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Neuroscience and the Adjudication of Uncontrollability

MIZUKI HASHIGUCHI

Mizuki Hashiguchi is an attorney-at-law admitted in New York (U.S.A.). She graduated *summa cum laude* from the University of Washington (U.S.A.) with a Bachelor of Science degree in Applied and Computational Mathematical Sciences. She further obtained a Juris Doctor degree from Columbia Law School in New York City (U.S.A.). During her studies at Columbia, she received The Parker School Certificate for Achievement in International and Comparative Law. She obtained a Master's degree, *summa cum laude*, in *Droit économique* (Economic Law) from Sciences Po Paris (France). During her studies at Sciences Po, she was nominated to study at Harvard Law School (U.S.A.) in the International Exchange Program. Ms. Hashiguchi received the Dean's Scholar Prize from Harvard Law School (U.S.A.). She also holds a Master's degree, *magna cum laude*, in *Droit constitutionnel et droits fondamentaux* (Constitutional Law and Fundamental Rights) from the Paris 1 Panthéon-Sorbonne University (France).

@ Mizuki.Hashiguchi@univ-paris1.fr

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ABSTRACT

During the Italian Renaissance, Leonardo da Vinci conducted research on neuroscience, striving to explain "how the brain processes visual and other sensory input, and integrates that information via the soul". Jonathan Pevsner observes that Leonardo da Vinci took an "integrative approach to art and science". Today, research takes an integrative approach to law and science, examining how neuroscience works in the administration of justice.

Neuroscience has contributed substantially to criminal adjudication by providing criminal law with context, encouraging humane sentencing, increasing objectivity in evidence, and supporting explanations that link brain anatomy with human behaviour. In addition, neuroscience prompts a re-evaluation of the concept of free will in human behaviour and the human brain. Although free will has been viewed as an assumption underlying criminal law, neuroscience suggests that free will may be an illusion.

Neuroscience plays a crucial role in courts adjudicating crimes triggered by varying degrees of uncontrollability. Uncontrollability of actions occurs from conditions such as brain lesion, frontotemporal dementia, enlarged amygdala, and addiction to narcotics. The contributions of neuroscience to the justice system have the potential to be strengthened even further. Prospective measures for promoting individuals' future well-being, ethical frameworks for safeguarding fundamental rights, enabling the symbiotic evolution of law and neuroscience, and removing obstacles to neuroscientific research are some of the ways to create an infrastructure in which law can benefit from the flourishing of neuroscience.

KEYWORDS

Neuroscience, Criminal Adjudication, Free Will, Technological Progress, Constitutional Rights

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INTRODUCTION

Leo Tolstoy, in "War and Peace", wrote that "innumerable people . . . were moved by fear or vanity, rejoiced or were indignant, . . . imagining that they knew what they were doing and did it of their own free will".[1] Tolstoy observed that: "The presence of the problem of man's free will . . . is felt at every step of history".[2]

During the Italian Renaissance, Leonardo da Vinci conducted research on neuroscience, striving to explain "how the brain processes visual and other sensory input, and integrates that information via the soul".[3] Jonathan Pevsner observes that Leonardo da Vinci took an "integrative approach to art and science", reflecting on questions about "how the brain works in health and in disease".[4] Today, research takes an integrative approach to law and science, examining how neuroscience works in administering justice.

Neuroscience is the study of the architecture and function of the brain and the nervous system associated with thought, consciousness, and personal identity.[5] Neuroscience provides insights into mental processes and human behaviour.[6] What is the impact of neuroscience on the adjudication of uncontrollability?

Neuroscience has contributed substantially to criminal adjudication by providing criminal law with context, encouraging humane sentencing, increasing objectivity in evidence, and supporting explanations that link brain anatomy with human behaviour (Section 1). In addition, neuroscience prompts a re-evaluation of the concept of free will in human behaviour and in the human brain (Section 2). Although free will has been viewed as an assumption underlying criminal law, neuroscience suggests that free will may be an illusion.

Neuroscience plays a crucial role in courts' adjudication of crimes triggered by varying degrees of uncontrollability (Section 3). Uncontrollability of actions occurs from conditions such as brain lesion, frontotemporal dementia, enlarged amygdala, and

[1] Leo Tolstoy, *War and peace*, Book Ten: 1812, Chapter I (Project Gutenberg EBook ed.) (ebook), https://www.gutenberg.org/files/2600/2600-h/2600-h.htm.
[2] *Id.* Second Epilogue, Chapter VIII.
[3] Jonathan Pevsner, *Leonardo da Vinci's contributions to neuroscience*, 25 Trends in Neurosciences 2017 (2002), https://pubmed.ncbi.nlm.nih.gov/11998691/ (Neth.).
[4] *Exploring Leonardo da Vinci's knowledge of the brain*, NEUROSCIENCE NEWS (Apr. 11, 2019), https://neurosciencenews.com/da-vinci- brain-knowledge-11070/.
[5] *See generally* Olivier Oullier et al., *Le cerveau et la loi : analyse de l'émergence du neurodroit* [The brain and the law: Analysis of the emergence of neuro-law], Centre d'analyse stratégique [Center of strategic analysis] 15 (2012), http://archives.strategie.gouv.fr/cas/system/files/cas-dqs_dt-neurodroit_11septembrereduit_0.pdf (Fr.).
[6] *See generally* Georgia Martha Gkotsi, V. Moulin & J. Gasser, *Les neurosciences au Tribunal: de la responsabilité à la dangerosité, enjeux éthiques soulevés par la nouvelle loi française* [Neuroscience in the Courtroom: From responsibility to dangerousness, ethical issues raised by the new French law], 41 *L'Encephale* 385, 387, column 1 (2015) (Fr.).

addiction to narcotics. The contributions of neuroscience to the justice system have the potential to be strengthened even further. Prospective measures for promoting individuals' future well-being, ethical frameworks for safeguarding fundamental rights, enabling the symbiotic evolution of law and neuroscience, and removing obstacles to neuroscientific research are some of the ways to create an infrastructure in which law can benefit from the flourishing of neuroscience (Section 4).

1. EFFECT OF NEUROSCIENCE ON CRIMINAL ADJUDICATION

Science and technology can provide insights to humans. In *Cone v. Carpenter*, a neuropsychologist invented a computer algorithm for assessing test results concerning human behaviour.[7] The neuropsychologist testified: "Usually I use it to see if there is something I didn't see".[8]

This enlightening nature of science and technology can benefit law. David M. Eagleman argues that neuroscience provides greater equity in judicial decision-making.[9] The effect of neuroscience on criminal adjudication includes bringing context to criminal law (Subsection 1), encouraging humane sentencing (Subsection 2), increasing the objectivity of evidence (Subsection 3), and linking brain anatomy with human behaviour (Subsection 4).

1.1. BRINGING CONTEXT TO CRIMINAL LAW

Neuroscience can provide a scientific context that sheds light on defendants' backgrounds.[10] For example, on April 14, 2021, in *Ex parte Humberto Garza*, the Court of Criminal Appeals of Texas found that evidence concerning a defendant's childhood trauma can provide "important context about Applicant's life".[11] According to the Court,

[7] *See* Cone v. Carpenter, No. 97-2312-JPM, 2016 WL 1274599, at 47, 49 (W.D. Tenn. Mar. 31, 2016).
[8] *Id.* at 50.
[9] *See* David M. Eagleman, *Pourquoi les sciences du cerveau peuvent éclairer le droit* [Why the sciences of the brain can bring clarity to the law], *in* Oullier et al., *supra* note 5, at 33(Fr.).
[10] *See generally* Sénateur M. Michel Amiel, *Neurosciences et responsabilité de l'enfant* [Neurosciences and responsibility of children], Office parlementaire d'évaluation des choix scientifiques et technologiques [Parliamentary office of evaluation of choices on science and technology], Assemblée nationale [National Assembly of France], Note n° 20, at 1 (Nov. 2019), https://www.senat.fr/fileadmin/Fichiers/Images/opecst/quatre_pages/OPECST_2019_0090_note_neurosciences.pdf (Fr.).
[11] *Ex parte* Garza, No. WR-78,113-01, 2021 WL 1397860 (Tex. Crim. App. Sep. 13, 2017).

such mitigating evidence can draw "a considerably different picture for the jury of Applicant's childhood and mental health".[12]

In this case, the defence failed to present evidence of the defendant's trauma.[13] The jury sentenced the defendant to capital punishment.[14] The defendant argued that the failure to present this evidence concerning trauma constitutes a violation of his right to effective assistance of counsel under the Sixth Amendment.[15]

The Sixth Amendment of the United States Constitution provides that the accused in criminal prosecutions shall "have the assistance of counsel for his defence".[16] In *Strickland v. Washington*, the Supreme Court held that counsel's assistance must be *reasonably* effective, and that ineffective assistance must have caused prejudice to the defence in order to be a violation of the defendant's right under the Sixth Amendment.[17]

The Court in *Ex parte Humberto Garza* found that there is a reasonable probability that the evidence on the defendant's trauma could have persuaded at least one juror to decide differently and thereby "spare Applicant's life".[18] This case presents a powerful example that neuroscience can lead to more informed decisions that save individuals' lives.

1.2. ENCOURAGING HUMANE SENTENCING

Neuroscience can also lead to humane decisions in sentencing. On April 9, 2021, in *United States v. Cruz*, the District Court of Connecticut reduced a sentence from life in prison to "a term of time served" with supervised release.[19] Neuroscience contributed to this decision. Expert testimony and scientific articles concerning the development of the adolescent brain persuaded the court that the defendant was less culpable.[20]

The defendant was eighteen years and twenty weeks old when he committed murder in 1994.[21] He was a member of a group.[22] The leader suspected that another member was an informant.[23]

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[12] *Id.*
[13] *See id.*
[14] *See id.*
[15] *See id.*
[16] U.S. Const. amend. VI.
[17] *See* Strickland v. Washington, 466 U.S. 668 (1984) (emphasis added).
[18] *Ex parte* Garza, No. WR-78,113-01.
[19] *See* United States v. Cruz, No. 3:94-CR-112 (JCH), 2021 WL 1326851, at 1, 5 (D. Conn. Apr. 9, 2021).
[20] *See id.* at 5-7.
[21] *See id.* at 1, 5.
[22] *See id.* at 1.
[23] *See id.*

The leader ordered the defendant to kill this member.[24] Defendant continued to insist that "[h]e did not want to kill anyone".[25] Defendant ultimately carried out the order, murdering two men.[26] He was sentenced to life imprisonment without parole.[27]

Defendant filed a motion to reduce the term of this sentence pursuant to Section 3582(c)(1)(A) of Title 18 of the United States Code.[28] The Court found that expert testimony and scientific articles demonstrate that "[eighteen]-year-olds display similar characteristics of immaturity and impulsivity as juveniles under the age of [eighteen]".[29] The Court acknowledged that "[eighteen]-year-olds are still developing in terms of maturity, impulse control, ability to resist peer pressure, and character".[30]

The Court thus noted the incongruity that the defendant, "who was less than fully blameworthy for his crimes given his age when he committed them, will end up serving significantly more time than adults who, fully blameworthy for their conduct, have committed the same crimes".[31] "This reality cannot be ignored", the Court wrote.[32]

The defendant's "extraordinary rehabilitation" also contributed to the Court's conclusion.[33] The Court remarked that the defendant "never received a disciplinary ticket" while being in custody for more than twenty-six years.[34] The Court further recognised the defendant's "extensive participation" in an "intensive cognitive-behavioral treatment program" called the "Challenge Program".[35] This program taught skills such as reducing anti-social peer associations, enhancing self-control, and improving problem-solving capabilities.[36] The Court thus found that the defendant has "transformed"[37] and "no longer poses a danger to the public".[38] This case exemplifies how neuroscience contributes to greater humanity in the criminal justice system.

[24] *See id.*
[25] *Id.*
[26] *See id.*
[27] *See id.* at 2.
[28] *See id.* at 1, 4.
[29] *Id.* at 6.
[30] *Id.* at 7.
[31] *Id.*
[32] *Id.* at 8 (citing Graham v. Florida, 560 U.S. 48, 70-71 (2010)).
[33] *See id.*
[34] *See id.*
[35] *Id.* at 13.
[36] *See id.*
[37] *Id.* at 8.
[38] *Id.* at 13.

1.3. INCREASING THE OBJECTIVITY OF EVIDENCE

In addition, neuroscience is expected to enhance the objectivity of evidence. Olivier Oullier et al. observe that one of the goals of "neuro-law" is to prevent future crimes by determining the dangerousness of an individual.[39] Georgia Martha Gkotsi et al. explain that public safety is a "preoccupation" in France.[40] Hence, the assessment of a defendant's dangerousness has "become paramount in the process of judicial decision" in France.[41]

Neuroscientific technology such as magnetic resonance imaging [hereinafter M.R.I.] is believed to provide "tangible" information about how dangerous a defendant is likely to be.[42] Brain imaging is expected to enhance the objectiveness of evidence for mental dysfunction.[43]

However, Gkotsi et al. caution that this expectation might lead fact-finders to place excessive importance on data obtained by neuroscientific technology.[44] For example, the psychological bias of "seeing is believing" might make brain-scanning images appear to have greater probative value.[45]

Applying generalisations to individual conduct requires caution as well. Inferences made from generalisations concerning neuroscience may lack relevance and persuasiveness. For instance, in *State v. Rogers*, expert witnesses for the defence testified that the defendant "could not appreciate the wrongfulness of his conduct and conform his behaviour to the requirements of the law" due to his bipolar disorder.[46] The Court of Appeals of Wisconsin found that two articles titled "Post-Traumatic Stress Disorder: The Role of Medical Prefrontal Cortex and Amygdala" and "Global Prefrontal and Fronto-Amygdala Disconnectivity in Bipolar I Disorder with Psychosis History" were "of marginal relevance at best".[47] The Court's opinion suggests that the Court reached this conclusion because the defendant was never personally diagnosed with post-traumatic stress disorder, and the defendant's individual brain was never actually scanned.[48]

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[39] *See* Oullier et al., *supra* note 5, at 8.
[40] *See* Gkotsi et al., *supra* note 6, at 392, column 1.
[41] *Id.* at 386, 391, column 1.
[42] *Id.* at 391, column 2; 392, column 1.
[43] *See* Florence Rosier, *Les neurosciences peuvent-elles devenir des auxiliaires de la justice?* [Can neuroscience become auxiliaries of justice?], Le Monde (Feb. 4, 2019), https://www.lemonde.fr/sciences/article/2019/02/04/les-neurosciences-peuvent-elles-devenir-des-auxiliaires-de- la-justice_5419193_1650684.html (Fr.). *See also* J. Vanmeter, *Neuroimaging: Thinking in pictures*, *in* Scientific and Philosophical Perspectives in Neuroethics 230, 241 (James J. Giordano & Bert Gordijn eds., Cambridge University Press, 2010) (U.K.).
[44] *See* Gkotsi et al., *supra* note 6, at 392, column 1.
[45] *See id.*
[46] State v. Rogers, 2015AP609–CR, 2016 WL 8605326, at 1 (Wis. Ct. App. May 4, 2016).
[47] *Id.* at 2.
[48] *See id.*

David L. Faigman et al. point out the possibility that group data might not provide precise information concerning individuals.[49] This problem is called the Group to Individual [hereinafter G2i] problem.[50] The Court's reluctance in *State v. Rogers* to accept the two scientific articles appears to reflect a recognition of this G2i problem. Inferences made from group data cannot substitute personal data obtained from individual diagnoses of the defendant.

1.4. LINKING BRAIN ANATOMY WITH HUMAN BEHAVIOR

Moreover, neuroscience provides information which links a defendant's anatomy to the defendant's behaviour at issue. Brain imaging shows the anatomical structure of a person's brain.[51] Brain imaging can, for example, help detect brain lesions of a defendant.[52] Such findings can contribute to explanations connecting brain lesions with the defendant's behaviour.[53] This is an important contribution of neuroscience to the law. Without neuroscience, a defendant's conduct might be assumed to be the result of the defendant's volition and personal choice.

2. RE-EVALUATION OF FREE WILL IN HUMAN BEHAVIOR AND IN THE HUMAN BRAIN

John Steinbeck, in "East of Eden", suggested that individuals can exercise "choice".[54] He wrote that the word "Timshel" "carried a man's greatness if he wanted to take advantage of it".[55] Can individuals be good whenever they want to be good? Can individuals control their actions freely? Do certain legal doctrines assume that persons' "free will" directs their behaviour?

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[49] *See* David L. Faigman et al., *G2i Knowledge Brief: A Knowledge Brief of the MacArthur Foundation Research Network on Law and Neuroscience* 2-3 (Columbia L. Sch. Scholarship Archive Working Paper, 2016), https://scholarship.law.columbia.edu/faculty_scholarship/2017/https://scholarship.law.columbia.edu/faculty_scholarship/2017/; David L. Faigman et al., *Group to Individual (G2i) Inference in Scientific Expert Testimony*, 81 U. Chi. L. Rev. 417, 418, 426 (2014).

[50] *See also* Zink v. State, 278 S.W.3d 170 (Feb. 24, 2009) (finding that scientific evidence presented by the defence failed to establish a link between defendant's positron emission tomography [hereinafter P.E.T.] scan and defendant's mental condition).

[51] *See*, *e.g.*, Gabriella V. Hirsch et al., *Using structural and functional brain imaging to uncover how the brain adapts to blindness*, Ann. Neurosci. Psychol. (2015), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6168211/ (U.K.).

[52] Oullier et al., *supra* note 5, at 8.

[53] *Id.*

[54] John Steinbeck, East of Eden 395 (Penguin Books ed., 1952) (ebook).

[55] *Id.* at 674.

Although the existence of free will is an assumption underlying criminal law (Subsection 1), neuroscience demonstrates that there is great variability in how each person's brain functions (Subsection 2).[56] Neuroscience suggests the possibility that, in some instances, an individual might be incapable of controlling his or her behaviour (Subsection 3).[57] Such uncontrollability has led to tragedies (Subsection 4).

2.1. FREE WILL AS AN UNDERLYING ASSUMPTION OF CRIMINAL LAW

Law assumes that a person has "free will".[58] In particular, an implicit assumption in criminal law is that "behaviour is a consequence of free will".[59] One of the principles of criminal law is that "only rational people can be held criminally responsible for their actions".[60] The meaning of criminal culpability includes "capacity for free will".[61] Criminal law thus assumes that "persons can be held responsible for their actions because they have freely chosen them, rather than had them determined by forces beyond their control".[62]

Neuroscience challenges these assumptions.[63] Joshua D. Greene explains that "you can have someone who is totally rational but whose strings are being pulled by something beyond his control".[64] Hence, Greene suggests that criminal law should abandon "the idea that bad people should be punished because they have freely chosen to act immorally".[65]

Dov Fox observes that criminal law punishes even mentally ill persons "so long as they exhibit minimal capacity to reason or tell right from wrong".[66] This mode of punishment

[56] Oullier et al., *supra* note 5, at 9.
[57] *See id.*
[58] Eagleman, *supra* note 9, at 39; Symposium, Taku Sasaki et al., Jiyū to jiyū ishi [Freedom and Free Will], Philosophical Association of Japan, 1, column 1, https://philosophy-japan.org/wpdata/wp-content/uploads/2019/11/ed4f45dd54a2ed6bdd0bf5b1fefc5c73.pdf (Japan).
[59] Deborah W. Denno, *Human Biology And Criminal Responsibility: Free Will Or Free Ride?*, 137 U. Pa. L. Rev. 615 (1988).
[60] Jeffrey Rosen, *The Brain on the Stand*, The New York Times Magazine, Mar. 11, 2007, https://www.nytimes.com/2007/03/11/magazine/11Neurolaw.t.html.
[61] Amy D. Gundlach-Evans, *State v. Calin: The Paradox Of The Insanity Defense And Guilty But Mentally Ill Statute, Recognizing Impairment Without Affording Treatment*, 51 S.D. L. Rev V. 122, 130-31 (2006).
[62] Michele Cotton, *A Foolish Consistency: Keeping Determinism Out Of The Criminal Law*, 15 B.U. Pub. Int. L.J. 1 (2005).
[63] *See, e.g.*, Wada Toshinori, N*ō kagaku jidai no keihō ni okeru jiyū ishi: Chūshi-han no nin'i-sei yōken wo daizai ni* [*Free will in the criminal law in the era of neuroscience: Intent requirement of defendants in attempted crimes*] 2, columns 1 & 2 (research paper, Keio University Repository of Academic Resources) (2009), https://core.ac.uk/download/pdf/145719532.pdf (Japan).
[64] Rosen, *supra* note 60.
[65] *Id.*
[66] Dov Fox, *Subversive Science*, 124 Pa. St. L. Rev. 153, 167 (2019).

appears to disregard the possibility that individuals might know right from wrong but cannot control their behaviour.

2.2. QUESTION ON EQUALITY IN THE CAPACITY OF SELF-CONTROL

Eagleman points out that individuals are not on an "equal footing" with respect to the freedom one has to choose and control one's behaviour.[67] Eagleman writes that, although "all citizens" are "equal before the law," every person has "different perspectives, distinct personalities, and diverse capacities in decision-making".[68]

Thus, Eagleman argues that, from a neuroscientific point of view, the notion of equality is "simply false".[69] Similarly, Oullier et al. suggest that the concept of "everyone being equal before the law" contradicts scientific findings that the neurobiology of each individual varies greatly.[70]

2.3. FREE WILL AS AN ILLUSION

Philosophical contemplations on neuroscience may suggest that free will is an illusion. Eagleman states that the idea that a person has "free will" is "totally false" because the brain of each individual is different.[71] According to Eagleman, every behaviour, every thought, and every decision is linked to biological phenomena taking place "beneath the surface of our consciousness".[72] Eagleman points out that individuals are not at liberty to choose all the elements that contribute to their behaviour.[73] Singer and Roth argue that the law of criminal responsibility is a "product of illusion" with no neuroscientific foundation because criminal law assumes that free will exists.[74]

These arguments challenge the idea that individuals' "free will" controls their conduct. Thus, neuroscience teaches the possibility that a defendant behaved in a way due to an anatomical factor of the brain that the defendant did not know and could not control.[75] Biological changes in the brain influence individuals' desires and even

[67] *See* Eagleman, *supra* note 9, at 37.
[68] *Id.* at 39, 49.
[69] *Id.* at 49.
[70] *See* Oullier et al., *supra* note 5, at 9.
[71] *See* Eagleman, *supra* note 9, at 38.
[72] *Id.*
[73] *See id.* at 39.
[74] Masuda Yutaka, Jiyū ishi to keiji sekinin [Free Will and Criminal Responsibility], Meiji University Academic Repository, at 204 (2007), https://m-repo.lib.meiji.ac.jp/dspace/bitstream/10291/12666/1/shakaikagakukiyo_46_1_201.pdf (Japan).
[75] *See*, *e.g.*, Gkotsi, *supra* note 6, at 387, column 2.

decisions.[76] Serge Stoléru thus poses the question: "Is society confronting perpetrators of offences and crimes? Are they instead sick people?"[77]

Even if a brain has abnormalities that can lead to aggressive behaviour, are there portions of the human consciousness that make decisions despite these abnormalities? Peggy Larrieu suggests that it is currently impossible to determine whether "free will" is spontaneous or whether it is programmed in the human brain.[78] Eagleman points out that every part of the brain is connected to some other part of the brain.[79] Thus, according to Eagleman, no part of the brain is "independent" nor "free".[80] This interconnectedness of the brain suggests that there is no single component of the brain which corresponds to "free will".[81]

Neuroscientists explain that human actions result from two networks of the brain.[82] The first is the automated network that humans themselves are unconscious of.[83] The second is the cognitive network that humans are conscious of.[84]

These neuroscientific theories pose questions concerning criminal responsibility and punishment. Should both of these networks be evaluated to decide whether a person was criminally responsible? Would it be fair to penalise a person for the consequences of the unconscious, automatic network? Does the impact of the unconscious, automated network on human behaviour reduce the person's criminal responsibility over that behaviour?

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[76] *See* Eagleman, *supra* note 9, at 35.

[77] Rosier, *supra* note 43. Meanwhile, Jean Decety maintains: "Abnormalities detected in their brain do not exonerate them. They still have free will". *See also id.*

[78] Peggy Larrieu, *Neurosciences et évaluation de la dangerosité. Entre néo-déterminisme et libre-arbitre* [Neurosciences and evaluation of dangerousness: Between neo-determinism and free will], 72 Revue interdisciplinaire d'études juridiques [Review of interdisciplinary studies in law] 22 (2014), https://www.cairn.info/revue-interdisciplinaire-d-etudes-juridiques-2014-1-page-1.htm (Belg.).

[79] *See* Eagleman, *supra* note 9, at 41.

[80] *Id.*

[81] *Id. See also* Jorge Morales, Bria Odegaard & Brian Maniscalco, *The Neural Substrates of Conscious Perception without Performance Confounds*, Neuroscience and Philosophy 296-97 (Felipe De Brigard & Walter Sinnott-Armstrong eds., 2022); N. Kohls & R. Benedikter, *The origins of the modern concept of "neuroscience": Wilhelm Wundt between empiricism, and idealism: implications for contemporary neuroethics*, *in* Scientific and Philosophical Perspectives in Neuroethics 62 (James J. Giordano & Bert Gordijn eds., 2010) (U.K.); A. Autiero & L. Galvagni, *Religious issues and the question of moral autonomy*, *in* Scientific and Philosophical Perspectives in Neuroethics 139-41, 144 (James J. Giordano & Bert Gordijn eds., 2010) (U.K.); William G. Lycan, *Philosophical Theories of Consciousness*, *in* Mind, Cognition, and Neuroscience: a Philosophical Introduction 268-69, 274-76 (Benjamin D. Young & Carolyn Dicey Jennings eds., 2022); Myrto Mylopoulos, *Neurobiological Theories of Consciousness*, *in* Mind, Cognition, and Neuroscience: a Philosophical Introduction 281, 283-90 (Benjamin D. Young & Carolyn Dicey Jennings eds., 2022); Rocco J. Gennaro, *The Unity of Consciousness*, *in* Mind, Cognition, and Neuroscience: a Philosophical Introduction 299-300, 304-5 (Benjamin D. Young & Carolyn Dicey Jennings eds., 2022); Alon Goldstein & Benjamin D. Young, *The Unconscious Mind*, *in* Mind, Cognition, and Neuroscience: a Philosophical Introduction 345, 349-50, 352, 354-56, 358 (Benjamin D. Young & Carolyn Dicey Jennings eds., 2022).

[82] *See* Rosier, *supra* note 43.

[83] *Id.*

[84] *See Id.*

2.4. TRAGEDY OF UNCONTROLLABILITY

In the summer of 1966, a man repeatedly fired his rifle from the top of the University of Texas Tower.[85] Innocent pedestrians lost their lives.[86] Before these killings, the perpetrator had left notes questioning his tendency to behave violently.[87] For example, the perpetrator had written, "I cannot rationally [sic] pinpoint any specific reason for doing this".[88]

According to *The Washington Post*, the perpetrator had noted that "he had been suffering from headaches and that his brain should be examined to find out why he had violent thoughts".[89]

In the brain of the perpetrator, there was a growing tumour called "glioblastoma".[90] This malignant tumour was compressing the perpetrator's amygdala.[91] Generally speaking, "[s]timulation of the amygdala causes intense emotion, such as aggression or fear".[92]

The discovery of the tumour in the perpetrator's brain stirred a debate.[93] Some argued that this "tumour could explain his actions".[94] Others maintained that "he was a calculating killer" because of "the calm way he carried out the attack".[95]

Could the perpetrator have known that his amygdala was being compressed by glioblastoma? Could the perpetrator have prevented this tumour from growing and stimulating his amygdala even further? Assuming that this pressure on the amygdala generated "intense emotion" of aggression, was the perpetrator's violent conduct a result of the perpetrator's volition? Did his aggressive behaviour occur regardless of his volition? Was it possible for the perpetrator to control his thoughts and actions? Generally speaking, how should criminal law punish a perpetrator, considering the possibility that the perpetrator's brain tumour might have stimulated his amygdala and therefore increased his aggressiveness unbeknownst to the perpetrator?

[85] *See* Michael S. Rosenwald, *The Loaded Legacy of the UT Tower Shooting*, The Wasington Post, July 31, 2016, https://www.washingtonpost.com/sf/local/2016/07/31/the-loaded-legacy-of-the-ut-tower-shooting/.
[86] *Id.*
[87] *See id.*
[88] *Id.*
[89] *Id.*
[90] Oullier et al., *supra* note 5, at 34.
[91] *See id.*
[92] Anthony Wright, *Chapter 6: Limbic System: Amygdala*, Neuroscience Online (Oct. 10, 2020), https://nba.uth.tmc.edu/neuroscience/m/s4/chapter06.html.
[93] *See* Rosenwald, *supra* note 85.
[94] *Id.*
[95] *Id.*

3. CRIMINAL ADJUDICATION OF UNCONTROLLABILITY

In the "Old Curiosity Shop", Charles Dickens depicted how the "disease of the brain" transformed the grandfather of the protagonist, Nell.[96] Dickens recounts the horror of Nell, as she caught a glimpse of her grandfather stealing Nell's hard-earned money.[97] He "seemed like another creature in his shape, a monstrous distortion of his image . . . so unlike him".[98] Dicken's portrayal conveys the tragic, sorrowful condition that brain disease triggers.

This Section explores how neuroscience has played a role in courts' adjudication of the uncontrollability of defendants' behaviour. Such uncontrollability includes disinhibition associated with brain lesions (Subsection 1), symptoms of frontotemporal dementia (Subsection 2), effects of a "survival mode" caused by an enlarged amygdala (Subsection 3), and loss of discernment due to narcotic addiction (Subsection 4).

3.1. BRAIN LESION AND DISINHIBITION

3.1.1. *PEOPLE V. WEINSTEIN*

The New York Times Magazine suggests that *People v. Weinstein* may represent a "moment that neuroscience began to transform the American legal system".[99] In *Weinstein*, the defendant killed his wife and threw her body out of their apartment's window on the twelfth floor, presumably to create the impression that the victim committed suicide.[100]

After the defendant was indicted, his brain was scanned using P.E.T. scan. [101] A radioactive substance was injected into the defendant's body.[102] When this substance reached the brain, it was metabolised.[103] During this metabolic process in the brain, radioactivity occurred.[104] This radioactivity was captured by a device monitoring the defendant's brain.[105]

[96] *See* Charles Dickens, The Old Curiosity Shop, Chapter 31 (Project Gutenberg EBook) (ebook), http://www.gutenberg.org/files/700/700-h/700-h.htm.
[97] *Id.*
[98] *Id.*
[99] Rosen, *supra* note 60.
[100] *See* People v. Weinstein, 591 N.Y.S.2d 715, 717 (N.Y. Sup. Ct. 1992).
[101] *Id.* at 717.
[102] *Id.*
[103] *Id.*
[104] *Id.*
[105] *Id.*

This P.E.T. scan revealed an arachnoid cyst in the defendant's brain.[106] An arachnoid cyst is described as a "congenital benign condition resulting from the splitting" of one of the layers surrounding the brain.[107] The court stated that the defendant's "brain is abnormal due to the presence of the arachnoid cyst, the attendant displacement of the left frontal lobe, and . . . metabolic imbalance".[108] The court further found that the defendant's "abnormalities are most apparent" in the frontal lobes.[109] The court notes that the frontal lobes control executive functions including the "ability to reason and to plan".[110]

Based on this evidence, the defence intended to argue that the defendant "lacked the cognitive ability to understand the nature and consequences of his conduct or that his conduct was wrong".[111] This defence raises at least two questions.

First, was the defendant rational? The defence planned to argue that the defendant could not understand that killing his wife was wrong. This argument suggests that the defendant could not distinguish right from wrong. This inference seems to contradict the notion that some individuals with brain lesions are rational and can distinguish right from wrong but cannot control their actions. Perhaps the defence in *Weinstein* planned to portray the defendant as a person who is not rational and who cannot control his behaviour.

Second, the neuroscientific evidence showed that the defendant's brain abnormality was apparent in the frontal lobes which control executive functions such as planning. Does this mean that the defendant had less cognitive capacity to plan? This inference seems to contradict the defendant's behaviour. The defendant threw the victim's body out the window to make the incident appear to be a suicide. This requires planning. This seems to mean that the defendant had the capacity to plan. How can one reconcile this contradiction between inferences made from abnormalities of frontal lobes and the cunning planning that the defendant seems to have executed during the crime?

This enigma suggests intricacy and difficulty in deciphering neuroscientific evidence in conjunction with a defendant's conduct being adjudicated. One possible explanation is that a person with abnormalities in the frontal lobes has difficulty exercising clairvoyance in making long-term plans while being capable of exercising

[106] *Id.* at 717-18.
[107] *Arachnoid Cyst*, St Vincent's Private Hospital Melbourne, St Vincent's Neuroscience https://www.stvincentsneuroscience.com.au/downloads/conditions/st-vincents-neuroscience-conditions-arachnoid-cyst.pdf (explaining the "Arachnoid Cyst") (last visited Sept. 4, 2024).
[108] *Weinstein*, 591 N.Y.S.2d at 722.
[109] *Id.*
[110] *Id.*
[111] *Id.* at 724.

dexterity in devising short-term plans.[112] For instance, in *Edwards v. Ayers*, the Court of Appeals for the Ninth Circuit found that defendant "planned, deliberated, and decided where and when he would shoot his victims".[113] The Court found that such "circumstances of the crime negate diminished capacity"[114] even though experts suggested the possibility that defendant's impulsivity is linked to dysfunction of the prefrontal lobe.[115]

3.1.2. BRAIN SCAN AND GENETIC TESTING LEADING TO MITIGATION IN COMO, ITALY

In Como, Italy, brain imaging and genetic testing persuaded a court to mitigate a convicted murderer's sentence.[116] Brain scans using an imaging technique called Voxel-based morphometry revealed that the gray matter volume of the anterior cingulate gyrus and insula in the defendant's brain was different from the volume of ten people in a control group.[117] Changes in the anterior cingulate gyrus and insula have been correlated with reduced inhibition.[118] Changes in the insula have been correlated with aggressive behavior.[119] In addition, a genetic test showed that defendant has abnormality in the activity of monoamine oxidase A (MA.O.A) genes which are "linked to violent behavior".[120]

Considering this neuroscientific and genetic evidence, the Italian court in Como found that the defendant has "partial mental illness".[121] The Court consequently reduced the defendant's sentence from life in prison to twenty years in prison.[122]

[112] *See* Cone v. Carpenter, No. 97-2312-JPM, 2016 WL 1274599, at *45 (W.D. Tenn. Mar. 31, 2016) (noting a neuropsychologist's testimony that "people with brain damage in the very front may lose long-term plans, but can still have very good short-term plans").
[113] *Edwards v. Ayers*, 542 F.3d 759, 775 (9th Cir. 2008).
[114] *Id. Cf.* State v. Haag, No. 51409-5-II, 2019 WL 4273918, at *3, *6 (Wash. Ct. App. Sept. 10, 2019) (taking into consideration the "nature of the crime" to determine the appropriate sentence of defendant whose "rational thinking process was based more in the primitive amygdala versus the sophisticated frontal cortex").
[115] *Edwards*, 542 F.3d at 769-70.
[116] *See* Emiliano Feresin, *Italian court reduces murder sentence based on neuroimaging data*, NATURE, (Sept. 1, 2011), http://blogs.nature.com/news/2011/09/italian_court_reduces_murder_s.html (U.K.).
[117] *Id.*
[118] *See id.*
[119] *See id.*
[120] *Id.*
[121] *Id.*
[122] *Id.*

3.1.3. BRAIN LESION AND UNCONTROLLABILITY LEADING TO MITIGATION IN THE NETHERLANDS

In the Netherlands, a man set fire to a painting in the National Museum in Amsterdam in 2006.[123] He was charged with arson and property damage.[124] Experts in psychiatry, psychology, and behavioural neuroscience opined that the defendant had a lesion in the frontal lobe of his brain.[125] Experts explained that, although the defendant had the cognitive capability to recognise what is unlawful, the defendant's brain lesion made him incapable of controlling his behaviour when he was acting.[126]

The court declared that the defendant was partially responsible and mitigated his sentence.[127] Defendant was sentenced to one year in prison and was ordered to be hospitalised in a psychiatric facility.[128]

3.1.4. DIFFERING PSYCHIATRIC OPINIONS IN LYON, FRANCE

In France, a man in Lyon hit a victim violently during an altercation in 2007.[129] The victim, trying to escape, climbed over the bannister of a staircase and fell two stories below.[130] Defendant's medical record contained a diagnosis of "frontal syndrome".[131] Defendant had this condition since age twelve when he underwent an operation to remove a brain tumour.[132]

Two neuro-psychiatrists opined that the defendant's "frontal syndrome" was the principal cause of the defendant's impulsiveness.[133] They further stated that the defendant was not responsible for his acts.[134] Another expert in psychiatry opined that the defendant's "anti-social personality" was the source of his behaviour.[135]

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[123] *See* Gkotsi et al., *supra* note 6, at 388, column 2.
[124] *See id.*
[125] *Id.*
[126] *Id.* at 389, column 1.
[127] *Id.*
[128] *See id.*
[129] *See* Benoit de La Fonchais, *Quand la neuropsychologie est convoquée au tribunal* [When neuro-psychology is called to court], Cortex Mag (Mar. 20, 2018), laboratoire d'excellence CORTEX, l'Université de Lyon, https://www.cortex-mag.net/neuropsychologie-convoquee-tribunal/https://www.cortex-mag.net/neuropsychologie-convoquee-tribunal/ (Fr).
[130] *See id.*
[131] *Id.*
[132] *See id.*
[133] *Id.*
[134] *Id.*
[135] *See* Rosier, *supra* note 43.

The court found that the causality between the defendant's aggression and the victim's death had not been proven.[136] The defendant was ultimately found guilty and was sentenced to a fine.[137]

3.1.5. FRONTAL LOBE DAMAGE AND APATHY IN *CONE V. CARPENTER*

In *Cone v. Carpenter*, adjudicated by the United States District Court for the Western District of Tennessee, a neuropsychologist testified that the defendant suffered "brain damage or brain dysfunction" in the frontal lobe.[138] The expert also testified that disinhibition is one of the symptoms of frontal lobe damage.[139]

Yet the Court in this case found that there is "little evidence" to demonstrate that the defendant was unable to know right from wrong or to act lawfully.[140] The Court stated that the defendant "simply did not care to conform his conduct".[141]

At the same time, this apathy and disinterestedness in conforming one's behaviour to the law seem to be symptoms of frontal lobe damage. The observation that the defendant "simply did not care to conform his conduct" does not appear to be a sufficient reason for eliminating the possibility that frontal lobe damage affected the defendant's behaviour and cognition.

3.2. FRONTOTEMPORAL DEMENTIA AND THEFT

3.2.1. ACQUITTAL FOR INSANITY IN OSAKA, JAPAN

In Japan, a defendant's diagnosis of frontotemporal dementia led to acquittal. On December 28, 2015, the defendant stole steak and pickles from multiple supermarkets.[142] In one supermarket, the manager was sitting right next to the shelf of pickles.[143] Yet the defendant took the package of pickles with both hands and left the supermarket.[144]

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[136] *See* De La Fonchais, *supra* note 129.
[137] *See id.*
[138] Cone v. Carpenter, No. 97-2312-JPM, 2016 WL 1274599, at *41-*42 (D.Tenn. Mar. 31, 2016).
[139] *Id.* at 46.
[140] *Id.* at 137.
[141] *Id.*
[142] Zentousokutouyou-gata ninchishō (FTD) ni rikan siteita dansei no manbiki-koui ni tsuite muzai ga iiwatasareta jirei Osaka Chisai:H29.3.22 Hanketsu [Man with frontotemporal dementia judged innocent for shop-lifting - Osaka District Court, March 22, 2017, Decision], http://kawaguchi-saiwai.com/?p=2098 (Japan).
[143] *See id.*
[144] *See id.*

Eight years earlier, in 2007, the defendant had suffered a stroke.[145] Then, in November 2015, approximately one or two months before the theft in question, the defendant was diagnosed with frontotemporal dementia.[146]

During the trial, a psychiatric evaluation concluded that (1) the defendant suffers from frontotemporal dementia and (2) the defendant tends to become incapable of controlling his behaviour when he sees something that interests him.[147]

Article 39(1) of the Penal Code of Japan provides that "[a]n act of insanity is not punishable".[148] Article 39(2) states that "[a]n act of diminished capacity shall lead to" mitigation of punishment.[149] The Supreme Court of Japan has ruled that judges have the discretion to interpret psychiatric evaluations of defendants because criminal responsibility is an issue of law.[150]

In the present case, the Osaka District Court observed that defendant did not engage in similar theft before he became affected by frontotemporal dementia[151] The Court stated that it cannot reasonably deny the possibility that defendant was in a state of insanity due to frontotemporal dementia when he committed theft.[152] Thus, the Court issued a judgment of acquittal.[153]

This case did not involve evidence from brain imaging. However, neuroscientific information concerning frontotemporal dementia and the court's observation of defendant's behavior led to the exoneration of the defendant.

According to Johns Hopkins Medicine, frontotemporal dementia occurs when "nerve cells in the frontal and temporal lobes of the brain are lost".[154] The orbitofrontal cortex, which is a part of the frontal lobe,[155] plays a role in processing emotions and

[145] *See id.*
[146] *See id.*
[147] 'Ninchi-shō de manbiki' saisin seikyū 75-sai-dansei, becken no muzai uke — Osaka Kansai ["Theft under dementia" Request for retrial filed in Osaka Summary Court, 75-year-old man, acquitted in different case], MAINICHI (Dec. 3, 2020), https://mainichi.jp/articles/20201202/k00/00m/040/388000c (Japan) (last visited May 6, 2021).
[148] Keihō [Keihō] (Pen. C.), art. 39, para. 1 *translated in* (Japanese Law Translation [JLT DS]) http://www.japaneselawtranslation.go.jp/law/detail/?id=1960 (Japan).
[149] *Id.* at article 39, para. 2.
[150] Saikō Saibansho daisan shōhōtei [Supreme Court of Japan, Third Chamber], Sept. 13, 1983, Showa 58 (a) 753, page 1, Saibansho saibanrei jōhō [Saibanshoweb], https://www.courts.go.jp/app/files/hanrei_jp/328/058328_hanrei.pdf. (Japan).
[151] [Man with frontotemporal dementia judged innocent for shop-lifting - Osaka District Court, March 22, 2017], *supra* note 142.
[152] *Id.*
[153] *Id.*
[154] *Frontotemporal Dementia*, John Hopkins Medicine, https://www.hopkinsmedicine.org/health/conditions-and-diseases/dementia/frontotemporal-dementia (last visited Sept. 4, 2024).
[155] *See* David Zald Scott Rauch, *The Orbitofrontal Cortex, Abstract*, Oxford University Press, https://oxford.universitypressscholarship.com/view/10.1093/acprof:oso/9780198565741.001.0001/acprof-9780198565741 (U.K.) (last visited May 6, 2021).

self-regulating behavior.[156] The ventromedial prefrontal cortex has a role in moral judgment.[157] Frontotemporal dementia is associated with dramatic behavioral changes.[158] Stealing is one of its symptoms.[159] Thus, in the Osaka District Court's decision, defendant's frontotemporal dementia was deemed sufficient to meet the criteria of the insanity defence under Article 39(1) of the Penal Code.

In contrast, the Ohio Court of Appeals in *State v. Ford* reasoned that frontotemporal dementia "could not have excused" defendant, who "did not otherwise meet the legal definition of insanity" under Ohio state law.[160] The Ohio Court of Appeals noted an expert's opinion that frontotemporal dementia might support an inference that "irresistible impulse" was what drove defendant's behavior.[161] At the same time, the Ohio Court of Appeals stated that "irresistible impulse" does not excuse the defendant's offense.[162]

3.2.2. DEFENDANT'S BEHAVIOR NEGATING FINDINGS OF INSANITY AND UNCONTROLLABILITY

A defendant's behavior might negate findings of insanity and uncontrollability. In a case involving theft, the High Court of Osaka, Japan, evaluated neuroscientific evidence and defendant's behavior.[163] The Court then concluded that the defendant was capable of controlling his conduct.[164]

In a store, the defendant placed a carpet into a shopping cart, put magazines, food, and other items into his bag, and tried to flee.[165] A physician diagnosed the defendant with post-traumatic stress disorder, eating disorder, alcohol addiction, and kleptomania.[166] A psychiatrist referred to images from the defendant's brain scan and pointed out that the defendant's brain function might be impaired.[167] The psychiatrist further stated that such

[156] Shazia Veqar Siddiqui et al., *Neuropsychology of Prefrontal Cortex*, 50 INDIAN J. PSYCHIATRY 202 (2008) (India).
[157] Amitai Shenhav & Joshua D. Greene, *Integrative Moral Judgment: Dissociating the Roles of the Amygdala and Ventromedial Prefrontal Cortex*, 34 J. NEUROSCIENCE 4741 (2014).
[158] Johns Hopkins Medicine, *supra* note 154.
[159] *See id.*
[160] State v. Ford, No. 102617, 2015 WL 6797320, at *1 (Ohio Ct. App. Nov. 5, 2015).
[161] State v. Ford, Nos. 88946, 88947, 2007 WL 3105267, at *2 (Ohio Ct. App. Oct. 25, 2007).
[162] *Id.* at 3.
[163] Osaka-kōtō-saibansho dai-ichi keiji-bu, Heisei 26 nen 10 gatsu 21 nichi hanketsu [Osaka High Court, First Criminal Division], Oct. 21, 2014, Case No. Heisei 26 (u) 829, pages 2-4, Saibansho saibanrei jōhō [Saibanshoweb] https://www.courts.go.jp/app/files/hanrei_jp/953/084953_hanrei.pdf (Japan).
[164] *Id.*
[165] *Id.* at 2-3.
[166] *Id.* at 1.
[167] *Id.*

impairment in brain function and environmental factors have influenced the defendant's commission of theft at issue.[168]

The Court noted that when the defendant tried to leave the store, he left the shopping cart in the mattress area, walked to the cash register to see how store employees were working, then returned to the shopping cart, went to an elevator, arrived at a roof-top parking lot, and then tried to run away.[169] A security officer, however, had followed him.[170] When the security officer said, "You haven't paid, have you?", the defendant replied, "I stole them, sorry".[171]

Based on this behavior, the Court found that the defendant sufficiently knew the unlawfulness of his conduct.[172] The Court also found that, since the defendant observed store employees and stole the commodities when the employees did not seem to be looking, defendant was controlling his behavior.[173] The Court determined that the defendant had the capacity to control himself with respect to making the final decision of whether to commit the theft.[174] Thus, the Court found that the defendant's psychiatric condition had a limited impact on impairing the defendant's control over his behavior.[175] The High Court therefore affirmed the District Court's ruling that the defendant was criminally responsible.[176]

3.3. ENLARGED AMYGDALA AND THE SURVIVAL MODE

In *State v. Kirkland*, the defence argued that the defendant's "survival mode" due to an enlarged amygdala constitutes a mitigating factor. An expert witness for the defence testified that "toxic stress" from child abuse enlarges a person's amygdala and weakens its connection to the prefrontal cortex.[177] The amygdala perceives threats.[178] Meanwhile, the prefrontal cortex corrects this perception so that individuals will not continue feeling intense fear when they encounter a phenomenon that is actually safe.[179]

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[168] *Id.*
[169] *Id.* at 3.
[170] *Id.*
[171] *Id.*
[172] *Id.*
[173] *Id.* at 4.
[174] *Id.*
[175] *Id.* at 6-7.
[176] *Id.* at 7.
[177] State v. Kirkland, 157 N.E.3d 716, at 748 (Ohio 2020).
[178] *Id. Cf.* Com. v. Evans, 12-P-246, 2015 WL 478698 (Mass. App. Ct. Feb. 6, 2015). In *Com. v. Evans*, defence counsel presented evidence that an underdeveloped frontal lobe of an adolescent would make the adolescent's behavior be governed by the amygdala, which leads to impulsiveness and aggression. *Id.* at *1. The Court characterised this argument as "interesting and potentially important". *Id.*
[179] *See Kirkland*, 157 N.E.3d, at 748.

In *Kirkland*, an M.R.I. scan showed that the defendant's right amygdala was abnormally enlarged.[180] Thus, the expert witness theorized that when the defendant encountered the victim, the defendant's enlarged amygdala triggered a "survival mode".[181] However, the Supreme Court of Ohio concluded that the mitigating factors are outweighed by aggravating circumstances[182]

The theory concerning "survival mode" may be applied to construct a self-defence argument at the brain level. Since the defendant's enlarged amygdala was in "survival mode", he likely perceived the victim as threatening his life. According to this argument, the defendant's aggression against the victim should be construed as self-defence because the defendant's aggression was prompted by the amygdala's perception that the defendant must act immediately to save himself.

3.4. VOLUNTARY ADDICTION AND THE DESTRUCTION OF LEGAL DISCERNMENT

A ruling issued on April 14, 2021, by a French court provoked a debate concerning the source of legal insanity and the degree to which it should affect a defendant's criminal responsibility. On April 4, 2017, an individual was severely beaten and killed by an acquaintance.[183] The perpetrator threw the victim out of the window.[184] On December 19, 2019, the Court of Appeal of Paris[185] declared that the perpetrator had no criminal responsibility.[186] The perpetrator had testified that he thought the victim was the devil.[187] The defence submitted testimony from witnesses who reportedly heard him cry, "I killed a devil".[188] Experts observed that the victim's religious affiliation led the perpetrator to perceive the victim as the devil.[189] Experts also stated that this perception triggered the perpetrator's violence.[190]

[180] *Id.* at 746.
[181] *Id.* at 748.
[182] *Id.* at 749-50.
[183] *See* Jean-Christophe Muller & David Sénat, *Affaire Sarah Halimi: «La loi doit clarifier la question de la responsabilité pénale en cas de consommation volontaire de toxiques»* ["Law must clarify question concerning criminal responsibility in cases of voluntary consumption of toxic substances"], Le Monde (Apr. 24, 2021), https://www.lemonde.fr/idees/article/2021/04/24/affaire-sarah-halimi-la-loi-doit-clarifier-la-question-de-la-responsabilite-penale-en-cas-de-consommation-volontaire-de-toxiques_6077896_3232.html (Fr.).
[184] *Id.*
[185] Cour d'appel [CA] [regional court of appeal] Paris, ch. inst. 6., Dec. 19, 2019, 2019/05058 (Fr.).
[186] Muller & Sénat, *supra* note 183.
[187] Cour de cassation [Cass.] [supreme court for judicial matters] crim., Apr. 14, 2021, 20-80.135, Bull. crim., No. 4, para. 23 (Fr.).
[188] *Id.* at 23.
[189] *Id.*
[190] *Id.*

The family of the victim appealed to the highest judicial court in France, called the *Cour de cassation* [Court of Cassation].[191] On April 14, 2021, the *Cour de cassation* affirmed the Court of Appeal's conclusion that the perpetrator had "no criminal responsibility due to a psychiatric or neuro- psychiatric trouble that abolished his discernment or control of his acts at the moment he committed these acts".[192] The Court determined that the perpetrator's "discernment was abolished".[193] As a result, the perpetrator will not be subject to any proceedings before the *Cour d'assises* [Court of Assizes],[194] which is a court that adjudicates crimes in France.[195]

An expert in psychiatry testified that the deterioration of the perpetrator's mental state was due to his voluntary and regular consumption of "very large quantities" of cannabis.[196] The expert then opined that the perpetrator should be held criminally responsible, noting that the severity of his mental troubles far exceeded expectations.[197] If this expert opinion was accepted, then the perpetrator would have been tried before the *Cour d'assises*.[198] The crime that the perpetrator would have been charged with normally results in life in prison.[199] The perpetrator's "modified discernment" would have resulted in a mitigated sentence of at most thirty years in prison.[200]

The second group of experts stated that the perpetrator's delirious conduct was probably due to schizophrenia.[201] They therefore suggested that the perpetrator's consumption of cannabis did not worsen his already deteriorated mental state.[202] The third group of experts opined that, when the perpetrator committed the aggression at issue, the perpetrator had no free will.[203]

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[191] Muller & Sénat, *supra* note 183; *Les missions de la Cour de cassation*, Cour de Cassation [Cass.] [supreme court for judicial matters], https://www.courdecassation.fr/la-cour/les-missions-de-la-cour-de-cassation (last visited July 1, 2024) («La Cour de cassation est la plus haute juridiction de l'ordre judiciaire français») (Fr.).

[192] Muller & Sénat, *supra* note 183; Cour de cassation [Cass.] [supreme court for judicial matters] crim., Apr. 14, 2021, 20-80.135, Bull. crim., No. 4, para. 28 (Fr.).

[193] Muller & Sénat, *supra* note 183.

[194] *See id.*

[195] *See Procès devant la cour d'assises ou la cour criminelle* [Proceeding before the *cour d'assises* or the criminal court] Ministère Chargé de la Justice, [Ministry of Justice], https://www.service-public.fr/particuliers/vosdroits/F1487 (last visited July 1, 2024) (Fr.).

[196] Muller & Sénat, *supra* note 183; Cour de cassation [Cass.] [supreme court for judicial matters] crim., Apr. 14, 2021, 20-80.135, Bull. crim., No. 4, para. 25 (Fr.).

[197] Muller & Sénat, *supra* note 183.

[198] *Id.*

[199] *Id.*

[200] *Id.*

[201] Cour de cassation [Cass.] [supreme court for judicial matters] crim., Apr. 14, 2021, 20-80.135, Bull. crim., No. 4, para. 25 (Fr.).

[202] *Id.*

[203] *Id.*

Muller et al. suggest that progress in neuroscience and psychiatry raises questions about the origin of legal insanity.[204] If the perpetrator's voluntary consumption of addictive substances was the origin of insanity, should the perpetrator be held criminally responsible, even at the level of mitigated responsibility?[205] "No" was the *Cour de cassation*'s answer on April 14, 2021.[206]

Article 122-1, Paragraph 1, of the French Penal Code provides that "[a] person is not criminally liable who, when the act was committed, was suffering from a psychological or neuropsychological disorder that destroyed his discernment or his ability to control his actions".[207] The *Cour de cassation* ruled that this statutory text does not make any distinction between the sources of mental trouble, which led to the abolition of discernment.[208] It was noted that this articulation was being made for the first time in the judicial history of France.[209]

The *Cour de cassation* observed that the record contained no information indicating that the perpetrator consumed cannabis knowing that it might lead to the conduct at issue.[210] The *Cour de cassation* explained that, when mental trouble exonerates a perpetrator, the law does not distinguish between the origins of mental trouble.[211] This means that (i) a perpetrator who is in a state of insanity under law but did not voluntarily consume any addictive toxin and (ii) a perpetrator who voluntarily consumes addictive toxin and reaches a state of insanity under law will both be exonerated.[212]

In a press release, the *Cour de cassation* explained that a division of the Court of Appeal called the *chambre de l'instruction* [chamber of instruction][213] ordered the perpetrator to be hospitalized under psychiatric care.[214] The Court of Appeal also prohibited him from contacting civil parties, and further prohibited him from appearing at the site of the crime for twenty years.[215]

[204] *See* Muller & Sénat, *supra* note 183.
[205] *Id.*
[206] *Id.*
[207] Code pénal [C. pén.] [Penal Code] art. 122-1, para. 1 (Fr.).
[208] Cour de cassation [Cass.] [supreme court for judicial matters] crim., Apr. 14, 2021, 20-80.135, Bull. crim., No. 4, paras. 2, 29 (Fr.).
[209] Press Release, Cour de Cassation, *Trouble mental et irresponsabilité pénale* [Mental trouble and criminal responsibility] (Apr. 14, 2021) (online), https://www.courdecassation.fr/toutes-les-actualites/2021/04/14/trouble-mental-et-irresponsabilite-penale (Fr.).
[210] Cour de cassation [Cass.] [supreme court for judicial matters] crim., Apr. 14, 2021, 20-80.135, Bull. crim., No. 4, para. 26 (Fr.).
[211] Muller & Sénat, *supra* note 183.
[212] *See id.*
[213] *Quel est le rôle de la chambre de l'instruction ?* [What is the role of the *chambre de l'instruction*?], VIE PUBLIQUE, https://www.vie-publique.fr/fiches/268572-quel-est-le-role-de-la-chambre-de-linstruction (last updated Sept. 5, 2022) (Fr.).
[214] Press Release, Cour de Cassation, *supra* note 209.
[215] *Id.*

In most cases, it is difficult to ascertain whether individuals have lost control of their actions. The workings of their brains are hidden in their skulls. The law determines whether an individual's discernment was "abolished" or not. This is legal fiction because individuals deemed to have "abolished discernment" under the law might in fact be cognitively capable of controlling their actions. Such legal fiction can affect how the public acts in the future.

For example, according to the *Cour de cassation*'s decision of April 14, 2021, if individuals voluntarily consume narcotics, they might be exempt from being tried before the Court because they are deemed to have no discernment. Meanwhile, if these individuals refrain from voluntarily consuming narcotics, they might be subject to court proceedings as long as their discernment is deemed unaffected. Does this outcome encourage initiatives to stay away from addictive and toxic substances? Does this outcome promote public safety? Is it possible that some individuals will deliberately consume narcotics in order to be exonerated from the criminal justice system?

Le Monde reports that, after the *Cour de cassation*'s decision on April 14, 2021, President Emmanuel Macron of France asked the Minister of Justice Eric Dupond-Moretti to "change the law . . . as soon as possible."[216] According to *Le Monde*, President Macron stated that "[d]eciding to take narcotics and then going 'like insane' should not, in my view, remove one's criminal responsibility[217]

4. FUTURE DIRECTIONS FOR STRENGTHENING THE CONTRIBUTIONS OF NEUROSCIENCE

Neuroscience has contributed to refining judicial adjudications of uncontrollability. Neuroscience has brought insights that facilitate a greater understanding of the defendants' brain conditions and their conduct. Eagleman argues that progress in neuroscience opens up a new avenue for structuring a legal system that is more efficient,

[216] Jean-Baptiste Jacquin, *Irresponsabilité pénale : la volonté d'Emmanuel Macron de modifier la loi fait débat* [Lack of criminal responsibility : The will of Emmanuel Macron to amend the law stirs debate], Le Monde (Apr. 20, 2021), https://www.lemonde.fr/societe/article/2021/04/20/emmanuel-macron-veut-precipiter-une-reforme-sur-l-irresponsabilite-penale_6077387_3224.html (Fr.).

[217] *Id.* (« Décider de prendre des stupéfiants et devenir alors "comme fou" ne devrait pas à mes yeux supprimer votre responsabilité pénale »). *See also* Alexis Brézet, Delphine de Mallevoüe, Christophe Cornevin & Jean-Marc Leclerc, *Emmanuel Macron au Figaro : «Je me bats pour le droit à la vie paisible».* [Emmanuel Macron to Figaro : "I am fighting for the right to a peaceful life."], Le Figaro (Apr. 18, 2021), https://www.lefigaro.fr/actualite-france/emmanuel-macron-au-figaro-je-me-bats-pour-le-droit-a-la-vie-paisible-20210418 (Fr.).

effective, humane, and adaptive to each individual.[218] How can these contributions be reinforced?

Future directions for strengthening the contributions of neuroscience to the law include prospective measures enabling enhanced well-being of the parties (Subsection 1), ethical frameworks for safeguarding fundamental rights in light of the increasing application of neuroscientific technology (Subsection 2), cultivating a synergetic evolution of law and neuroscience (Subsection 3), and reducing unnecessary limitations imposed on neuroscientific research (Subsection 4).

4.1. FORWARD-LOOKING MEASURES FOR ENHANCED WELL-BEING

Eagleman opines that the legal concept of "culpability" should be withdrawn from the legal system.[219] This is because a person's conduct is not necessarily the person's fault.[220] A myriad of elements, including genetic factors and socio-economic conditions in a person's environment, can influence the person's conduct. [221] Eagleman thus proposes replacing the concept of "culpability" with "forward-looking measures".[222]

According to this idea, when a person commits a crime, the question is not "Was the person at fault?". Instead, the question is "What measures should be taken to rehabilitate the person in the future[223] and prevent analogous harm to society in the future?". Greene similarly argues that "the law should focus on deterring future harms".[224]

Former French Senator Michel Amiel emphasizes the importance of protecting and educating delinquent minors.[225] Neuroscience indicates that the delinquent acts of these youths are at least partially due to the underdeveloped state of their brains.[226] Their

[218] Eagleman, *supra* note 9, at 37.
[219] *Id.* at 43.
[220] *See id.*
[221] *See id.*; Gkotsi et al., *supra* note 6, at 392, column 1; Florence Rosier, *« Depuis 2011, l'usage de l'imagerie cérébrale en justice ne cesse d'augmenter en France » ["Since 2011, the use of brain imaging in law continues to increase in France"],* Le Monde *(Feb. 4, 2019), https://www.lemonde.fr/sciences/article/2019/02/04/depuis-2011-l-usage-de-l-imagerie-cerebrale-en-justice-ne-cesse-d-augmenter-en-france_5419189_1650684.html* (Fr.).
[222] Eagleman, *supra* note 9, at 43.
[223] *See* Gkotsi et al., *supra* note 6, at 391, column 1.
[224] Rosen, *supra* note 60.
[225] Sénateur M. Michel Amiel, *Neurosciences et responsabilité de l'enfant* [Neurosciences and responsibility of children], Office parlementaire d'évaluation des choix scientifiques et technologiques [Parliamentary office of evaluation of choices on science and technology], Assemblée nationale [National Assembly of France], Note n° 20, at 4, column 1 (Nov., 2019), https://www.senat.fr/fileadmin/Fichiers/Images/opecst/quatre_pages/OPECST_2019_0090_note_neurosciences.pdf (Fr.).
[226] *Id.*

personalities continue to develop with time.[227] Thus, education may help develop moral character.

In Japan, a patient suffering from dementia was arrested after stealing a boxed lunch from a store.[228] The Tokyo Summary Court found that the defendant was criminally responsible.[229] At the same time, the Court stated that "[r]ather than ordering a patient with dementia to undergo rehabilitation in prison, it is more appropriate to . . . enable patients like the defendant to live a stable life in the community while receiving social welfare, thereby aiming to prevent the recurrence of crimes in the future".[230] The Court sentenced the defendant to a monetary fine of 500,000 yen .[231] The Court's decision in this case reflects a forward-looking consideration for the defendant's future well-being.

4.2. ETHICAL FRAMEWORKS FOR SAFEGUARDING FUNDAMENTAL RIGHTS

Ethical frameworks should be constructed to safeguard fundamental rights in the context of the growing use of neuroscientific technology in investigation[232]. It is necessary to strike a delicate balance between maximizing the benefits of neuroscience and minimizing unintended consequences that impinge on fundamental rights.

4.2.1. FIRST LEGISLATION ON THE USE OF BRAIN IMAGING IN THE COURTROOM

On July 7, 2011, the French legislature enacted Law No. 2011-814 concerning bioethics.[233] According to Gkotsi et al., this is the first legislation in the world concerning the use of

[227] Betty J. Casey et al., *Making the Sentencing Case: Psychological and Neuroscientific Evidence for Expanding the Age of Youthful Offenders*, Ann. Rev. Criminology 321 (2022). *See also* Joshua May et al., *The Neuroscience of Moral Judgment: Empirical and Philosophical Developments*, *in* Neuroscience and Philosophy 17, 34 (Felipe De Brigard & Walter Sinnott-Armstrong eds., 2022).

[228] Ogata Ayumi, Ninchi-shō to keiji-sekinin-nōryoku [Dementia and Criminal Responsibility], Chukyo Lawyer, Vol. 28 (2018) at 10 (citing and describing Decision of Tokyo Summary Court of Sept. 4, 2014) (Japan).

[229] *Id.*

[230] *Id.*

[231] *Id.*

[232] *See, e.g.,* Eyal Aharoni, Sara Abdulla, Corey H. Allen & Thomas Nadelhoffer, *Ethical Implications of Neurobiologically Informed Risk Assessment for Criminal Justice Decisions: A Case for Pragmatism*, *in* Neuroscience and Philosophy 161-162, 168, 174, 179, 183-186 (Felipe De Brigard & Walter Sinnott-Armstrong eds., The MIT Press, 2022); Thilo Hinterberger, *Possibilities, Limits, and Implications of Brain-computer Interfacing Technologies*, *in* Scientific and Philosophical Perspectives in Neuroethics 271, 277-280 (James J. Giordano & Bert Gordijn eds., 2010) (U.K.).

[233] Loi 2011-814 du 7 juillet 2011 relative à la bioéthique (1) [Law 2011-814 of July 7, 2011, relating to bioethics], Titre VIII: Neurosciences et Imagerie Cérébrale [Title VIII: Neuroscience and Brain Imaging], art. 45 Journal Officiel de la République Française [J.O.] [Official Gazette of France], July 8, 2011, p. 11826 (Fr.).

brain imaging in the courtroom.[234] Jean Léonetti, Member of the French Parliament at the time of enactment, wrote that "it is necessary to set the bases for an ethical framework on the subject of neuroscience and the use of brain imaging".[235] Title VIII of this law is "Neuroscience and Brain Imaging".[236] Title VIII, Article 45, amended the French Civil Code by adding Article 16-14.[237] Article 16-14[238] provides as follows:

> Brain imaging technology can be resorted to only for medical purposes or scientific research, or within the scope of a court ordered expert examination. The express consent of the person must be obtained in writing before the examination is conducted, after the person has been duly informed of its nature and its purpose. The consent shall specify the purpose of the examination. It can be revoked without formality and at any time.[239]

This provision allows judges to appoint an expert in neuroscience in order to evaluate the risks of recidivism, the veracity of a testimony, or the degree of criminal responsibility.[240]

The role of expert testimony differs in the United States and in France. According to *Daubert v. Merrell Dow Pharmaceuticals*, judges in the United States exercise a gate-keeping role in deciding whether to admit expert scientific testimony.[241] In France, scientific experts do not participate in the adversarial process of litigation.[242] According to Article 159 of the French Code of Criminal Procedure,[243] "judges of instruction" in France appoint experts and provide them with instructions on which issues to testify.[244] "Judges of instruction" are judges who are charged with investigating serious, complex crimes and rendering judicial decisions on these cases.[245]

Oullier explains that Law No. 2011-814 "effectively bans the commercial use of neuroimaging in France".[246] One purpose of enacting this law was to protect individuals

[234] *See* Gkotsi et al., *supra* note 6, at 386-87, column 1.
[235] *Id.* at 389, column 1.
[236] Loi n° 2011-814.
[237] Gkotsi et al., *supra* note 6, at 389, column 1.
[238] Code civil [C. civ.] [Civil Code], Chapitre IV [Chapter IV], art. 16-14 (Fr.).
[239] Code civil [C. civ.] [Civil Code] as of July 1, 2013 *translated in* David W. Gruning Trans., (Sept. 2014), https://www.wipo.int/edocs/lexdocs/laws/en/fr/fr512en.pdf (Fr.).
[240] *See* Julien Larregue & William Wannyn, *Le neurodroit, oublié du débat sur la bioéthique* [The neurolaw, forgotten in the debate on bioethics], Le Monde (Feb. 11, 2018), https://www.lemonde.fr/idees/article/2018/02/11/le-neurodroit-oublie-du-debat-sur-la-bioethique_5255105_3232.html (Fr.).
[241] Daubert v. Merrell Dow Pharms., 509 U.S. 579, 592-595 (1993).
[242] Oullier et al., *supra* note 5, at 24.
[243] Code de procédure pénale (C. pr. pén.) [Criminal Procedure Code], art. 159 (Fr.).
[244] *Id.*; Oullier et al., *supra* note 5, at 24.
[245] *See À quoi sert le juge d'instruction ?* [What are the roles of the judge of instruction?], The French Republic, https://www.vie-publique.fr/fiches/268568-role-et-pouvoirs-du-juge-dinstruction (last updated Jan. 15, 2024) (Fr.).
[246]

from "potential misuses of neuroscience".[247] Lie detection and prediction of future behavior are listed as examples of misuse.[248] Overinterpretation of neuroscientific evidence is also raised as a concern.[249] In addition, there is a concern that neuroscience might be used for unintended, abusive, or discriminatory purposes.[250] The legislation aims to address these concerns.

However, despite this legislation, Gkotsi et al. note that defendants are not shielded from brain-imaging procedures that might violate their fundamental rights.[251] In particular, Gkotsi et al. express concern that neuroscientific data might be interpreted as an indication of defendants' dangerousness.[252] As a result, Gkotsi et al. explain that defendants might face longer sentences impinging upon their liberty.[253] This consequence is problematic because brain abnormality does not automatically mean that a person is ill or that the person has a propensity to act violently.[254] The legislative history of the new bioethics law in France also suggests that the legislators intended to prevent neuroscience from being used to establish the culpability of the defendants instead of mitigating their culpability.[255]

Although Law No. 2011-814 permits the use of brain imaging technology in expert examination ordered by a court, the application of this technology in the French criminal justice system has been infrequent.[256] In 2014, Gkotsi et al. stated that they were unaware of any instances in which neuroscientific technology was used in a courtroom.[257] In March 2018, Benoit de La Fonchais reported that the use of neuroscientific findings in criminal adjudication remains rare in France.[258] In February 2019, Florence Rosier reported that experts in neuroscience, law, and ethics believe that brain imaging is "not ripe enough" for evaluating criminal responsibility.[259] Alexandre Salvador states that "[t]here is no brain function that corresponds uniquely to responsibility".[260]

Olivier Oullier, *Clear up this Fuzzy Thinking on Brain Scans*, NATURE (Feb. 29, 2012), https://www.nature.com/articles/483007ahttps://www.nature.com/articles/483007aa (U.K.).

[247] Gkotsi et al., *supra* note 6, at 386.

[248] *Id.*

[249] *Id.* at page 389, column 2.

[250] *Id.*

[251] *Id.* at 386, 390, column 2.

[252] *Id.* at 386.

[253] *Id.* 386, 392, column 2.

[254] *See id.* at 392, column 2.

[255] *Id.* at 389, column 2; 390, column 2.

[256] *See* «Monsieur le juge, ce n'est pas lui, c'est son cerveau!» [*"Monsieur Judge, it was not him, it was his brain!"*], LE PROGRÈS (June 8, 2014), https://www.leprogres.fr/rhone/2014/06/08/monsieur-le-juge-ce-n-est-pas-lui-c-est-son-cerveauhttps://www.leprogres.fr/rhone/2014/06/08/monsieur-le-juge-ce-n-est-pas-lui-c-est-son-cerveau (Fr.).

[257] Gkotsi et al., *supra* note 6, at 389, column 1.

[258] De La Fonchais, *supra* note 129.

[259] Rosier, *supra* note 43.

[260] *Id.*

4.2.2. CAUTION AGAINST OVERSIMPLIFICATION AND BIOLOGICAL DETERMINISM IN JAPAN

Japan's Ministry of Education, Culture, Sports, Science and Technology argues that it is simplistic for laypersons to believe that certain areas of the brain correspond to specific behavioral tendencies.[261] This belief echoes the notion of biological determinism.[262] The Ministry expresses concern that these oversimplified ideas might lead to human rights violations and discrimination against criminals and mentally ill patients.[263] The Ministry states that these outcomes are contrary to what neuroscientists aim to achieve.[264] Similarly, Peggy Larrieu argues that there is a danger in replacing legal reasoning with biological reasoning.[265]

Eagleman explains that "Is the defendants' conduct their fault or due to their biology?" is not the right question to ask.[266] This is because a person's behavior cannot be separated from the biological functions of the person's neuronal circuits.[267]

Furthermore, the brain is not the only factor that determines how a person behaves. Individuals' conduct may also be influenced by their socio-economic environment and past experience.[268] Childhood trauma, for example, affects psychological development.[269] Exposure to paint containing lead can also increase aggressiveness.[270]

4.2.3. NEUROSCIENTIFIC TECHNOLOGY AND CONSTITUTIONAL RIGHTS IN INDIA

In *Smt. Selvi & Ors. v. State of Karnataka*, the Supreme Court of India pointed out that the use of neuroscientific technology in legal investigation presents a tension between (i) enhancing the efficiency of investigation through the deployment of novel technology and (ii) protecting fundamental individual liberties.[271] For example, the Brain Electrical

[261] Monbu-kagaku-shō [Ministry of Education, Culture, Sports, Science and Technology of Japan], Nōkagaku kenkyū to shakai tono chōwa ni tsuite [Harmonizing neuroscience research and society], Nōkagaku no rinri-teki / hō-teki / shakai-teki kadai [Ethical, legal, and social issues involving neuroscience], https://www.mext.go.jp/b_menu/shingi/gijyutu/gijyutu2/shiryo/attach/1236342.htma (Japan).
[262] *Id.*
[263] *Id.*
[264] *Id.*
[265] *See* Larrieu, *supra* note 78, at 22-23.
[266] Eagleman, *supra* note 9, at 37.
[267] *Id.* at 36-7. *See also* May et al., *supra* note 227, at 28-29.
[268] Oullier et al., *supra* note 5, at 9. *See also* Aharoni et al., *supra* note 232, at 169.
[269] Eagleman, *supra* note 9, at 38.
[270] *Id.*
[271] Smt. Selvi & Ors. v. State of Karnataka, (2010) 7 SCC 263, Supreme Court of India, at 2, 76, 86 (India).

Activation Profile [hereinafter B.E.A.P.] test was used to ascertain how well a defendant knows the details of a crime at issue.[272] This technology is a precursor to brain fingerprinting.[273]

Meanwhile, Article 20(3) of the Constitution of India provides that "[n]o person accused of any offence shall be compelled to be a witness against himself".[274] This is a right against self- incrimination.[275]

The Supreme Court of India notes the possibility that "the mere apprehension of undergoing scientific tests that supposedly reveal the truth could push them to make confessional statements".[276] The Court thus observes that the administration of these tests could prompt "individuals from weaker sections of society" to make incriminating statements because they are not fully aware of their constitutional rights.[277] The Court further found that "a forcible intrusion into a person's mental processes is also an affront to human dignity and liberty, often with grave and long-lasting consequences".[278] The Supreme Court of India therefore ruled that imposing investigative technologies such as the B.E.A.P. test on a defendant without the informed consent of the defendant constitutes a violation of the right against self-incrimination under Article 20(3) of the Indian Constitution.[279]

4.2.4. CONSTITUTIONAL PROTECTION OF PERSONAL DATA IN SWITZERLAND

Brain imaging yields sensitive personal data. Such data may include information about a person's "psychic health, their emotional world, their decision-making processes, and their personality profile".[280] Article 13, Paragraph 2, of the Swiss Federal Constitution provides that "[e]very person has the right to be protected against the misuse of their personal data".[281] This provision has been interpreted to mean that each person has the

[272] *Id.* at 6, 71.
[273] *Id.* at 74.
[274] India Const. art. 20(3) (India).
[275] *Smt. Selvi & Ors.*, at 3.
[276] *Id.* at 226.
[277] *Id.* at 225-26.
[278] *Id.* at 230-31.
[279] *Id.* at 246.
[280] Bärbel Hüsing et al., *Impact Assessment of Neuroimaging* 231 (2006), https://repository.publisso.de/resource/frl:3688947-1/data (Switz).
[281] Bundesverfassung [BV] [Constitution], Apr. 18, 1999, SR 101, art. 13, para. 2 (Switz.).

right to determine how one's personal data is used and disclosed.[282] Thus, the use of data obtained from brain imaging requires the informed consent of the data subject.[283]

4.3. EVOLUTION OF LAW AND SCIENTIFIC PROGRESS IN A MATURING SOCIETY

Former French Senator Michel Amiel writes that neuroscience does not teach lawmakers the precise age at which a person reaches maturity.[284] From what age should an individual be adjudicated as an adult? According to former Senator Amiel, setting such a specific age is within the responsibility of politicians, not scientists.[285]

When neuroscientific research is not reflected in legislation, courts' judgment and discretion enable the application of neuroscience. This crucial role of courts is exemplified in the case of *In re Monschke*. On March 11, 2021, the Supreme Court of Washington held that Section 10.95.030 of the Revised Code of Washington [hereinafter R.C.W.] violates the Constitution of the State of Washington.[286] Section 10.96.030(1) R.W.C. mandates a sentence of "life imprisonment without possibility of release or parole"[287] for all defendants above age the age of eighteen who commit aggravated first degree murder.[288] The Court noted that when the legislature enacted this statute, it "did not have the benefit of psychological and neurological studies" demonstrating that areas of the brain regulating the control of behavior "continue to develop well into a person's [twenties]".[289] The Court noted the State's argument that, since the exact age at which a person reaches maturity is uncertain, the court "may as well give up and let the legislature draw its arbitrary lines".[290]

Yet the Court refused to give up. The Court stated that "giving up would abdicate our responsibility to interpret the constitution".[291] Thus, the Court held that the

[282] Hüsing et al., *supra* note 280, at 232.
[283] *Id.* at 234.
[284] Sénateur M. Michel Amiel, *Neurosciences et responsabilité de l'enfant* [Neurosciences and responsibility of children], Office parlementaire d'évaluation des choix scientifiques et technologiques [Parliamentary office of evaluation of choices on science and technology], Assemblée nationale [National Assembly of France], Note n° 20, at 4, column 2 (Nov., 2019), https://www.senat.fr/fileadmin/Fichiers/Images/opecst/quatre_pages/OPECST_2019_0090_note_neurosciences.pdf (Fr.). *See also* Betty J. Casey et al., *Healthy Development as a Human Right: Insights from Developmental Neuroscience for Youth Justice*, Ann. Rev. L. Soc. Sci. 203, 211 (2020).
[285] Assemblée nationale [National Assembly of France], Note n° 20, at 4, column 2.
[286] *In re* Pers. Restraint of Monschke, 482 P.3d 276, at 287 (Wash. 2021).
[287] Wash. Rev. Code §10.095.030 ¶ 1 (2023), https://app.leg.wa.gov/rcw/default.aspx?cite=10.95.030.
[288] *Id.*; Restraint of Monschke, 482 P.3d, at 287.
[289] *Id.* at 285.
[290] *Id.*
[291] *Id.*

statute's "rigid cutoff at age [eighteen] combined with its mandatory language creates an unacceptable risk that youthful defendants without fully developed brains will receive a cruel [life without parole] sentence".[292]

Also remarkable was the Court's observation that "bright constitutional lines in the cruel punishment context shift over time in order to accord with the 'evolving standards of decency that mark the progress of a maturing society'".[293] What is a "maturing society"? It may mean a society that enriches its understanding of humans by absorbing what neuroscience unveils about the human brain and behavior. The "progress" of this "maturing society" includes questioning conventional notions such as responsibility, culpability, and free will.

People v. Brewer shows a glimpse of such progress. On February 8, 2021, the Appellate Court of Illinois ruled that "the law and the science demonstrate" that the eighty-year sentence that the defendant received for first degree murder committed when he was "barely [eighteen] years old" may violate the Eighth Amendment of the Constitution of the United States and the Proportionate Penalties Clause of the Constitution of Illinois.[294] The Court expressly acknowledged neuroscientific research, articulating that "[e]merging research indicates that the development of the young brain continues well beyond the age of [eighteen]".[295] The Court further observed that "[t]he law in Illinois has *evolved* to recognise the *reality* and *failed utility* of lengthy sentences for adolescents".[296]

People of the State of Michigan v. Miller also reflects the evolution of neuroscience. In this case, a jury convicted the defendant in 2003 for second-degree murder of a child.[297] The child was believed to have suffered from abusive head trauma [hereinafter A.H.T.].[298] However, in 2018, the defendant filed a motion for relief from judgment, presenting new scientific evidence that fulminant pneumonia caused the child's death, not A.H.T.[299] In response, the Court of Appeals of Michigan acknowledged that the "science underlying the [A.H.T.] diagnosis has evolved considerably since 2003". [300] The

[292] *Id.* at 286. *Cf.* People v. Osborne, No. 346867, 2021 WL 941437, at 4-5 (Mich. Ct. App. Mar. 11, 2021) (noting the prohibition of the mandatory nature of a sentencing scheme for juvenile offenders); People v. Cortez, No. 4-19-0158, 2021 WL 926289 (Ill.App.Ct. 2021) (affirming life sentence for first degree murder committed at age eighteen, citing trial court's characterization of "the nature and the circumstances of the offense" as "horrible" and "almost beyond description").
[293] Restraint of Monschke, 482 P.3d, at 282 (citing Trop v. Dulles, 356 U.S. 86, at 100-101 (1958)).
[294] People v. Brewer, No. 1-17-2314, 2021 WL 431889, at 1, 3 (Ill. App. Ct. 2021).
[295] *Id.* at 4.
[296] *Id.* at 5 (emphasis added).
[297] People v. Miller, No. 346321, 2021 WL 1326733, at 1 (Mich. Ct. App. Apr. 8, 2021).
[298] *Id.*
[299] *Id.*
[300] *Id.*

Court, therefore, ruled that "newly discovered, noncumulative scientific evidence necessitated a new trial at which a different result was probable".[301] In these ways, progress in neuroscience is having a palpable impact on adjudication.

Does the principle of *stare decisis* prevent courts from incorporating neuroscience into their analysis? In *State v. Kirkland*, the Supreme Court of Ohio cited precedent to explain that "we have seldom ascribed much weight in mitigation to a defendant's unstable or troubled childhood".[302] Thus, the Court was not persuaded by the defence's argument that the defendant experienced "childhood abuse and neglect", which led to post-traumatic stress disorder, which then resulted in the defendant's inability to "conform to the norms of the law".[303] However, to what extent should the legal system impose an obligation on courts to adhere to precedent when they evaluate neuroscientific findings? *State v. Kirkland* was decided in 2020.[304] The Court cited precedent from 1989 and 2002.[305] Could strict adherence to these precedents prevent the Court from applying neuroscientific findings, made since 2002,[306] which illuminate how childhood trauma and civilian post-traumatic stress disorder can have long-term, adverse effects on individuals' ability to control their behavior?

United States v. Dreyer presents an example of a departure from long-standing precedent in order to bring greater humanity to the criminal justice system.[307] In this case, the defendant was convicted of conspiring to distribute controlled substances.[308] Three reports by four medical experts indicated that the defendant suffered from "early stage frontotemporal dementia".[309] The Court of Appeals for the Ninth Circuit concluded that the defendant should have been granted a competency hearing before sentencing.[310] The dissent stated that the "majority's conclusion is a significant expansion of existing precedent, under which we have found plain error only when the quality and magnitude of mental health evidence far exceeded what has been presented in this case".[311] It seems proper and more humane to evaluate whether a defendant is competent to undergo sentencing proceedings when three medical reports have unanimously concluded that the defendant is affected by "early stage frontotemporal

[301] *Id.*
[302] State v. Kirkland, 157 N.E.3d 716, 749 (Ohio 2020).
[303] *Id.* at 749.
[304] *Id.* at 716.
[305] *Id.* at 749.
[306] *See, e.g.*, Sachiko Donley et al., *Civilian PTSD Symptoms and Risk for Involvement in the Criminal Justice System*, 40 J. Am. Acad. Psychiatry L. 522 (2012).
[307] United States v. Dreyer, 705 F.3d 951 (9th Cir. 2013).
[308] *Id.* at Synopsis, Background.
[309] *Id.* at 954.
[310] *See id.* at 953.
[311] *Id.* at 954.

dementia". This case suggests that the incremental development of case law in the United States engenders hope for bringing humanity into the justice system, despite the principle of *stare decisis*.

In Japan, the High Court of Takamatsu found in 2016 that the Trial Court's refusal to consider neuroscientific evidence was unlawful.[312] In this case, the defendant stole four items.[313] The defence counsel sought the opinion of an expert who stated that the defendant might have suffered from frontotemporal dementia at the time of the theft.[314] The defence counsel filed a request for an official psychiatric evaluation in order to ascertain the presence and degree of the defendant's criminal responsibility.[315] The Court of First Instance declined the request for psychiatric evaluation and did not seek an expert opinion on psychiatry.[316] The High Court found that this procedure was unlawful because it "clearly has influence on the final ruling".[317] Thus, the High Court vacated the ruling and remanded for further proceedings.[318] This example evokes the concept of willful blindness. Even though neuroscientific evidence was likely to be relevant, the Court declined to consider it. Although there are debates concerning the reliability of neuroscientific evidence, it has the possibility of providing considerable insight into human cognition and behavior. The High Court's ruling highlights the importance of taking advantage of this possibility and opportunity in order to determine what was transpiring in the mind and body of the defendant during the alleged crime.

[312] Ogata Ayumi, *supra* note 228, at 10 (citing and discussing Decision of High Court of Takamatsu of 2016).
[313] *Id.*
[314] *Id.*
[315] *Id.*
[316] *Id.*
[317] *Id.*
[318] *Id.*

4.4. HUMANE USE EXCEPTION IN PATENT LAW FOR FACILITATING NEUROSCIENTIFIC TECHNOLOGY

Case law suggests that intellectual property law might limit the application and research of neuroscientific technology. Companies claim to own intellectual property involving brain fingerprinting technology.[319] A different corporation claims that it is the true owner of intellectual property concerning brain-fingerprinting technology.[320] This corporation sought an order enjoining another company from selling and licensing this technology.[321] The definition of "brain fingerprinting technology" covered by the corporation's proposed order was ambiguous.[322] For example, it was uncertain whether the definition includes the electroencephalography system.[323]

Such disputes might impose restrictions on the research, development, and applications of neuroscientific technology. These restrictions could limit the benefits that neuroscience brings to society and to the legal system. For instance, in *Brainwave Science v. Life Science and Technology* , a forensic neuroscientist stated that adjudication concerning intellectual property agreements "would adversely affect [his] rights to use his research, pursue his profession as a forensic neuroscientist, and practice his invention".[324]

Brain fingerprinting technology helps provide the justice system with insights into human cognition. Neuroscience contributes to the administration of justice, helps prevent excessive incarceration, and can save lives from capital punishment. It can lead to informed, insightful, and humane judicial determinations. Neuroscientific technology thus has the potential to benefit society and the justice system.[325] How can intellectual property law facilitate applications and research in neuroscientific technology?

Creating a "humane use exception" in intellectual property law might alleviate unnecessary restrictions imposed by intellectual property litigation. This exception would allow researchers to use patented technology in neuroscience to develop their

[319] Neuro Science Technologies LLC v. Farwell, C20-1554 TSZ, 2020 WL 7425603, at *1 (W.D.Wash. Dec. 18, 2020); E. Hedinger AG v. Brainwave Sci., LLC, 363 F. Supp. 3d 499, 503 (D. Del. 2019) (involving a party claiming to be the "lawful owner" of brain fingerprinting technology).

[320] Brainwave Science v. Life Science and Technology LLC, 2:19-CV-00167-F, 2020 WL 572751, at *2 (D.Wyo. Jan. 9, 2020).

[321] *Id.*

[322] *Id.*

[323] *Id.*

[324] Brainwave Science Inc v. Life Science and Technology LLC, 2:19-CV-00167-F, 2019 WL 7842548, at *2 (D.Wyo. Dec. 12, 2019). *Cf.* Charleston Medical Therapeutics v. AstraZeneca Pharmaceuticals, 2:13-CV-2078, 2016 WL 7030743, at *5 (D.S.C. Feb. 19, 2016).

[325] *See*, *e.g.*, A. M. Jeannotte, K. N. Schiller, L. M. Reeves, E. G. Derenzo & D. K. McBride, *Neurotechnology as a public good: Probity, policy, and how to get there from here*, *in* Scientific and Philosophical Perspectives in Neuroethics 302-303, 315-316, 320 (James J. Giordano & Bert Gordijn eds., Cambridge University Press, 2010) (U.K.).

research. It would also permit various applications of such technology in ways that generate social benefit through humane use. The Courts should have broad discretion to apply this "humane use exception" to each particular case by evaluating the ramifications and potential social benefits of permitting such uses.

CONCLUSION

In the Second Epilogue of "War and Peace", Tolstoy implied that how free will impacts history is just as undefinable and esoteric as how kinetic forces move planets in the universe.[326] Criminal adjudication involves the difficult task of discerning a person's mind which is intangible, invisible, and ephemeral. This determination is challenging because observing a person's conduct does not always yield the truth about the person's mental state or background. What seems to be a cold-blooded murder might be the tragic consequence of a struggle by an individual tormented by the recurrence of violent thoughts and sudden impulses to engage in aggression. What appears to be the truth might be far from the truth. Yet criminal law requires courts to make definitive findings about *mens rea*. Law requires courts to make determinations that are difficult or even impossible to determine.

Neuroscience bridges this gap.[327] Neuroscience brings insights into biological and chemical phenomena hidden behind the façade of human appearance and behavior. It provides critical information that helps understand why a person behaved in a certain way. Neuroscience teaches that individuals who appear to be acting with their "free will" might in fact lack the cognitive capacity to control their thoughts and behavior. Neuroscience thus supports the search for truth in criminal adjudication.

Discoveries, however, often generate additional questions. Insights stimulate further inquiries and even controversy. In the web of debates concerning the application of neuroscience to law, it is crucial to keep in mind what is important in law. Adjudication is not always the mechanical application of rules. The justice system should render justice. Rendering justice requires figuring out, to the greatest extent possible, what exactly occurred in a case. Neuroscience can aid in this mission. As a potential source of illumination, neuroscience merits being applied in the justice system circumspectly to augment the good in society and to render justice.

[326] Tolstoy, *supra* note 1, Second Epilogue, Chapter X.
[327] *See*, *e.g.*, May et al., *supra* note 227, at 18.