WINNING ARTICLES

“The Story of Aducanumab and Its Accelerated Approval: Maximizing the Freedom of Choice or Endangering the Patient’s Dignity”
- Ante Čolak (Winner)

“Morality versus Entropy: Can Humans Be Held Morally Responsible?”
- Ariya Patel (Honorable Mention)

“Neurocriminology: An Ethical Review of Functional Magnetic Resonance Imaging in Neurolaw”
- Shalmali Rao (Honorable Mention)

“If You Give a Man a New Head: The Ethical Boundaries of Neurotransplantation”
- Benjamin Cohen (Honorable Mention)
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### INTRODUCTION

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### NEUROETHICS

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Alzheimer’s Disease (AD) research aimed at removing one of its biomarkers, $\beta$-amyloid plaques, resulted in the discovery of a drug referred to as aducanumab Aduhelm™. The FDA has approved Aduhelm under its accelerated approval pathway. The drug is a synthetically made monoclonal antibody and has the role of binding on $A\beta$ molecules, after which it activates the brain's immune system. However, clinical studies have shown conflicting results as to the drug’s efficacy. Many argue that the accelerated approval pathway allowed for an additional treatment option that was brought to patients faster, whereas others suggest aducanumab may be giving patients a glimmer of hope despite it not being ascertained as efficient. Regardless, the FDA’s decision is justified as it offers a new treatment option for families that find it is the most suited for them.

If You Give a Man a New Head: The Ethical Boundaries of Neurotransplantation | Benjamin Cohen  | 11-15 |

A recurring flurry of media attention directed toward the prospect of head transplantation in humans suggests that the possibility is near given our current procedural techniques, though research belies the impression. Studies involving blood vessel reconnection that would be necessitated by head transplantation are limited to rat models, which display unfavorable survival rates. Even beyond the ethical concern of technical readiness, a head transplant suggests the brain is responsible for the self, and the body is an appendage that can be switched while retaining one’s distinct personality, which acts as an inadequate proposition. Head transplantation stands extremely far ahead of its time such that legal and regulatory frameworks have not caught up to all its implications. The procedure requires reflection and research to assess the multitude of barriers surrounding its implementation.


There are numerous historical cases that illustrate the possible role of neuroscience in the criminal justice system, raising important questions about the relevance and reliability of such evidence. Functional magnetic resonance imaging or fMRI is a popular brain imaging method that measures changes in blood flow into active areas of the brain and thus may illustrate alterations in behavior that often underpin criminal behavior. While fMRI has been previously used in court settings, the occurrence of false positives may lead to mistaken conclusions about a person’s guilt. A healthy balance between benefiting from the
scientific findings of brain scanning and their misuse is necessary to avoid unjust court verdicts. Nonetheless, fMRI holds the potential of improving the field of criminology.

Morality versus Entropy: Can Humans Be Held Morally Responsible?  Ariya Patel  pages 20-23

Entropy is the measure of randomness in a system. The conscious mind and the signals in the brain are related to entropy. Low entropy occurred during the sleep state, and high entropy occurred during wakeful states. Many people now postulate that humans cannot be held morally responsible for their decisions on account of only acting in agreement with the second law of thermodynamics: all systems strive towards the increase of entropy. Neuromorality is a study in which neuroscientists analyze the connection between morality and neuronal functions. The inconclusive nature of neuromorality and entropy leads to the conclusion that neuroscience and other fields that explore moral responsibility can never deny or accept a sole answer as to whether humans should be held morally responsible.

The Fragility of Identity: An Ethical Evaluation of Decoded Neurofeedback  Sudhi Chavadam  pages 24-27

Decoded Neurofeedback (DecNef) details a novel method of therapy where participants are tasked to match their neural activity with the same neural activity presented when recalling a painful stimulus from their past. DecNef poses potential to better the lives of anxiety disorder patients. However, due to the aversive nature of re-exposure to traumatic incidents in one's life, many patients choose to discontinue the therapy. DecNef requires patients to be unaware of the purpose of the treatment, which itself engenders ethical concerns as consent may be compromised, considering those undergoing the treatment suffer from anxiety disorders and may need forewarning. DecNef also unveils fMRI data regarding one's processing of subjective experiences, and ill-intended access to such authorized data may result in detriments to privacy as the technology evolves. Though the therapy exemplifies the progress made by neuroscience in treating the human mind, it needs to address ethical concerns prior to implementation.

Analyzing the Ethical Use of Optogenetic Memory Modifications  Isha Mahadeshwar  pages 28-31

Optogenetics, a rising field, allows scientists to activate different neural circuits with light, allowing for the selective modulation of neural pathways; therefore, memory-modifying techniques from optogenetics enable researchers to modify and manipulate parts of the human memory. By removing or editing people's memories, people will lose the motivation to enact systemic changes because they forgot the mistreatments that they have endured. Also, it has been found that activating positive memories artificially is sufficient to suppress depression-like behaviors. The various benefits of optogenetic therapy make this form of memory modification effective in therapy and to cure mental illnesses.

Evaluating the Mechanics and Ethics of Persuasion in the Attention Economy  Min Hyung Lee  pages 32-35

This article focuses on the implications of the "attention economy" and the race for "user attention" in the
wake of the ever growing social media industry. Companies try to benefit by exploiting the psychological vulnerabilities of the users in order to make profit. Social networking companies such as Facebook, Instagram, Tiktok try to capture their users' attention by offering different experiences in order to achieve their motive - to win in the attention economy to maximize their revenue. Social media platforms have a lot of benefits and even though a lot of ethical questions can be raised regarding this subject, it’s ultimately up to the users to use technology in moderation. This is especially important for teenagers who are comparatively more vulnerable. Apart from the users, corporations must also ensure that data collection, product design, and persuasive technology are being used responsibly; users should educate themselves on the implications of social networking; legislature should draw causal relationships between citizen health and tech usage and take action accordingly through restrictive measures.

The Fault in Our Genes: A Call for Enhanced Legal Protection of Genetic Information

Ai Ni Einez Wu

Behavioral genetics is defined as the study of the relationship between the genetic composition of an organism and its behavior. Extensive research on behavioral genetics set the foundation for the search for the exact genetic sequences of intelligence. A genetic factor to depression as children from families with generational diagnoses of depression have higher risks of obtaining mental illnesses. This revelation is powerful in detecting and prescribing early preventative measures and emphasizing social justice, but has the potential to be abused as a tool for discrimination. It is only from the advocacy of people that serious amendments to genetic information will occur.

The Adolescent Brain: Exploring the Validity of Juvenile Law

Sunga Kim

The decision of the US Supreme Court to outlaw juvenile death penalty has shed light on a debate regarding the role of brain development in criminal justice. It is well known that the cognitive capacities of adolescents are very different from those of adults. This is mainly due to unequal pace of maturation observed in the amygdala, involved in spontaneous and emotional behavior, compared to that of the prefrontal cortex, responsible for judgment. These natural differences may be further exacerbated by poor environmental conditions during early life, which can then increase the likelihood of developing mental health disorders and the occurrence of violent behavior. It is therefore important to consider these factors when deciding on the criminal liability of juveniles, as advances in neuropsychology continue to uncover new knowledge about the human mind.

The Criminal Investigation of Neuroethics: The True Culprit behind Dissociative Identity Disorder

Nayeon (Rachel) Lee

In court cases involving perpetrators suffering from DID (dissociative identity disorder), there is a lot of ambiguity regarding the exact rules as to how to judge whether a person has committed a crime or not. Currently, the court’s view on crimes committed by the DID convicts are as follows: If the host personality is unaware or suppressed by the alter during crime, the host is not guilty. Yet, if the host personality is aware and has control over the alter during crime, the host is guilty. This ambiguous nature of the rules makes the court still unclear whether the host or its alters should be liable for the crime in question. With respect to the
issue of DID convicts, modern medicine and scientists must therefore work assiduously to develop a strict system of proper psychoanalysis to determine whether the convict is truly suffering from a mental disorder or is taking advantage of insanity defense. Furthermore, the government should allocate more funding in research of DID, as it often stems from trauma that is highly correlated to crime rates.
Dear Readers,

Welcome to the fifth installment in the fifth season of the IYNA Journal! In this special edition, we are excited to recognize the work of students who competed in the 2022 IYNA-INS High School Neuroethics Essay contest. Our volunteer judges and staff have worked diligently, carefully reviewing all submissions and determining the highest-scoring essays. These papers are included in this issue, presenting a broad array of neuroethical concerns. The IYNA journal would also like to thank every contestant for taking the time to contribute their thoughts and promote neuroethics discussions. Neuroethics is still such a young field, so we are proud to see the discourse on this subject evolve every day across the world. With that being said, here are some previews of the the winning essay along with three honorable mentions (in that order) for this year’s contest:

Ante Čolak examines the the ethics behind the FDA approval of a medication designed to treat Alzheimer's disease, Benjamin Cohen sheds light on the moral dilemmas surrounding the possibility of introducing head transplants for humans, Shalmali Rao evaluates the use of fMRI in neurocriminology and its ethical concerns, and Ariya Patel analyzes the connections between consciousness and moral responsibility.

As we approach the end of 2022, we would like to recognize all of our dedicated editors for helping us make this issue the success that it is. You can see all of their names and positions on our Contributors page. If you have any questions, comments, or suggestions for us, please email apan@youthneuro.org. We hope you enjoy reading this issue as much as we enjoyed editing it!

Best Regards,
Annie Pan - IYNA Journal Editor-In-Chief
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The Story of Aducanumab and Its Accelerated Approval: Maximizing the Freedom of Choice or Endangering the Patient’s Dignity

Ante Čolak

Abstract

Current treatments for Alzheimer's disease vary from symptomatic treatments to the drug known as aducanumab which reduces the β-amyloid plaques that are considered to be one of the causes of the disease. Since AD affects a large number of people, the question regarding the possibilities of treatments stands as one of the most crucial questions in modern neuroscience. This essay considers the moral application of the accelerated approval pathway that allowed aducanumab to access public markets. Due to the complexity of the issue and the specific nature of this neurodegenerative disorder, this controversial decision separates itself from the consideration of other cases of accelerated approvals. The essay concludes that aducanumab maximized the freedom of choice the patients have, therefore justifying the FDA's decision from a moral standpoint.

The Look at Alzheimer's Disease

A progressive neurodegenerative disorder known as Alzheimer's disease (AD), affects 75% of 55 million people living with some form of dementia, a brain disorder that causes intellectual and cognitive decline [1]. The signs of the disease include forgetting recent events or conversations, to severe memory impairment [2]. Currently, there are symptomatic treatments that help patients improve their cognitive capabilities such as
temporarily improving or slowing the progression of symptoms [2].

Clinical studies have shown a moderately beneficial effect of symptomatic drugs on cognitive activity, with donepezil being the most effective [4]. Donepezil is a selective acetylcholinesterase inhibitor. Clinical studies showed prominent improvement in the subject’s cognitive capacity. Moreover, memantine, as a low-affinity open-channel blocker, shows a beneficial effect on cognitive functions and the prevention of agitation and aggression [4]. Unfortunately, symptomatic therapies do not affect disease modification [5].

Furthermore, clinical trials are usually unsuccessful because scientists still do not fully understand the complex pathophysiology of AD [6]. Although research aimed at removing one AD biomarker, β-amyloid plaques, resulted in the discovery of a new drug: aducanumab Aduhelm™ [7]. America’s Food and Drugs Administration has approved Aduhelm under the accelerated approval pathway [7], which provides patients suffering from the disease with earlier access to treatment but also requires the company to conduct a new clinical trial to verify the drug’s clinical benefit. If the trial fails, the FDA may withdraw approval of the drug [8]. Moreover, aducanumab yearly costs around $28,200 for US patients. Two parallel groups of clinical trials were conducted and showed conflicting results, thus raising relevant arguments against FDA’s decision [9].

This essay aims to ethically assess the FDA’s decision of approving aducanumab under its accelerated approval pathway and its moral implications. This essay doesn’t evaluate the morality of the accelerated approval pathway generally, but rather looks at this specific context of aducanumab. Irrespective of utilitarian outcomes, this essay will argue that patients’ freedom of choice ought to be maximized with the consideration of preserving human dignity.

Clinical Trials: Aducanumab’s Story

Alzheimer’s disease is a multifactorial neurodegenerative disorder that mostly occurs due to genetic, epigenetic and environmental factors [10]. There are two key AD biomarkers: β-amyloid plaques (Aβ), and neurofibrillary tau tangles (NFT) [6]. Hyperphosphorylation of the tau protein and its intracellular accumulation causes pathological characteristics of AD, while accumulations of toxic β-amyloid are believed to disrupt neuronal communication [11]. However, it has been proven that many people have
Aβ plaques in the brain but no symptoms of cognitive decline or AD [12]. Aducanumab is a synthetically made monoclonal antibody and has a role of binding on Aβ molecules. Once bound, aducanumab activates the brain’s immune system [7]. There were two clinical trials conducted and the scientists are not convinced of the success of aducanumab precisely because of the conflicting results of the ENGAGE and EMERGE studies: ENGAGE showed a significant decrease in Aβ accumulation but did not show better cognitive ability in patients [13]. However, some experts argue that these trials couldn’t efficiently represent the real effect of the drug [14]. Firstly, the trials weren’t long enough with many participants not reaching the endpoint. Additionally, some patients on placebo discovered how they weren’t getting the drug, thus compromising the results of the control group [15].

**The Freedom of Choice Ought to Be Maximized**

Building on stated facts, it is clear why some patients and experts support FDA’s decision. They argue how having access to aducanumab increases the treatment options. Additionally, that allows patients to decide what they and their families believe is the most suited and beneficial for them. Therefore, aducanumab provides patients with a choice they haven’t had before: the possibility to finally stop the AD’s progression.

Additionally, some members of the scientific community believe that to determine the efficiency of aducanumab, it has to undergo this accelerated pathway. Specifically,
experts claim that the clinical trials weren’t conducted efficiently regarding placebo groups, and therefore the drug should be let on the market to see its efficiency in the real world. If Biogen shows the benefit of aducanumab, that information could save lives in the future. Hence, accelerated approval is justified due to the possibility of maximizing the autonomy of future and current patients. Dr Patrizia Cavazzoni, director of the FDA’s Center for Drug Evaluation and Research stated that “…we have learned from the fight against cancer, the accelerated approval pathway can bring therapies to patients faster while spurring more research and innovation [8].”

Disadvantages of Aducanumab

On the other hand, it could be argued that it is morally culpable to utilize individuals as a means to an end. Crucially, giving patients a glimmer of hope, while aducanumab hasn’t yet been ascertained as efficient, could be devastating for them. For example, patients’ families could encourage them to undergo aducanumab treatment as opposed to undergoing symptomatic therapies only to, later on, find out that aducanumab hasn’t cured their AD.

Importantly, patients who undergo symptomatic therapies understand that their condition cannot be improved, but their cognitive abilities won’t drastically decline while the effect of the drugs works. So one very important question arises. Is it ethical to provide patients with a drug option that isn’t yet proven to be effective and safe, knowing that this opportunity sounds very alluring and thus gives hope to the sick? Some people believe that exploiting people who paid for their treatment a lot, hoping to see promised results, harms their dignity.

Conclusion

All things considered, I would still argue that irrespective of possible risk, the FDA’s decision was justified. Future generations can only benefit from extensive research which has to be done in the real world if the results are to represent real consequences. Patients suffering from AD aren’t provided with sufficient options in the status quo. In conclusion, it’s important to note that to protect the human dignity of a patient, they firstly need an option that could potentially preserve it. Thus, having more options is a prerequisite for future autonomy.
References


If You Give a Man a New Head: The Ethical Boundaries of Neurotransplantation

Benjamin Cohen

Abstract

With advances in neuroscience and surgical technology, the once-impossible prospect of a head transplant has rapidly edged closer to reality, driven by a recent flurry of media attention. However, it is essential to examine head transplantation from a critical, nuanced perspective and account for the significant research gaps through a synthesis of bioethical concerns and recent studies, which challenge the key principle of informed consent, call into question the procedure’s impacts on a patient’s psychological state and sense of self, dispute the operation’s application of resources, and pose legal confusion. While a head transplant is a promising treatment for conditions impacting the entire body, the salient ethical and legal dilemmas must be resolved before the procedure is applied in a human subject.

“Residency Match Day” for the Brain

In a hospital near you, a patient is rapidly slipping into organ failure, and prospects of recovery appear slim. As a last-ditch effort, a multidisciplinary surgical team finds a brain-dead motorcycle crash victim and emergently severs both patients’ spinal cords with an extremely thin blade. Racing against the clock of dying neurons and blood loss, the surgeons reattach the organ failure patient’s head to the new body with a cell-fusing polymer and reconnect the blood vessels to restore the oxygen supply. Saved from certain death, the patient regains movement within weeks and returns to normal life. Could this cutting-edge procedure, which goes beyond a single organ transplant to an entire part of a human body with its resident infrastructure, be the answer for patients with intact brains – or even a step towards human immortality?
Technical Background

Head transplantation trials date back to the early 1900s, with the first success taking place in dogs, although the procedure has not been performed in humans as of yet [4]. Despite vast promise fueled by over 100 years of research, a head transplant is fraught with technical hurdles and pressing ethical and legal dilemmas. Removing the recipient’s head brings the significant challenge of severing the spinal cord, leading to nearly certain paralysis [4]. A successful head transplant also requires connecting the head’s vascular system to the new body and preventing neural death from lack of oxygen while the head is disembodied. However, current research offers apparent solutions to these problems of spinal function and blood supply. Italian neurosurgeon Sergio Canavero proposed a head transplant protocol that uses a nanoscale blade to minimize spinal damage, reattaches the spinal cord with a polyethylene glycol pump – a “fusogen” that rebuilds neuron membranes – and employs electrical stimulation to speed recovery [2][9]. A group of Chinese neurosurgeons led by Xiaoping Ren applied the new method of “cross-circulation,” cutting only one pair of the head’s blood vessels instead of both to maintain uninterrupted blood supply to the donor brain in a transplant between two rats. Further improvements involved adding a third rat and mechanical pumps for blood supply to the donor head, leading to greater survival [8][10].

Figure 1. Two-headed rat from Xiaoping Ren’s head transplant study [11]

Ready for Humans?

Amidst the surgical technicalities, head transplant surgery remains tenuous from a neuroethical and legal perspective. With surgical advances limited to animal models, are theoretical speculations and scanty data sufficient to be applied to humans? Though media attention directed at head transplantation paints a picture of a well-studied protocol, the research belies the impression. While a significant step forward, Xiaoping Ren’s blood vessel reconnection studies are limited to rat models, which are euthanized after a short duration or display...
unfavorable survival rates, and the membrane-rebuilding fusogen has only been evaluated in one small human trial of spinal cord transplant to treat injuries, with modest improvements noted [7][8][10]. Key technical details of potential complications are yet to be explored through experiments – to prevent the body from rejecting the head, immune-suppressing medications would likely be necessary, which may cause unanticipated neurological side effects, while spinal damage resulting from the procedure could lead to “central pain,” leaving a head transplant recipient in chronic full-body agony [1] [6]. The lack of comprehensive evaluation of the protocol renders informed consent for a head transplant impossible, as prospective patients, desperate for a lifesaving procedure, are left in the dark regarding the risks and outcomes, allowing overzealous investigators to exploit the harvesting of human subjects, especially in third-world countries with corrupt or underdeveloped systems.

Is a Brain a Self?

Moving beyond the ethical concern of technical readiness, a head transplant operation implies the naive viewpoint that the brain is wholly responsible for the self, and that the body is a mere appendage that can be swapped while maintaining personal identity. However, this perspective is misguided – a head transplant would entail a complete switch of the microbiome and enteric nervous system, which could subtly and unpredictably impact the recipient’s behavior, personality, and sense of self. Around 95% of the body’s serotonin is synthesized by intestinal endocrine cells, with many other neurochemicals produced by intestinal bacteria; the enteric nervous system has a bidirectional link to the brain, as evidenced by the ability of microbiome changes to impact both brain and gut functions [13] [14]. Furthermore, it is essential to consider “psychological rejection” of a head transplant; despite cognitive and philosophical theories, it remains impossible to predict how a patient would react to the perception of being newly embodied, or the potential struggle to integrate the acquired body into the sense of self, until the procedure takes place [11].

Do the Means Justify the Ends?

As a head transplant requires monumental coordination of multiple surgeons and millions of dollars, it is crucial to recognize concerns over resource allocation due to the highly experimental nature of the operation and its potential to cause death and waste lifesaving donor organs [12, 15]. Even if the spinal reconnection protocol is mastered, ethical quandaries on whether to treat large populations with spinal cord injuries or a single person, and who gets lifesaving head transplants would emerge. Due to the massive investments of capital and human resources, the procedure has the potential to serve the socioeconomically advantaged, becoming a flashy
publicity stunt and a means to achieve immortality by replacing failing bodies [5]. Head transplantation stands so far ahead of its time that the legal and regulatory framework has not caught up, potentially classifying the procedure as homicide due to the surgical decapitation involved, and making it difficult to define the identity of the recipient, who would assume the donor’s fingerprints and genetic makeup, leading to a host of ethical and legal disputes [3][9][11][12]. In conclusion, while a head transplant holds tremendous promise in advancing our ability to treat daunting conditions that affect the entire body, further research, reflection, and regulation are necessary to assess the neuroethical, legal, and socioeconomic boundaries surrounding the procedure.

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Neurocriminology: An Ethical Review of Functional Magnetic Resonance Imaging in Neurolaw

Shalmali Rao

Abstract

Neurocriminology is a rising, yet controversial field that encompasses fMRI, a technique which evaluates neural activity to reveal information such as the state of mind of suspects and eyewitnesses. While fMRI can provide a more holistic and equitable view of criminology, critics warn against its potential misuse. This article reviews the benefits and drawbacks of neurocriminology by reviewing past criminal justice cases and research on fMRI to assert that neuroscience should be considered in court, while accounting for the necessary ethical guidelines.

Introduction: The Rising Prevalence of Neurocriminology

Many have heard of the 1981 assassination attempt on President Ronald Reagen, but few are aware of the final verdict given to the shooter, John Hinckley Jr. Despite being charged for shooting the President of the United States, Hinckley was pronounced not guilty. The reason behind this unexpected verdict was neuroscience. A scan revealed that Hinckley’s atrophied brain had signs of schizophrenia, so the shooter was acquitted on the grounds of insanity [1].

In 2005, Grady Nelson was convicted for murdering his wife and stabbing his two children. When a brain scan disclosed structural abnormalities indicating his predisposition to violent behavior, Nelson avoided the death penalty and was sentenced to life in prison instead. Jurors acknowledged that neuroscientific evidence was the deciding factor [2].
These cases are just two among many that illustrate the immense consequence of neuroscience in law—neuroscience was the coin that determined the result of the case, the fence between life and death for the defendant. Naturally, these cases were controversial landmarks in the rising field of neurocriminology (the intersection of neuroscience, biology, and crime), raising the following question: Should neuroscience be considered in court?

As of the Bureau of Justice Statistics’ 2015 census, the US criminal justice system imprisoned almost 7 million people, and over 50% were estimated to have mental health complications [3]. Neuroscientific evidence was not always a consideration, but it would have held relevance when viewing such cases holistically. In order to increase the accuracy and equity of criminal case verdicts, it would be beneficial for an advance in neurocriminology—but to what extent? Should neuroscience act as exculpatory evidence, as it was in the Hinckley Trial and Florida v. Grady Nelson cases, or should it be supplementary information?

**Functional Magnetic Resonance Imaging (fMRI)**

The first step to answering these questions is understanding the potential of functional magnetic resonance imaging (fMRI). This technique produces activation maps identifying active regions of the brain during various actions (Figure 1). Since active areas consume more oxygen and require greater blood flow, fMRI perceives alterations in blood flow and oxygenation to analyze neural activity [4].

![fMRI and Activation Map](image)

*Figure 1. Diagram representing a functional magnetic resonance imaging (fMRI) machine (left) and the produced activation map (right). In the activation map, areas of the brain highlighted in yellow/orange represent active regions [4].*

In neurocriminology, fMRI can predict the state of mind that may have influenced criminal activity. Abnormalities in the brain can severely alter behavior, resulting in
unprecedented, and even violent, actions [5]. If brain structure pre-determines personality, should criminals be held accountable for their actions? In severe criminal cases, it is understandable to expect the offender to receive a penalty comparable to the crime, but when the case involves a compromised state of mind, a note of caution is crucial. It could be unjust to penalize someone for something out of their conscious control. Therefore, fMRI can provide a comprehensive perspective in such instances, leading to fair decisions.

Additional avenues fMRI could contribute to now or in the future include conducting more accurate lie-detector tests, recreating images from brains, predicting the likelihood of committing a crime, and determining the reliability of eyewitness memory [1]. Yet the more doors that fMRI opens, the more concerns that critics raise.

For instance, while certain fMRI research shows high accuracy, other studies have observed false positives; in one case, brain scans seemed to indicate that dead salmon were thinking [6]. In addition, the possibility of “brain overclaim syndrome” is inevitable; this involves drawing fallacious correlations between neuroscience and criminal behavior to vindicate suspects. Critics therefore oppose the way neurocriminology could be misused, not only to wrongly acquit criminals, but also to violate privacy and human rights [5].

Conclusions: The Role of fMRI in Neurocriminology

These ethical concerns are valid, increasing the need for strict guidelines regarding neurocriminology. Ultimately, it is not what fMRI can accomplish, but how it is implemented that determines its morality. fMRI’s predictive scans should identify recidivism to help rehabilitation efforts, not to penalize potential criminals for possible future crimes; its image recreation and lie-detecting abilities should validate eyewitness testimonies, not violate privacy; and its place in the courtroom should be to corroborate findings, not to solely influence the verdict.

Additionally, free will cannot be rejected, or neurobiology would either completely excuse criminals or unjustly penalize them for potential future crimes, such as in the science fiction movie Minority Report. By factoring in free will, but also accounting for the implications of neuroscience in extreme cases (such as brain atrophy), fMRI can be effectuated equitably [6].

This ethical exploration opened with a review of two cases in which the incorporation of neuroscience dramatically altered the verdict—but how has the absence of neuroscience impacted criminal justice cases? In 1983, Carlos DeLuna was wrongfully convicted of homicide,
and despite a lack of physical evidence, an eyewitness testimony landed him the death penalty. After DeLuna’s execution, law professor James Leibman discovered DeLuna’s innocence, and the eyewitness admitted having a testimony certainty of only 50% [7]. If fMRI and its capabilities of validating eyewitness testimonies had been an option at the time, it might have prevented DeLuna’s undeserved death. In fact, at least 189 people on death row have been exonerated since 1973 in the US, and around 75% of exonerations involved false eyewitness identification [8]. If neuroscience has the potential to prevent erroneous convictions in the future, then it should undoubtedly be a consideration in court. Of course, additional research on fMRI is imperative, but by being conscious of the margin of error and brain overclaim syndrome, adhering to principles of free will, and following ethical guidelines, fMRI can make criminology more open-minded and save countless lives.

References


Morality versus Entropy: Can Humans Be Held Morally Responsible?

Ariya Patel

Abstract

The rise of consciousness studies as a topic of neuroscience has led neuroscientists to theorize that the purpose of human consciousness is merely to increase entropy in the universe, directing all actions towards the building of chaos. As human consciousness is perceived as a mechanism of entropy, the longstanding belief that humans are morally responsible for their decisions is threatened. This article confronts the notion that consciousness, as a byproduct of entropy, absolves humans of moral responsibility on the basis of the existence of neuromoral functions in the brain and the inconclusive nature of conscious control studies. Through various studies explored in this essay, the intersectional ideas of physics, philosophy, neuroscience, and ethics surrounding consciousness are expressed to solidify the ethical belief in moral responsibility. In the long run, although many neuroscientists believe they have reached a definitive of understanding human consciousness, the conflict of these definitives leaves the quandary of moral responsibility to ethical interpretation.

The Conscious Mind

Consciousness - the state of awareness - has been attributed to scientific fields spanning from neuroscience to law, and recently to physics as well. Following hundreds of years of study and debate regarding the purpose and existence of consciousness, some scientists now speculate that the emergence of the conscious mind is the consequence of the brain's propulsion towards entropy - the measure of disorder or randomness in a system [2].

For reference, a study completed by scientists at the University of Toronto and
Paris Descartes University analyzed the brain waves of nine participants, seven of which were pre-diagnosed with epilepsy, in “conscious” and “unconscious” states. Utilizing electroencephalography (EEG) and magnetoencephalography (MEG) equipment, researchers recorded brain wave patterns to determine their entropy values. The study confirmed the lowest entropy occurred during the sleep state and seizure state, with decreasing entropy correlating to deeper sleep. In contrast, the highest value of entropy determined occurred during wakeful states [1].

In response to the results of this study, many now postulate the idea that humans cannot be held morally responsible for their decisions on account of only acting in agreement with the second law of thermodynamics; that all systems strive towards the increase of entropy. If human consciousness is guided towards entropy, often in violation of morality, then humans are not subject to upholding moral responsibility [3][1]. The accepted notion that humans do not possess conscious control and therefore should not be morally responsible for their actions leaves many philosophers and neuroscientists fearing the ethical outcomes.

Despite the study’s assumed conclusion, no definitive answer as to whether conscious control is dictated by entropy can be confirmed by neuroscientists. In contrast, opposing theories suggest the purpose of the conscious mind lies in Darwin’s evolution and the survival of the organism [4]. Thus, as the question of conscious control remains an open-ended question, humans cannot be absolved of their moral responsibility.

The Neuromorality of Moral Responsibility

In opposition to the belief that human consciousness is directed towards entropy, neurobiologists propound that a neural basis for morality exists. The concept of neural-based moral behavior and judgment has developed into a branch of study known as neuromorality - where neuroscientists analyze the connection between morality and neuronal functions [3][5].
For example, multiple studies conducted by neuroscientists propose that a “neuromoral” network in the brain controls moral decisions. Presenting participants with moral dilemmas, researchers recorded neural activity in different regions of the brain using functional magnetic resonance imaging (fMRI) [7]. When compared to other regions of the brain, the ventromedial prefrontal cortex, ventrolateral prefrontal cortex, dorsolateral prefrontal cortex, orbitofrontal cortex, and amygdala displayed heightened neural activity; formulating the basis of a neuromoral network [5].

However, since morality remains a concept, not consisting of physical matter or able to be quantitatively measured, neuroscientists cannot verify its validity [8]. The inconclusive nature of the aforementioned studies leaves all notions of moral responsibility subject to humans open to ethical interpretation.

**Multiplicity in Perception**

In understanding the ethical debate of humanity’s vindication of moral responsibility, we must acknowledge that morality and a sense of moral responsibility are purely ethical [9]. The amorphous sense of consciousness and its connection to morality prevents any clear conclusions from being drawn. Morality and consciousness are also perceived differently by certain cultures, religions, and sociological groups, meaning that an individual’s experience with consciousness and moral responsibility will be uniquely distinct [6]. While exploring neuromorality and consciousness allows us to uncover more about the functions of the brain, moral responsibility continues to be a concept that cannot be solidified as an obligation of humans [3].

Furthermore, while biophysicists attribute the laws of thermodynamics to the functioning of consciousness, neuroscientists endeavor to explain its existence through examination of neuronal functions and activity. While both specialties provide explanations for moral
responsibility, neither is able to assert a singular conclusion [6]. Thus the study of neuroscience and other fields that explore moral responsibility can never deny or accept a sole answer as to whether humans should be held morally responsible.

**Inclusive Interpretation**

Although neuroscience has allowed for the continuous exploration behind the inner workings of moral responsibility, it is limited in its ability to explain the logical reasoning behind the existence of moral responsibility [10]. The duality of studies regarding moral responsibility upholds the indetermination surrounding consciousness and neuromorality [3]. Hence, moral responsibility is an ethical quandary to be sincerely questioned and explored through various approaches.

**References**


The Fragility of Identity: An Ethical Evaluation of Decoded Neurofeedback

Sudhi Chavadam

Abstract

As neuroscience continues to advance, neuroscientists will be able to peer into the personal minds of others. Not only will they be able to observe the modularities of the human mind for the sake of advancing mental healthcare, but will be able to modify said mind. Decoded Neurofeedback has begun to illuminate this road to discovering human identity and its modification. Although Decoded Neurofeedback (DecNef) holds numerous benefits for target demographics, it also provided several ethical implications. This article aims to evaluate both the benefits and potential implications of DecNef and to offer solutions to mitigate its abuse as DecNef becomes a widespread treatment for patients.

Human Identity

Human Identity remains to be of imperative importance, not just due to the fact it provides diversity amongst others, but also because it defines one’s character. In less broad terms, our identity is what allows us to be distinguished as more than just a human, and bestows our unique traits, personalities, and behaviors that define us.

Regardless of the precise composition of identity as garnered within the Nature vs Nurture debate, it can be said that one’s identity is shaped by our own experiences and can change as we accumulate more experiences [i]. In the vast amount of memories we have, the ones that truly impact our identity are the ones that have strong emotional attachment. Although all of us experience strong emotions when recalling certain memories, there are some experiences
that account experiences such as trauma and abuse which may lead to severe anxiety disorders such as PTSD due to the memory's emotional significance.

In order to lessen the burden of the emotional attachment that such patients face in regard to such traumatic memories, a novel method of therapy called Decoded Neurofeedback has been under development. Decoded Neurofeedback (DecNef) details a process where participants are tasked to “match” their neural activity with the same neural activity presented when recalling a painful stimulus from their past. Neural activity is monitored in real time through fMRI and the patients, unaware of the significance of the goal neural activity, receive awards such as cash as they succeed. Although the explanation as to why this therapy works is still not completely clear, patients have experienced numerous benefits such as fear reduction associated with traumatic experiences [2].

**The Potential of DecNef**

DecNef proves to hold a vast horizon of capabilities to better the lives of anxiety disorder patients. The most clinically tested group of patients through DecNef are those with Post Traumatic Stress Disorder (PTSD). The current most effective treatment for PTSD is exposure-based therapy, which requires patients to recall their traumatic stimuli. However, due to the aversive nature of re-exposure to such stimuli, many patients drop out of such therapy. [3].

In order to prevent aforementioned ethically ambiguous conscious re-exposure to traumatic stimuli, treatments such as DecNef come to be especially effective. A study conducted by Chiba et al. conducted a systematic review of DecNef based on the results of DecNef treatments upon 4 PTSD diagnosed patients. The patients were tasked to regulate their neural activity to unknowingly match the target trauma stimulus neural activity of “angry male faces”. The patients underwent 3 days of DecNef treatment, and were given eleven fMRI runs each day. Each fMRI run consisted of 15 trials, or chances to match their neural activity, with 20 seconds per each trial. After DecNef treatment, all 4 patients
exhibited a clinically significant reduction (10-point decrease) in scores on the Clinician-Administered PTSD scale for DSM-IV (CAPS-4), which represents PTSD severity. One patient no longer even met the PTSD score criteria [4].

**Quandary of DecNef Administration**

Having established the potential for DecNef as a treatment for patients suffering from anxiety disorders based on past experiences, there are yet 2 major ethical implications that arise when considering the expansion of DecNef as a widespread therapeutic treatment. First, in order for DecNef to actually work, patients must be unaware of the purpose of the treatment prior to receiving it. The second is the idea of neural data privacy and the consequences of its leakage.

Given that DecNef therapy requires the patients to be unaware of the purpose of the treatment, there are numerous implications that arise when it concerns the purpose and consent of treatment. Without proper clinical and ethical approval, patients may be subject to manipulation and long term identity changes as a result of memory modification [5]. Further, the majority of DecNef recipients are those who suffer from severe anxiety disorders. Some of these patients who may not be in the right state of mind at times to responsibly consent for treatment, would be at risk to be unethically treated. If such manipulation is then recognized by recipients, then we face the worse risk of increasing the severity of their anxiety.

Even if patients are not treated with manipulative intent, there are implications that arise due to personal information that is revealed as a result of DecNef treatment. When DecNef is administered, neural pathways that are associated with different areas such as food, love, money, and more are revealed [6]. The significance is that the patient’s unique experiences with such topics are revealed and as DecNef technology advances, inferences about one’s “First person subjective experiences” may be accumulated [7]. As a result, ill-intended access to such
authorized data may result in much larger implications such as identity theft which can be much more accurate, and thus dangerous, with the deeper secrets of the patient’s mind at stake.

A Hopeful Outlook

DecNef most certainly has areas in which it can improve the lives of those who sincerely suffer from severe anxiety disorders and trauma. However, as we see the treatment become more mainstream as an alternative to treatments such as exposure-based therapy, the aforementioned ethical implications gain a higher likelihood of occurrence. In order to prevent said implications such as manipulative memory modification and neural data privacy, there must be two major safeguards that protect those who receive treatment. DecNef should only be used for severe cases of patients who may not be able to handle the recurrence that occurs in exposure-based therapy. Otherwise, the risk of intended identity manipulation may become more common as those who truly don’t need treatment receive it. Finally, separate security measures must be put in place for the protection of extremely personal memory data that is inferred and accumulated from DecNef neural pathway observance. In all, DecNef exemplifies the impressive progress that neuroscience has made into treating the human mind. However, it must be particularly noted that the human mind itself must be protected within said process.

References


Analyzing the Ethical Use of Optogenetic Memory Modifications

Isha Mahadeshwar

Abstract

Optogenetics-based memory-modification techniques (MMTs) have the potential to revolutionize neurology and psychiatry when used in a controlled and mindful fashion. This article argues for the necessity of optogenetic-based therapeutics, as they are more fast-acting, safer, and more specific than pharmacological therapies. The effect of MMTs on an individual’s will to fight injustices and fulfill their moral duties are also discussed as possible societal side-effects of this technology. Accordingly, potential avenues for policy implementation are examined that show that with the correct regulatory measures, optogenetic memory modification is a fair and promising new therapeutic avenue.

Optogenetics in Psychiatry

Grace just started college, but she can’t seem to find the energy to go out with her friends or even go to her classes. Every day, she wakes up crippled by the memories of a car accident she lived through a couple months ago. Then, with the flip of a switch, the once isolated and hopeless teenager loses her anxiety. Slowly but surely, she begins going to school sports games, joins new clubs and even starts aceing her classes. It is as if Grace’s depression has been completely turned off. Fascinatingly, this occurrence is not far from reality. Optogenetics is a burgeoning field that allows scientists to activate and inhibit different neural circuits with the use of light, thereby enabling the selective modulation of neural pathways [1][2]. Through memory-modifying techniques (MMTs) via optogenetics, researchers are able to modify, manipulate and even erase parts...
of our hypothetical Grace’s memories, drastically improving her quality of life [2].

Some, however, are concerned by the long-term societal effects of this memory-modification method. Our society improves itself by trying to fix the issues that are experienced in our everyday lives. According to the argument, by removing or editing people’s memories, people will lose the motivation to enact systemic changes because they will have “forgotten” the mistreatments that they have endured and the source of their trauma [4]. In this work, we examine the effect of MMT implementation in two major contexts: criminality and social injustice advocacy. The concerns in these contexts only hold true if the technology is misused without adequate regulatory oversight. Why force individuals to position their mental health as a subordinate to the betterment of society, when there is a way to help both? With the correct policies and limitations in place, the use of optogenetics in the context of memory-modification is not only ethical, but _needed_ as an integral aspect of future medical therapies.

Current treatments for most psychiatric illnesses are too generalized and do not allow for the personalized treatment that is integral to effectively combat these ailments. In fact, the largest prolonged exposure therapy study for PTSD to date found that 50% of participants retained their diagnosis after treatment was complete [5]. Optogenetics has finally given hope to patients to potentially find a cure for their neurological ailments. These illnesses manifest themselves in patients for many different reasons, from epigenetic dispositions to biochemical imbalances. But, the manipulation of memories can counter all of these issues. It has been found that activating positive memories artificially is sufficient to suppress depression-like behaviors, and similar approaches can be taken to combat other psychiatric illnesses like anxiety and PTSD [6].

**Criminality & Moral Obligation**

It can be hard trying to decipher the line between self-care and moral obligation, but furtherance of this MMT technology has provided ways in which it can be used without obstructing the justice system. Imagine that you witness a terrorizing robbery occur, and you are the only one who saw the robber. Are you morally obligated to retain your memories and help bring the criminal in? The ability of optogenetic MMTs to precisely target and remove even well-consolidated memories allows us to erase memories without obstructing the progression of the criminal case. From a policy and judicial standpoint, the justice system can set a time after which witnesses can manipulate their memories. If an already manipulated memory is needed, there is also potential for this technology to reintroduce certain memories.
into the mind [7]. This allows for the removal and manipulation of memories in people without hindering the utility of witness accounts, all while still allowing them to fulfill their moral obligations in the context of criminal persecution.

**Individual vs. Society**

Additional systems can be put into effect that let individuals make decisions that help themselves without harming society. Recent global movements like #MeToo or #BlackLivesMatter stemmed from people connecting through their shared experiences and trauma and mobilizing en masse. As they joined together, individuals highlighted the issues in our current institutions and pushed to correct and rebuild the system. If these changemakers were to have erased or manipulated their memories, our society would never have progressed in the way that it did. This brings up the issue of negative composition effects: the consequences caused by the amalgamation of individual choices. While having one person erase their traumatic experience won’t have a major impact on society, if enough people decided to remove their memories of maltreatment this could help to preserve oppressive social relations and serve the interests of oppressors [4]. Here, once again, robust policy measures can alleviate these ethical quandaries. Before the administration of any memory modifications, a measure of how much a certain event is interfering with a patient’s everyday life must be assessed. Only the most severe cases - those in which individuals’ lives are significantly hampered by the illness - would be allowed to partake in this optogenetic therapy. Such phenotypic categorization has diagnostic precedent in the DSM-5. Additionally, any memories that are modified or erased need to be documented. These can then be used as anonymous motivators for people to turn to when trying to rebuild societal structures and systems.

According to the Kantian and liberal ideals of self-autonomy, everyone has the right to control themselves and their minds, including the memories inside of it [8]. But, if everyone in society were to practice full self-autonomy, the actions of one would interfere with the autonomy of another. Indeed, a pragmatic approach to supporting the ideals of self-autonomy when introducing a new technology like MMT is to set some limitations at an individual level via robust regulation commensurate with the powerful potential of this therapeutic method.

**Conclusion**

By having systems and guidelines in place to control the admissibility of memory-modifying optogenetics in different scenarios, we can create a community where this technology can be used in
an ethical yet powerful way. The speed, specificity, and effectiveness of optogenetic therapy make it a necessary tool in our arsenal to curing debilitating mental illness.

References


Evaluating the Mechanics and Ethics of Persuasion in the Attention Economy

Min Hyung Lee

Abstract
Increasing online social interactions and everyday technology use have opened way for the attention economy and a subsequent race for user attention. Yet ethical concerns rise as corporations deliberately have used psychological vulnerabilities and cognitive patterns in the interest of profit. This article explores the mechanism behind changing user behavior by describing the manipulation of brain function and activity before evaluating possible implications of such practices. The article then evaluates multiple viewpoints from corporate, user, and legislature. The double-edged nature of social networking and its complex business model calls for a joint effort between all three parties, a solution which may be the only practical and effective.

The Attention Economy

“Our biggest competitors are YouTube, Facebook and sleep,” declared Reed Hastings, the Chief Executive Officer of the video streaming service Netflix. Such a business model is a manifestation of the “attention economy” – a new system of economics emerging with the rise of online social networking [1]. Unlike traditional markets, the system approaches human attention - the cognitive ability to focus on a particular stimuli - as a commodity and treats information as supply. Subsequently, a “wealth of information” causes a “poverty of attention”; that is, the human brain is only capable of devoting its attention to one source at a time, so one can only consume a limited amount of information [2].

Time is limited throughout each 24-hour cycle, which prompts Netflix to capture as much of a user’s attention as much as possible - even if it necessitates taking away a user’s bedtime to show another episode of their favorite series. Such is only one example; while social networking
companies, such as Twitter, Instagram, TikTok, and Youtube, offer different experiences, they offer the same product - information - and their business model thus eventually routes back to the same objective: to win in the attention economy. In an industry which generates revenue through advertisers and film studios hoping to gain more customers and viewers for their movies, it is crucial that the companies sell as much of the product - user attention - to their clients for maximized revenue [3].

There are a variety of methods to control and retain human attention, although some are more effective than others. Research by Stanford professor B.J. Fogg demonstrates the seemingly simple mechanism behind changing human behavior through his behavior model B=MAP, where behavioral change is the convergence of Motivation (the desire to change one’s behavior), Ability (whether one is physically or mentally capable of changing the behavior), and Prompt (a trigger that elicits the behavioral change). Social networking companies have recognized its effectiveness and have designed their products in a way to capitalize on as much user attention as possible [4]. Yet the implications of such engineering has raised serious ethical concerns. Many raise questions as to whether it is proper for corporations to deliberately manipulate psychological vulnerabilities and have cited free will, misinformation and polarization, and worsening mental health as potential side effects.

**Intermittent Variable Rewards**

A notable example of keeping a user “hooked” is by manipulating the brain’s reward circuits through intermittent variable rewards, where a user continuously awaits a ‘reward’ - in this case, a notification, a new message, or a ‘like’ on a post - which comes at an unknown time. This can cause users to repeatedly check their phones to see if they have received something new, which, in turn, prompts them to spend more time. Upon receiving the notification or message, the user receives a large dopamine release. In a study concerning teenagers using social media at UCLA, the nucleus accumbens, a part of the brain’s reward circuit, was more active when someone had ‘liked’ the teenagers’ posts [5].
The popular photo-sharing app Instagram, in particular, has frequently practiced the variable-ratio reward schedule by delaying notifications about ‘likes’ on one’s post to later release them in one ‘burst.’ The subsequent flooding of new stimuli elicits a stronger dopamine rush and also combats tolerance levels that strengthen upon sending smaller stimuli [5]. Technology ethicists argue that such techniques prey on the psychological need for social validation; we often want to be reflected positively by society, and likes, comments, and messages are often an effective outlet. The manipulation of dopamine releases may render one susceptible to addiction: consider brain scans of those addicted to social media, which have shown similar structural changes in regions controlling emotions, attention and decision making [6].

Ethicists also fault its potential implications on minors. Brian regions concerning emotion and reward - including the nucleus accumbens - are more sensitive to stimuli for adolescents who are yet to fully develop their cognitive functions. Dr. Frances Jensen of Children’s Hospital Boston argues there can be “change[s] [to] the trajectory of brain development” upon the manipulation of neurochemicals [7]. Excessive social media usage has also frequently been linked to increases in depressive symptoms and suicide rates for children, likely a byproduct of the small-scale, but still impactful, withdrawal states following dopamine releases.

**Conclusion: Who is to Blame?**

The attention economy remains multifaceted. It is impractical to argue for the destruction of social networking, nor is it justified: online social platforms are also applauded for facilitating more effective communication and providing improved access to new social connections. It is also improper to call for a complete redesign of their products; such would be at a direct conflict of interest with their business model.
One can further argue that the fault lies in the users - that it is their responsibility to use technology in moderation. Yet it must be clear that awareness does not imply successful action. That is, having a sufficient understanding of the psychological vulnerabilities one is subject to does not necessarily prevent one from being successfully manipulated by such vulnerabilities. Such can certainly be said for minors, who have significantly less control over psychological impulses and are much more prone to addiction.

Avoiding the potential negative outcomes of the attention economy is thus only possible through a collective effect from corporate, user, and public policy. Corporates must ensure that data collection, product design, and persuasive technology are being used responsibly; users should educate themselves on the implications of social networking; legislature should draw causal relationships between citizen health and tech usage and take action accordingly through restrictive measures.

References


The Fault in Our Genes: A Call For Enhanced Legal Protection of Genetic Information

Ai Ni Einez Wu

Abstract
As DNA technology becomes more advanced in recent decades, the field of behavioral genomics has made vast advancements in its findings on how genetics influences individuals and this information has begun to be used for a wide variety of purposes. The federal use of behavioural genomics and its potential to create discrimination raise concerns over the associated protection laws of genetic information in the United States. As behavioral genetics become more prominent, the legal code around the protection of genetic information should be reviewed and reinforced further.

The Power of Behavioral Genomics

Behavioral genomics, or behavioral genetics, is defined as “the study of the relationship between the genetic composition of an organism and its behavior” by Merriam Webster [1]. Proposed by Eric Turkheimer in 2000 are the three laws of behavioral genetics: 1. “All human behavioral traits are heritable”; 2. “The effect of being raised in the same family is smaller than the effect of the genes”; 3) “A substantial portion of the variation in complex human behavioral traits is not accounted for by the effects of genes or families” [2]. Studies in this field closely connect to technological advancements in the medical field, and due to the recent boom in genetic technologies, more findings were yielded.

One prime research focus in behavioral genetics is the heritability of intelligence. Summarized by Bouchard and McGue in 1981, their meta-analysis of 111 intelligence vs. family resemblance studies yielded a heritability coefficient of around 54%, which is high compared to
other factors. They also observed the general trend of gene similarities between two family members positively correlating with their average IQ correlations [3]. Thirty-six years later, Sniekers et al conducted a meta-analysis upon numerous genome-wide association studies that found 336 single nucleotide polymorphisms in 18 genomic loci related to intelligence, implicating 22 genes mainly expressed in brain tissues and cell development [4]. Though not yet completely understood, these prevailing researches set the foundation for the search for the exact genetic sequences of intelligence in the future.

Another focus in behavioral genetics is the heritability of mental illnesses. One study on such a topic is the 3-generations study conducted by Weissman et al in 2005 looking at the heritability of depression. Their results reinforced the idea of a genetic factor to depression as children from families with generational diagnoses of depression have higher risks of obtaining mental illnesses [5]. Fourteen years later, Petterson et al analyzed data of 4,408,646 Swedish full and half-siblings and the genetic data of 333,748 cases and controls. They found moderate to high heritability for alcohol dependence, anorexia nervosa, attention-deficit/hyperactivity disorder, autism spectrum disorder, bipolar disorder, major depressive disorder, obsessive-compulsive disorder, and schizophrenia [6]. Though the study also mentions the play of environmental factors on the likelihood of developing these disorders, the genetic correlation between them cannot be disregarded.

The above example studies and findings show how scientists can create relative approximations of intelligence and vulnerability to mental disorders based on genetics alone. This revelation is powerful in detecting and prescribing early preventative measures and emphasizing social justice for those differing in predisposed intelligence levels, but also has the potential to be abused as a tool of discrimination.

Medical Laws on Health Information Privacy in the United States

The main medical laws protecting one’s genetic information in the United States are the Health Insurance Portability and Accountability Act of 1996 (HIPAA) and the Genetic Information Nondiscrimination Act (GINA).

HIPAA are federal regulations on medical information that establishes criteria for disclosing personal health information, individual rights regarding health information, security standards for electronic patient information, and creates a common format and data structure for electronic health information regarding covered entities (healthcare providers, health plans,
healthcare clearinghouses) [7] [8]. Note that HIPAA was made with priorities to ensure the flow of information within the medical field and doesn’t have power over non-covered entities such as healthcare apps, personal DNA tests such as 23AndMe, etc. Also, the HIPAA privacy rule regarding the de-identification of health information does not include genetic information [7] [9].

GINA prohibits group health and Medicare supplemental plans from using genetic information to discriminate against an individual’s insurance chances and events, use of genetic information to discriminate in employment decisions and restricts employers from requesting or buying genetic information of employees [10]. However, it does not cover life, disability, or long-term care plans and does not apply to companies with 15 or fewer employees [11].

It’s important to know that the above medical laws only cover genetic information of someone who has not “manifested” certain diseases, and if genetic markers of certain traits or diseases are under the vague definition of manifestation, that information is not subject to protection under GINA or HIPAA [10].

These pre-established regulations hold inherent detrimental loopholes. Some states require individuals to sign an overly encompassing release that allows full access to their health information for employment or when applying for long-term plans, thereby maneuvering past the legal protection of this information and raising a huge privacy concern. In law enforcement, DNA collection does not require a warrant and DNA in federal DNA profile databases can be used without regard to medical privacy laws [12]. Combined with behavioural genetics in criminal profiling, this creates a potential source of discrimination against people with genetic disposition. All these instances suggest a need for modification in our current medical laws to strengthen protection around our genetic information.
Current Proposed Amendments and Evaluation

The current list of new HIPAA amendments and proposals of amendment tend to grant covered entities more freedom in accessing and sharing protected health information (PHI) rather than adding restrictions to their accessibility. There are no amendments on genetic information or PHI regarding non-covered entities nor does it clarify health information in HIPAA to include genetic information [13]. These observations follow logical sense as the currently covered and noncovered entities would likely not approve of new regulations that limit their freedom. It would depend on the advocacy of people to whom this information belongs for any serious amendments to genetic information protection to take place.

References


The Adolescent Brain: Exploring the Validity of Juvenile Law

Sunga Kim

Abstract

As science started to unveil the significant discrepancy between teenagers and adults’ brains, doubt about juvenile laws have reached its culmination in the United States. Although laws regarding juvenile justice have become less radical since the ban on the death penalty, the brutality remains evident today; juvenile life without parole, which incarcerates children behind the bars until their very last breath of air, has overtaken the viciousness of the death penalty, sentencing thousands of children in the US alone. This article challenges the austerity of the current juvenile laws on two major bases: the different structures of the brain of adults and teenagers and the impacts of personal background on the behaviors of children.

Introduction

On February 28, 2005, 71 juvenile offenders were awaiting their death row [1]. Since then, the death penalty and the sentencing of life without parole for juveniles have been challenged by the Supreme Court; the death penalty has been regarded as unlawful, while the sentencing of life without parole has been outlawed in...
some states across the United States.

The court has found these punishments as unconstitutional under the eighth amendment, which prohibits cruel and unusual punishment. As psychology and neuroscience started to disclose that the underdeveloped brain drives teenagers to make decisions against their free-will, doubts on juvenile laws are increasing dramatically.

The Different Structure of the Brain of Adults and Teenagers

The fundamental explanation behind the need for changes in juvenile laws includes the difference in the brain of adolescents compared to that of adults. The court asserted that “because of their disabilities in areas of reasoning, judgment, and control of their impulses, [adolescents] do not act with a level of moral culpability that characterizes the more serious adult criminal conduct [3].” Because teenagers’ brains are still underdeveloped, the court found it unreasonable to weigh the crime of teenagers on the same scale as adults. Numerous neuroscientific studies have shown that teenagers display a different cognitive capacity than adults; their frontal lobe, which controls risk and judgment, develops fully at the age of around 25, remaining underdeveloped during adolescence [4]. Instead, a region of the brain responsible for spontaneous behaviors involving aggravated emotions, namely the amygdala, develops early around adolescence [5]. Due to the imbalance in the development of the brain, teenagers’ emotions typically dictate their rationality, acting impulsively and without contemplation.

Moreover, advanced brain imaging discovered a significant distinction in the connection between the brain cells between teenagers and adults, which is responsible for the efficiency and effectiveness of brain pathways [5]. As children reach adulthood, their brain pathways develop from the back of the brain, gradually reaching the front by adulthood; thus, the prefrontal cortex that is located in the front matures the latest, conveying that children lack judgment and cognition [6]. In all, stimulated by the inharmonious development of brain regions, most argue that crimes committed in adolescence should not be regarded as an act of free will, lacking the volition to obey the social and legal contract.

The Impact of Personal Background on Behaviors of Children

Furthermore, the arbitrary growing environment of children plays a dependent factor in delinquency, prompted by child abuse, poverty, and neglect. In particular, studies have proven that there is a distinct correlation between the inadequate growing environment and the crimes
committed by children, having 78% of juvenile delinquents coming from violent homes [7]. Detrimental experiences during childhood induce a spectrum of behavior changes; these include antisocial personality disorder, anxiety, and post-traumatic disorder. Although these changes do not always entail violence and crimes, children of unfavorable growing conditions tend to rely on drugs and alcohol to overcome these behavioral disorders, eventually leading to violence. This leads to the passing down of violence and delinquency from parents to children, engendered by their traumatizing experience. Even though these behavioral problems can arise at any age, teenagers, especially, should not be held legally responsible for such adversarial environmental conditions.

In addition, the lack of parental involvement leads to social isolation and bewilderment for teenagers, which amplifies the inhumane behaviors. A study done with mice in their early period found that oligodendrocytes, brain cells that envelop neurons, did not manage to develop fully under isolated conditions [8]. While typical oligodendrocytes consist of long, intricate axons that resemble roots under the soil, the oligodendrocytes of isolated mice had short and simple axons that hindered communications inside the brain [8]. Damage to the oligodendrocytes, ultimately, provokes anxiety-like and anti-social behaviors, which are common attributes reflected in juvenile delinquents [9].

Lastly, studies have displayed strong correlations between children’s brains and their environment. Interestingly, children from a low socioeconomic background consisted of a smaller surface area of the neocortex that determines their judgment and perception, presumably caused by the lack of education and negative psychological experience [10]. Thus, external environmental conditions of children, having been predetermined by chance, contribute hugely to the behavioral aspects of the brain that exacerbate violent actions; stranded from the guidance of adults, are the struggles of children to survive in their bleak circumstances truly an act of free will?

**Conclusion**

Day by day, innocent individuals suffer devastatingly from the crimes committed by juveniles. Age, therefore, should certainly not justify the unforgivable acts of juveniles; however, whether or not they were solely responsible for their actions is a different question by nature. The classic view of criminology defines crime as a “free-will decision to make a criminal choice” [11]. What may appear to be a voluntary choice of action might be an accumulation of internal and external factors entangled together, including the intrinsically different formation of the brain between adults and teenagers and the arbitrary socioeconomic environment. Thus, a legal
punishment based utterly upon their crime would leave the juveniles neglected and suspended from the true definition of justice. The main purpose of the juvenile justice system, which presents significant differences from that of adults, is to support rehabilitation and reintegration into society. Some level of extenuation and justification should be applied, preventing them from being caught up in their childhood forever.

The current legal system is based upon justice and philosophy; a notion that leaves room for doubt based on individuals’ perspectives and opinions. Yet, as science and technology started to unravel the obscurity of the conventional legal system, a call for rational, logical decisions is arising. In particular, neuroscience and psychology that unveils the brain and mind behind the equivocal mask of the criminals seem to act as the determining factor of the dubious legal system that has, until now, relied too heavily on morality and philosophy. Although there are specific ethical issues that should be considered, further use of neuroscience and neuroimaging in investigation and trial should lead to fair and accurate decisions, bringing out true justice to all.

References


The Criminal Investigation of Neuroethics: The True Culprit behind Dissociative Identity Disorder

Nayeon (Rachel) Lee

Abstract
In light of investigating cases that involve defendants with dissociative identity disorder (DID), there are two main issues that arise: establishing liability to a specific culprit and determining an appropriate sentence. As modern science—to this day—reveals little about DID, the court still remains unclear whether the host or its alters should be liable for the crime in question. The judicial system has often forsaken fair trials and the convict’s capability to rehabilitate. Yet, a mere incarceration of mentally-inept defendants is not the key to the solution. To prevent further crimes committed by mentally unstable defendants and to conduct fair trials, the court must provide a clear definition of DID in the context of insanity defense and appropriate medical treatments. Ultimately, the court must work assiduously to establish social order by properly detecting who is at fault at the heart of the crime.

Introduction

For the first time in the court of law, medical professionals were at a crossroads. In 1977, Billy Milligan was convicted for nine counts of kidnap, rape, and robbery of women in the state of Ohio. However, during the arduous court proceedings, Milligan passionately denied his involvement in such a horrifying offense. Instead, he attributed the true culprit to Raegan and Adalana, two of the twenty-four distinct alternative personalities living within him [1]. Since the court had never dealt with cases on dissociative identity disorder (DID), the general public and the plaintiff challenged its legitimacy.
During the controversy, Milligan’s lawyer asserted that the alters had ultimate control over Milligan’s actions, and therefore Milligan could not be held criminally responsible for the heinous crimes. In particular, Milligan’s long history of physical and sexual abuse from his stepfather as a child was cited as a leading cause for the variety of psychiatric disorders Milligan suffered [1]. To bring credibility to Milligan’s defense, a total of 9 reliable witness testimonies and a series of psychoanalysis were conducted. Finally, in 1978, Milligan was acquitted by the judge for insanity. Yet, as many experts—to this day—argue about the validity of DID as a legal defense, the ethical dilemma still stands: does DID excuse the host of the criminal liability for the alter’s actions?

**Ambiguous Stance of Court on DID**

Currently, the court’s view on crimes committed by the DID convicts are as follows: If the host personality is unaware or suppressed by the alter during crime, the host is not guilty. Yet, if the host personality is aware and has control over the alter during crime, the host is guilty [2]. Nevertheless, the roughly defined scope of liability almost always skews in favor of the plaintiff—considering less than a quarter of insanity pleas as legitimate and admissible evidence in the court of law [3].

In the case of West Virginia vs. Carl E. Lockhart, the recent view of court is clearly shown: Despite the similarity of crimes between Milligan and Lockhart—sexually assaulting female victims—the court refused Lockhart’s DID as a part of his defense. Like Miligan, Lockhart had suffered from a long history of multiple personality disorder amongst other psychiatric problems. Furthermore, these claims were substantiated by Dr. Coffey and Dr. Scwabe who asserted Lockhart was not criminally liable due to his severe mental conditions. Yet, despite multiple professional testimonies, the court challenged Lockhart’s insanity defense and imprisoned him.

The seemingly inconsistent ruling behind DID convictions is likely due to obscure sentencing guidelines. Currently, the prosecutor is responsible for producing sufficient evidence which best represents the defendant’s mental state [4]. After weighing in all the evidence, the court makes the final decision on whether the defendant is liable for the crime. However, the court’s view
on DID criminals is that mental illness solely does not excuse defendants from taking accountability for their crimes. Consequently, despite numerous studies that support alarmingly high correlation between psychiatric illness and criminal capabilities, miscarriage of justice continue [5]: mentally-ill defendants such as Cecil Clayton who voluntarily checked-in to psychiatric ward in fear of his own violence and Andrew Brenan, a veteran who severely suffered from PTSD are put on death row every year [6][7].

Unfortunately, convicts rarely receive appropriate medical treatment early on to alleviate their uncontrollable impulses and aggression–resulting in a vicious cycle of progressively more grave crimes. The current legal system is based on a one-size-fit-all approach in which illnesses such as DID are frequently ignored for the sake of ease during court proceedings.

**Clear Establishment of Liability and Development of DID Medical Treatment**

To ethically approach criminal cases that involve mentally-ill individuals, a set boundary of liability and appropriate medical treatments must be established. In light of DID convictions, courts must limit instances where defendants’ pleas are wrongly denied or accepted. These measures are essential to protect citizens from further danger and provide rehabilitation opportunities for the sufferer.

While courts cannot justly imprison the host for its alter’s crime, merely releasing the host personality poses risks–especially the possibility of recurring criminal offenses. Therefore, the priority is not about whether to incarcerate the person in question but providing a proper medical treatment to prevent further damage. The court must break the perception that seeking treatment in a medical facility is far better than imprisonment as both cases–in many times–can be a life sentence with 24/7 monitoring. Hence, the court must consider the long-term consequences of the ruling–the future criminal implications and likelihood of rehabilitation of the convicts, rather than seeking an immediate incarceration.

With respect to the issue of DID convicts, modern medicine and scientists must work assiduously to develop a strict system of proper psychoanalysis to determine whether the convict is truly suffering from a mental disorder or is taking advantage of insanity defense. Furthermore, the government should allocate more funding in research of DID, as it often stems from trauma that is highly correlated to crime rates. In fact, people with a history of abuse are–4.2 times for men and 27.5 times for women—more likely to commit crimes than normal people [8]. Consequently, the research should prioritize the impact of DID on human behaviors and early stage remedies, which
will significantly contribute towards reducing subsequent crimes and providing appropriate medical treatments.

**Conclusion: Redefining the Insanity Defense**

Despite 10.7% of the global population suffering from varying degrees of mental illnesses, less than a quarter of insanity defenses are currently accepted in court [9]. As a result, most insanity defense cases receive little-to-no consideration. Understanding that mental illness with DID often serves as the prime instigator for a crime, the judicial system must re-balance the incarceration of dangerous criminals with treatment of mentally-ill patients. Ultimately, the court must accept its responsibility in the provision of establishing a clearer definition on DID and firm guidelines on when insanity defense should be given to inaugurate renewed social order and justice.
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