

Neurolaw on Hold

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A major car accident left a sixteen-year-old high school choir member and soccer player, Christopher Tiegreen, with traumatic head injuries and landed him in a month long coma. The accident severely damaged his frontal lobe and sheared a portion of his brain stem. When Tiegreen emerged from his coma, the formerly friendly teenager transformed into an irate, hostile, violent individual towards his mother, family members, and rehab staff. On September 11, 2009 Tiegreen escaped a treatment facility where he was to be held under twenty-four hour supervision, and attacked a young woman holding her infant son. According to journalist Kevin Davis in his article *Brain Trials: Neuroscience is Taking a Stand in the Courtroom*, Tiegreen was charged with: "aggravated assault, criminal attempt to commit a felony, false imprisonment, battery, sexual battery and cruelty to a child in the third degree" (Davis). Tiegreen's predicament provokes the question that: since Tiegreen experienced severe brain damage to his prefrontal cortex and brain stem—regions associated with decision making and impulse control—can evidence provided by a neurologist defuse his culpability and alleviate his prison sentence? This is a question that relates directly to the concept of neurolaw and its authority in the judicial court system.

Prior to the introduction of neuroscience, people believed that human beings had complete control over their actions. However, the progression of neuroscience aims to assign a locus for human behavior to a physical region of the brain; therefore the findings of neuroscience contradict the notion that human behavior can be controlled and instead suggest that the brain structure and biochemistry shape the actions and impulses of human beings. Introducing neurolaw into the judicial court systems would radically challenge and alter the notions of intentionality and culpability. The law operates under the assumption that all adults -who are not insane or under the influence of either drugs or alcohol- are capable of making rational decisions and exhibiting self-control, whereas neuroscience suggests that the above qualifications are not sufficient determinants. Instead, neuroscience proposes that all human beings are at the mercy of their brain biochemistry, a concept revolutionizing the application of law. The issue then becomes: can neuroscience hold authority in judicial rulings as neurolaw? In this paper I will argue that: while the findings of neuroscience are important in facilitating the understanding of human behavior, neuroscience and neurolaw are not substantially equipped to modify the current perceptions of intentionality and culpability since the science is not developed enough to oversee the operation of the entire judicial court system. Rather than dismissing neuroscience, I believe the court systems should consider neurolaw when issuing a judicial sentence as a supplement rather than as a sole determinant. I will first show society's need for neurolaw by defining neuroscience and neurolaw, discussing intentionality and culpability, and analyzing the applicability of neurolaw; I will then discuss the shortcomings of neurolaw by evaluating its limitations, and presenting the necessary changes for its implementation; and

finally, I will argue that although the limitations of neurolaw prevent the existence and execution of a judicial system operating only on neurolaw principles, neurolaw must be further integrated into the existing judicial system in order to achieve justice.

Professor Owen D Jones, a professor of Biology at Vanderbilt Law School and the director of the MacArthur Foundation Research Network on Law and Neuroscience, defines neuroscience in his article *Neuroscience in the Law* as: the “study of the nervous system” where the brain oversees its operations (Jones). An integral subfield of neuroscience is cognitive neuroscience, a field that incorporates “neuroscientific tools to study how the brain feels, thinks, and decides” (Jones). These specific neuroscientific tools include: magnetic resonance imaging (MRI), and positron emission tomography (PET). The MRI and the PET both serve to infer the structure and function of the neurological pathways, but each measure different molecules in the brain; the MRI measures the oxygen levels in the brain whereas the PET measures the glucose levels in the brain (Jones). According to Stanford University’s professor of Neuroscience and Neurosurgery, Robert M Sapolsky, in his *Los Angeles Times* article, *Brain Science's Day in Court; if Abnormal Behavior is the Product of an Abnormal Brain, how should it be Punished*, neurolaw is defined as the “growing collaboration between neuroscience and criminology” (Sapolsky). Therefore, neurolaw utilizes the findings and tools of specifically cognitive neuroscience, and applies them to the study of crime in order to evaluate the intentionality and culpability of a criminal deviant.

Before the court of law determines the defendant guilty for his or her actions, the court must first establish the intentions of the defendant and whether or not he or she is culpable. Culpable, as defined by Nolo’s *Plain-English Law Dictionary*, means to be “sufficiently responsible for criminal acts or negligence [;] to be at fault and liable for the conduct” (Nolo). Therefore culpability in the court of law determines whether or not the defendant can be held accountable for the alleged crime committed. Moreover, according to the USLegal website of legal terms and definitions, the term “intentionally” means done “deliberately [...], willfully, and purposefully, not accidentally and involuntarily” (USLegal). Both culpability and intentionality are crucial factors that ultimately determine the severity of the sentence for a criminal offender. Oftentimes, in order to receive a reduced sentence, the defense presents evidence to the court that limits culpability and eliminates intentionality. By reducing culpability, the responsibility and accountability of the individual diminish because under the eyes of the law; the offender lacks sufficient authority and autonomy to be held accountable for criminal actions. Furthermore, as outlined by the Eighth Amendment, unnecessarily inflicting a punishment on an individual who cannot be held responsible is “cruel and unusual” and therefore not permissible. Thus, judges and jurors need to thoroughly evaluate culpability and intentionality in each presented case because ultimately, the outcome of their ruling dictates the quality of life for the opposing parties.

Interestingly enough, the existing system of law considers some aspects of neurolaw for determining culpability and intentionality. The characterization of people liable for punishment based on culpability by the 2014 California Penal Code Part1, Title1, Section 26 do not include children under fourteen, people “mentally incapacitated”, and “people who committed an act without being conscious thereof”(California Codes). Furthermore, according to the Oregon Legislature, a person is deemed mentally incapacitated when he or she is “rendered incapable

of appraising or controlling the conduct [...] at the time of the alleged offence because of the influence of a controlled or other intoxicating substance” (Oregon Laws). Therefore, the mentally incapacitated and children under the age of fourteen lack the sufficient rationality to possess culpability, and to conduct themselves in an appropriate manner. From a neurological standpoint, children lack sufficient brain development to fully be held culpable for their actions, since they do not possess sufficient rationality to grasp their actions as unjust. Although the law sanctions children and the mentally incapacitated, the law does not offer similar protection for people with brain lesions, tumors, and mental disorders such as: schizophrenia, bipolarity, autism, and split-personalities. These individuals are not sanctioned under the list of mentally incapacitated even though they do not have complete control over their actions. Rather than being subjected to the influence of alcohol or drugs, like the mentally incapacitated, people with mental disorders and structural brain irregularities are subjected to the influences of their brain biochemistry, yet they still retain culpability in the court of law. For example, people who are schizophrenic cannot intentionally control their impulses; thus a schizophrenic individual convicted of an aggressive crime may lack intentionality but ultimately possess culpability merely because the standards of the mentally incapacitated that are exempt from culpability do not protect schizophrenics. However, the judicial courts have a loophole to protect the mentally compromised through the insanity defense. According to Cornell University Law School’s Legal Information Institute, the Comprehensive Crime Control Act passed by Congress in 1984 requires the defendant prove with "clear and convincing evidence," that "at the time of the commission of the acts constituting the offense, the defendant, as a result of a severe mental disease or defect, was unable to appreciate the nature and quality or the wrongfulness of his acts" (LII-Insanity Defense). Therefore, to avoid culpability, the defendant must prove his or her mental deficiencies or disorders. Criminals who successfully plead the insanity defense, are mitigated from the consequences of the crime they commit, regardless of how heinous the crime. Once the defendant is proven "federally insane", the law does not sentence the defendant to jail, and instead releases the defendant into a mental institution, or back into society with weekly mandatory rehabilitation sessions. Unfortunately, many convicted criminals use the insanity defense as a scapegoat to prevent time spent in jail. The current legal system cannot properly distinguish between defendants who have mental deficiencies and the sane defendants who wish to avoid jail, requiring additional aide. Introducing and applying neuroscience to the court systems will help enforce justice by identifying these distinctions and protecting the defendants who actually have physical problems in their brains. In fact, research studies indicate that some mental disorders physically manifest in the structure of the brain. At the University Of California School of Medicine, Los Angeles, Dr. Paul M Thompson and a team of researchers detected significant accelerated loss of grey matter in the parietal, or outer, regions of the brain in schizophrenic adolescents over a span of five years and published their findings in a scientific paper titled: “Mapping Adolescent Brain Change Reveals Dynamic Wave of Accelerated Gray Matter Loss in Very Early-Onset Schizophrenia” (Thompson). Dr. Thompson’s team documented the “striking accelerated loss of gray accelerated loss of gray matter” with peak values of greater than 5% brain loss per year in the “broad anatomical region encompassing frontal eye fields and supplementary motor, sensorimotor, parietal, and temporal cortices in both brain hemispheres” (Thompson). Gray matter aides in not only the perception of

reality, but also the expression of emotion; thus, individuals who lack gray brain matter are at a severe disadvantage when rationally assessing a situation, reducing culpability. Although the law does not explicitly make exceptions for individuals with specific mental illnesses, a study by the University of Utah illustrates the importance of neuroscience assigned by judges when considering mitigating factors. Researchers presented one hundred and eighty-one judges with a hypothetical crime committed by a psychopath: an individual with “reptilian, remorseless indifference to the sufferings of other” (Sapolsky). The researchers then separated the judges into two groups and both groups were privy to the details of the crime, but only group two was informed of the neurobiological differences in the hypothetical psychopath. The criminal possessed “atypical function” in the amygdala region of the brain and unusually low levels of enzymatic activity from the brain enzyme MAO-alpha; both of which have been proven in previous court cases to contribute to aggression (Sapolsky). When observing the effects of the additional knowledge of amygdala deficiencies, nearly 60% of group two considered mitigating factors when issuing a sentence and group two provided an 8% average sentence decrease when compared to group one (Sapolsky). The significant percentage of group two judges utilizing mitigating factors when issuing the sentence indicates that scientific evidence regarding the brain and body biochemistry dictate substantial authority in the justice system. Therefore, neurological evidence should be presented in trial for the execution of a just sentence and neurolaw should possess greater authority in the court.

When utilizing neurolaw, its applicability falls into either of two categories: the first category is a very broad interpretation of neurolaw that applies to a wide range of cases, whereas the second application carefully considers each case independently. A landmark Supreme Court case utilizing the broad application of neurolaw is the *Roper v Simmons* (2005) ruling. When he was seventeen, Christopher Simmons committed a capital murder for which the law found him guilty and sentenced him to jail. After Simmons turned eighteen, he was placed on the death penalty for the crime he committed as a minor. Simmons filed a petition that under the *Atkins v Virginia* (2002) ruling and reasoned that the Constitution prohibits the execution of juvenile criminal under eighteen. His case escalated to the Supreme Court, and the Court issued that the state “can exact forfeiture of some of the most basic liberties, but the State cannot extinguish his life and his potential to attain a mature understanding of his own humanity” (LII- *Roper v Simmons*). According to journalist Jeffrey Rosen of the *New York Times* in his article *The Brain on the Stand*, the leading neurolaw brief filed by the American Medical Association argued that: reasoning behind the Supreme Court's statement is that the adolescent brain is less developed than an adult brain, and thereby the State cannot issue a death penalty (Rosen). Assigning adult responsibility to an individual who lacks adult rationality is unfair and unjust. *The Roper v Simmons* case represents the first, broad application of neurolaw in that, Simmons' lack of adolescent brain development is not a unique condition isolated only to him, but rather an existing condition in all adolescents. Since neuroscientists perceive all adolescents to have underdeveloped brains, the law prevents sentencing adolescents to the death. Although evidence in the form of brain scans were not present in this case, neurolaw indirectly influenced the sentence. Furthermore, the second, case-specific application of neurolaw becomes evident through the trial of the forty-year-old Virginia school teacher who exhibited uncontrollable pedophilic urges with the development of a brain tumor. According to the *New*

Scientist journalist Charles Choi in his article *Brain Tumor Causes Uncontrolled Paedophilia*, since the pedophilic behavior was unprecedented behavior in the man's life and he did not exhibit early symptoms usually associated with typical pedophiles, the judge offered him the option of completing a twelve step Sexaholics Anonymous program or a prison sentence (Choi). The man did not complete the program because he made inappropriate advances to the women in the program, and the night before his prison hearing, he acted irrationally and complained of severe headaches. He was taken to the emergency room where the doctors conducted a brain scan and found an egg-sized tumor in his brain. The doctors promptly removed the tumor and the man returned to and successfully completed the Sexaholics Anonymous program without any incidents. He did not display any other pedophilic symptoms until a few years later when he collected child pornography and again complained of headaches. A second brain scan indicated that the tumor had regrown, suggesting that the tumor is responsible for the former teacher's pedophilic urges (Choi). This scenario is indicative of a case-specific application of neurolaw in that not all pedophiles have brain tumors that dictate pedophilic behavior. Evidence of the brain tumor is significant in assigning a cause for the former teacher's actions merely because he did not demonstrate the typical patterns of a pedophile earlier in his life. Therefore, the court must also incorporate a thorough neurological assessment for each individual case before issuing the final sentence, since every human brain is unique and not all brains perform according to the recurring behavioral patterns in society.

Although neurolaw has accomplished milestone achievements in aiding the understanding of human behavior, significant limitations of the science prevent neurolaw from achieving full authority in the judicial courts. First and foremost, the tools of cognitive neuroscience operate under "proxy" measurements (Jones). Proxy measurements are made when measurements the precise measurement that is needed cannot be attained. Thus proxy measurements are the subsequent measurements made on similar, measurable subjects to draw inferences on the original, unattainable measurement. The MRI's and the PET's do not measure neurological activity, but rather oxygen and glucose level in the brain (Jones). These oxygen and glucose measurements are then used to infer the activities, structures, and functions of the nerves. Therefore, introducing MRI and PET brain scans as evidence for human behavior falls privy to the "Christmas tree effect" as coined by forensic neuropsychologist Daniel Martell; the brain scans provide jurors with a colorful image that they cannot interpret because the precise effect of the measurements are unknown (Davis). Assuming that the foundation of cognitive neuroscience does not rely on proxy measurements and instead provides concrete measurements that accurately pinpoint human behavior to one locus, these measurements cannot be made until after the fact. The brain scans map the brain's activities several days or weeks after the actual crime took place in laboratory conditions that cannot recreate the original environment in which the crime occurred. Therefore accurate brain scans cannot be attained and invasive technology must be inserted into the brain to provide a continuous brain scan feed twenty-four hours a day, seven days a week, and three hundred and sixty-five days a year. Since privacy is a growing concern among the American public, the likelihood that society will approve of providing big data corporations with the accessibility to their most private inner thoughts -the only true privacy in their possession- is highly unlikely. Additionally, neuroscience operates under a purely mechanistic approach to human behavior by suggesting that human

beings are more like machines: they do not possess free will and their actions are dictated only by their brain biochemistry. However, flux in brain biochemistry does not directly cause a particular behavior, but rather increases the likelihood of that behavior occurring by constructing a mental environment where that behavior becomes more common. Moreover, according to the professor of Psychology and Law in Psychology at the University of Pennsylvania Law School, Dr. Stephan J Morse, in his paper, "The Status of Neurolaw: A Plea for Current Modesty and Future Cautious Optimism," the law does not assess free will, but rather consciousness, intention, and capacity for rationality (Morse). Dr. Morse also hinges the existence of laws on the premise that they serve a purpose, since the law is "primarily action-guiding and is not able to guide people directly and indirectly unless people are capable of using rules as premises in their reasoning about how they should behave" (Morse). Ultimately laws can only exist because of the ability of human beings to rationally assess the effect of breaking the law, otherwise machines lack sufficient rationality to assess the effects of their actions and would act in a particular way regardless of laws, societal standards, and consequences. Therefore, the very existence of laws solidify that human beings are not machines and neurolaw cannot preside over the current law system.

In order for neurolaw to be implemented, the science needs to be developed to the extent that it can precisely pinpoint the locus for human behavior. A concrete, binding decision regarding the fate of a human being cannot be established solely on a science that is not fully understood. Neuroscientist for the Baylor College of Medicine, Dr. David Eagleman, is a major proponent for neurolaw and discusses how he foresees the implementation of neurolaw in his paper *The Brain on Trial*. Dr. Eagleman believes that the genes and biology of human beings play a significant role in determining behavior; that biology and free will are "inseparable", so the "blameworthiness should be removed from the legal argot" and instead a "forward-looking" philosophy should be implemented (Eagleman). Even though Dr. Eagleman's argues that factors beyond the control of human beings significantly influence behavior, he does not condone criminal behavior; he agrees that criminal deviants must be isolated from society because they are threats to society and must be subject to some form of discipline (Eagleman). Although Dr. Eagleman believes this isolation should manifest in mental health treatment facilities, he does not oppose incarceration, merely the "one-size-fits-all solution" of subjecting dangerous mentally ill individuals into the prison systems since: "inflicting punishment on the mentally ill usually has little influence on their futures" (Eagleman). Building more mental health institutions for the treatment of criminal offenders will reduce the likelihood of a repeat offense, promote safer prison environments, and improve the quality of life in society. Changes need to be implemented in the existing judicial system to allow for the emergence of neurolaw by promoting the growth of mental health institutions. Furthermore, a fundamental obstacle preventing the authority of neurolaw is the availability of neurological information and brain scans during the actual crime. In order to provide judges and jurors with the most accurate neurological evidence, people's brain scans need to be accessible at every moment. The probability that people would allow their brains to be under twenty four hour surveillance is highly unlikely given by the various public uproars caused by invasions of privacy on social media accounts. Ultimately these implementations will not completely override the existing

judicial system with a neurolaw dictatorship, but rather further the existence of a just judicial system by fusing the old judicial philosophies with new neurolaw scientific findings.

In conclusion, the law is limited in its ability to establish complete justice because it does not fully apply the findings neuroscience when assessing intentionality and culpability. For a just trial, courts must operate by a case-specific application of neurolaw for each criminal. However, neuroscience is also limited in its understanding of human behavior. Neurolaw cannot dominate the judicial court system because of: its mechanistic approach to human behavior, its dependence on proxy measurements, and its inability to generate necessary neurological information at the scene of the crime. Furthermore, neurolaw cannot be used as a safeguard against criminal punishment, but the emergence of neurolaw provides a unique approach to analyzing criminal behavior and encourages the growth of mental health facilities and treatment centers for criminal deviants in the hopes of achieving justice. Unfortunately, within the past few years the prominent crimes especially heinous in nature are more prevalent in the United States and require neuroscience to facilitate the fundamental understanding as to why the crime occurred in the first place. For horrific crimes like the Slender Man stabbing crime committed by two twelve year old girls and the Aurora, Colorado theatre shooting by James Holmes, judges and jurors utilize neuroscience to analyze the mental health of the criminal deviants to issue the appropriate sentence. Society is already taking steps to promote the integration of neurolaw into the judicial system. This preliminary integration merely scratches the surface of endless possibilities leaving citizens to seek answers to question they previously did not consider. Personally, my study of neuroscience and neurolaw left me with more unanswered questions than answers: what constitutes a normal brain? Is anyone actually normal? Can the cause of human behavior be isolated to one locus? Will the law require brain scans for all criminal deviants require to ensure a just ruling? Will the victims of a crime ever receive retribution for their grievances? Can there ever be complete justice? Ultimately, I do not know the answers to the above questions, but I do know that neurolaw provokes essential, existential questions that redefine our perception of humanity.

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