more and more of brain function is being localized and explained through neuroscientific studies, much is still elusive. To what extent might mind be viewable as emergent from brain, but still not reducible to something that is physical and measurable? Many questions persist about how far science can go, as well as how far that science *should* go. This tension is addressed by nearly all contributions here, but especially those by Thomas Scott (2012), Henry Greely (2012), Ralph Greenspan (2012), Ann Pirruccello (2012), Christopher Frost and Augustus Lumia (2012), Terence McGoldrick (2012), James Miller (2012), Karma Lekshe Tsomo (2012), and Francisca Cho (2012).

Animal Studies

Much of biomedical research in general, and neuroscientific research in particular, has been constructed by first studying non-human animals (Society for Neuroscience, undated). Given the presumption that such studies are generalizable to humans, it is reasonable to ask whether there is some quality of mind or cognitive functioning that is distinctive for humans only. If the argument is that such qualities are distinctly human, then a case can be made that research on non-human animals would have only limited utility, and that, to the extent that utility is diminished, the

use of such research would be ethically problematic. Further, use of animals in understanding qualities of mind is limited in its generalizability since, at best, humans can only infer mental activity (as opposed to brain activity) in those with whom they cannot communicate, including non-human species. This question does not hinge solely on whether brain and mind are separable, but also on the conception that humans are, in fact, special. While this concern is not addressed directly, most contributions to this issue address questions that begin largely with work necessarily conducted in animal studies. This perspective is most clearly raised by McGoldrick (2012) and Bird (2012).

Stories

A critical theme emphasized in the 2007 *Neuroethics Week* was the importance of hearing different voices, perspectives, and views to understand the brain and mind and how they work. This idea was explicitly introduced to the conversation by Sanjay Nigam, a novelist and one of the contributors to this collection. However this is not only a perspective of someone from the humanities. Nigam is also both a physician and a scientist. His argument, which resonated with many, was that full understanding comes from looking at many facets, not just one. Science does provide stories, and they are important, but they are not the only stories that provide insight. An argument here is that thinking about neuroethics will be best informed by incorporating many voices telling many stories, including those of neuroscientists, social scientists, philosophers, humanists, theologians, and others. Not only is this view shared by many contributors to this issue (esp., Al-Delaimy 2012; Cho 2012; Frost and Lumia 2012; Greely 2012; Henry and Plemmons 2012; Langlais 2012; Moosa 2012; Nigam 2012; Pirruccello 2012; Tsomo 2012), but many of those diverse voices are included in the collection.

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