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Greetings,

I have attached my forthcoming book chapter for the AALS Legal Scholarship and Interdisciplinarity Panel, co-sponsored by Law and the Humanities on Friday, January 10, 2025:

> Deborah W. Denno, *The Neuroscience of Brain Injury in Criminal Cases: An International Scope*, in NEUROSCIENCE IN CRIMINAL JUSTICE SYSTEMS: THE POSITIVE IMPACT OF NEUROJUSTICE. London: Routledge Press __ (Hannah Wishart & Colleen Berryessa, eds. 2025) (draft under review)

The chapter is a springboard piece from a book I am currently writing, entitled CHANGING LAW'S MIND: HOW NEUROSCIENCE CAN HELP US PUNISH CRIMINALS MORE FAIRLY AND EFFECTIVELY (Oxford University Press, forthcoming). The chapter is in draft form, and I look forward to incorporating comments stemming from this session.

My PowerPoint presentation for the January 10 panel will put the attached chapter in a broader context with the overall goals of my book and the interdisciplinary nature of the Twelve Decade Neuroscience Study I'm examining.

Thank you and best wishes,

Debby

The Neuroscience of Brain Injury in Criminal Cases: An International Scope

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Introduction

At its broadest, neuroscientific evidence is "any information related to the brain."[1] Folded into this definition are brain injuries, typically "caused by a bump, blow, or jolt to the head" or by a "penetrating" source, such as a gunshot wound.[2] Survivors of brain injuries can experience health problems as severe and lifelong as a chronic disease.[3] With brain injuries impacting a large portion of the criminal population worldwide,[4] this chapter takes a critical look at the brain injury cases

[1] Darby Aono, Gideon Yaffe, and Hedy Kober, 'Neuroscientific Evidence in the Courtroom: A Review' (2019) 4(40) Cognitive Res.: Principles and Implications 3. Other references have more specific definitions of "neuroscience." According to one source, for example, "neuroscience" is "[t]he scientific study of the structure and function of the nervous system; includes experimental and clinical studies of animals and humans." Owen D. Jones, Jeffrey D. Schall and Francis X. Shen, Law and Neuroscience (2nd Edn, Aspen Publishing 2020) 931.

[2] U.S. Centers for Disease Control and Prevention, 'About Moderate and Severe TBI', *Traumatic Brain Injury & Concussion* <https://www.cdc.gov/traumatic-brain-injury/about/moderate-severe-tbi.html> accessed 22 November 2024.

[3] Ibid.

[4] E. Durand, M. Chevignard, A. Ruet, A. Dereix, C. Jourdan, and P. Pradat-Diehl, 'History of Traumatic Brain Injury in Prison Populations: A Systematic Review' (2017) 60(2) Annals of Physical and Rehabilitation Medicine, 95-101; Shelby Hunter, Lauren E. Kois, Ashley T. Peck, Eric B Elbogen, and Casey LaDuke, 'The Prevalence of Traumatic Brain Injury (TBI) Among People Impacted by the Criminal Legal System: An Updated Meta-Analysis and Subgroup Analyses' (2023) 47(5) Law and Human Behavior, 539–565 <https://doi.org/10.1037/lhb0000543>; D. O. Lewis, J. H. Pincus, M. Feldman, L. Jackson, and B. Bard, (1986) 'Psychiatric, Neurological, and Psychoeducational Characteristics of 15 Death Row Inmates in the United States', (1986) 143(7) The American Journal of Psychiatry, 838-845; Brett S. Schneider, David B. Arciniegas, Carla Harenski, Gerard Janez Brett Clarke, Kent A. Kiehl, and Michael Koenigs, 'The Prevalence, Characteristics, and Psychiatric Correlates of Traumatic Brain Injury in Incarcerated Individuals: An Examination in Two Independent Samples' (2021) 35(14) Brain Injury, 1690-1701; Eric J Shiroma, Pamela L Ferguson, and E Elisabeth Pickelsimer, 'Prevalence of Traumatic Brain Injury in an Offender Population: A Meta-Analysis' (2010) 16(2) Journal of Correctional Health Care, 147-159; and U.S. Centers for Disease Control and Prevention, 'TBI and Correctional Facilities', *Traumatic Brain Injury & Concussion* <https://www.cdc.gov/traumatic-brain-injury/health-equity/correctional-facilities.html> accessed 21 November 2024.

within my U.S. Neuroscience Study[5] and compares the results with empirical research conducted in six different countries: Australia,[6] Canada,[7] England and Wales,[8] the Netherlands,[9] and Slovenia.[10] Altogether, the studies show a double-edged-sword continuum of how various criminal justice systems treat brain-injured defendants, why countries differ in their approaches, and what the future holds for such influential and ever-evolving information.

The term "brain injury" needs clarifying. For purposes of consistency, the discussion that follows treats "brain injury" as synonymous with "head injury" and "brain damage" and focuses on external causes, such as blunt force injuries (like a car accident) or penetrations (such as a gunshot wound). The term also includes more internal-type sources of brain injury, such as dementia or alcohol-induced brain damage. There are differing definitions and consequences of "brain injury" depending on the injury's type and seriousness and whether it can be classified as "traumatic brain injury" (TBI). [11]

Part I of this chapter describes and compares the international studies noting that, despite some of their methodological differences, all studies included a defendant's brain injuries as a component of their definition of neuroscience. Part II analyzes how these studies examine brain-injured defendants in particular, pinpointing the reigning perspective of the double-edged sword. The double-edged sword concept suggests that when neuroscientific evidence is presented in a case, it may produce "a more lenient sentence in some instances but a harsher punishment in others."[12] In examining brain injury specifically, there appear to be especially revealing insights into the double-edged sword effect that are not as transparent when considering the impact of neuroscientific evidence as a whole. Likewise, different countries' criminal justice systems react more leniently or harshly to brain injury evidence in their sentencing of criminal defendants, which

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[5] Deborah W. Denno, 'The Myth of the Double-Edged Sword: An Empirical Study of Neuroscience Evidence in Criminal Cases' (2015) 56(2) BCLRev 493; Deborah W. Denno, 'How Experts Have Dominated the Neuroscience Narrative in Criminal Cases for Twelve Decades: A Warning for the Future' (2022) 63 William & Mary LRev 1215.

[6] Armin Alimardani and Jason Chin, 'Neurolaw in Australia: The Use of Neuroscience in Australian Criminal Proceedings' (2019) 12(3) Neuroethics, 255; Armin Alimardani 'An empirical study of the use of neuroscience in sentencing in New South Wales, Australia' (2023) 14 Frontiers in Psychology, 1.

[7] Jennifer A. Chandler, 'The Use of Neuroscientific Evidence in Canadian Criminal Proceedings' (2015) 2(3) JLBiosciences 550.

[8] Paul Catley and Lisa Claydon, 'The Use of Neuroscientific Evidence in the Courtroom by Those Accused of Criminal Offenses in England and Wales' (2015) 2(3) JLBiosciences 510.

[9] C. H. de Kogel and E. J. M. C. Westgeest, 'Neuroscientific and behavioral genetic information in criminal cases in the Netherlands' (2015) 2(3) JLBiosciences 580.

[10] Miha Hafner, 'Judging Homicide Defendants by Their Brains: An Empirical Study on the Use of Neuroscience in Homicide Trials in Slovenia' (2019) 6(1) JLBiosciences 226.

[11] See, for example, '§73.06 Management of head injury: Overview' in 4 Medical Malpractice: Guide to Medical Issues §73.06, Matthew Bender & Company, Inc. (2024); National Institute of Neurological Disorders and Stroke, '*Traumatic brain injury: Hope through research'*, (2020) <https://catalog.ninds.nih.gov/sites/default/files/publications/traumatic-brain-injury-hope-through-research_1.pdf> accessed 22 November 2024; '§39.18 Traumatic brain injury, listing 11.18' in 5 Social Security Practice Guide §39.18, Matthew Bender & Company, Inc. (2024); and Erin B. Wasserman and Kevin M. Guskiewicz, '§24C.02 TBI defined' in 1 Forensic Sciences §24C.02, Matthew Bender & Company, Inc. (2024).

[12] Alimardani 'An empirical study of the use of neuroscience in sentencing in New South Wales, Australia' (n 6) 10; see also Denno 'The Myth of the Double-Edged Sword' (n 5) and Owen D. Jones and Francis X. Shen, 'Law and Neuroscience in the United States,' in Tade Spranger, (ed), International Neurolaw: A Comparative Analysis (Springer-Verlag Berlin Heidelberg, 2012 ed.) 349, 362 (both discussing the double-edged sword).

this chapter illustrates by way of a theoretical continuum. For example, Slovenia represents one end of the continuum with a mitigating outlook on brain injury and an optimistic view that brain-injured defendants can be rehabilitated. In contrast, England and Wales constitute the other end of the continuum with a more aggravating and punitive perspective toward defendants with brain injuries. This continuum also highlights courts' potential biases and misjudgments concerning whether they believe defendants' brain injuries can be improved with rehabilitation--a perspective backed by science--or whether they view such injuries as permanent, making rehabilitation unlikely and defendants a "future danger" at risk of recidivism.[13]

I. Neuroscientific Evidence in Criminal Cases Worldwide

The international studies empirically investigated how the criminal justice systems in their respective countries used neuroscientific evidence, including indicators of brain injuries. While the studies differed in a variety of ways methodologically, their substantially shared approaches enable a type of comparison that pieces together the purpose and impact of head injury information in the courtroom and how it may be used in the future.[14]

As Table 1 shows, all studies examined their country's application of neuroscientific evidence during a particular time frame[15] and all relied on data derived from widely used legal databases, such as Westlaw or Lexis, or their country's specialized legal database. As would be expected, studies relied on varying definitions of "neuroscience" that corresponded with their goals and the type of information available in their respective databases. Yet, as Table 2 notes, on a more operational level, most studies investigated two types of neuroscientific evidence that attorneys introduced into the courtroom: (1) neuroimaging tests, such as M.R.I., C.T., and P.E.T. scans, which image the brain's structure and function; and (2) non-neuroimaging tests, including psychometric tests, which measure the brain's structure and function without imagining.[16] In addition, most criminal cases in all studies depended on expert witnesses who discussed a defendant's cognitive abilities and medical history, with or without reliance on neuroscientific testing.[17] It is often through the use of testifying experts that researchers could assess the impact of a defendant's brain injuries or other disorders on a defendant's behavior. That behavior predominantly involved a crime of violence, as Table 2 indicates.

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[13] Annie Liontas, 'Reckoning with the connection between brain injuries and criminal behavior,' *NYTimes* (30 November 2024) <https://www.nytimes.com/2024/11/30/opinion/brain-injury-incarcerations-crime.html?unlocked_article_code=1.eE4._cGN.2HRAjdpXmHgf&smid=url-share> accessed 30 November 2024.

[14] More detailed methodological comparisons of these studies (apart from the research in Australia) can be found in Deborah W. Denno, 'Empirical Use of Neuroscientific Evidence in Criminal Justice' The Encyclopedia of Behavioral Neuroscience (2nd ed) (Amsterdam, Netherlands: Elsevier, Sergio Della Salla, ed 2022) 719; Deborah W. Denno, 'Vulnerable defendants and neuroscience in courtrooms throughout the world' in Hannah Wishart and Colleen M. Berryessa (eds) *Neurolaw in the Courtroom: Comparative Perspectives on Vulnerable Defendants (series in contemporary issues in criminal justice and procedure)* (1st ed., New York: Routledge 2023) 3-20.

[15] The research in Australia did not specify a start date for the study's time frame, instead indicating that the study examined all available cases in the Australian databases up to 2016. Alimardani 'Neurolaw in Australia' (n 6) and Alimardani, 'An empirical study of the use of neuroscience in sentencing in New South Wales, Australia' (n 6). Alimardani's 2023 article only looked at the New South Wales jurisdiction.

[16] For more detail (apart from the research in Australia), see Denno 'Empirical Use of Neuroscientific Evidence in Criminal Justice' (n 14) and Denno 'Vulnerable defendants and neuroscience in courtrooms throughout the world' (n 14).

[17] Denno 'Empirical Use of Neuroscientific Evidence in Criminal Justice' (n 14) 721.

The type of crime could also influence the phase at which attorneys would present neuroscientific evidence, which is a critical component of how this information could impact defendants, as Table 3 delineates. For example, if evidence is presented at the pre-trial phase by either the defense or the prosecution, it may be an effort to garner a plea bargain or dismiss a case. At the trial stage, which determines guilt or innocence or anything in-between, such as the acceptance of the insanity or diminished capacity defenses, the evidence could be used to suggest why a defendant may not have the requisite mental state for committing the crime charged or why they may have acted in self-defense. Lastly, neuroscientific evidence could be employed at the sentencing phase to establish the defendant's penalty, assuming they were convicted at trial.

Table 3 shows that, for all countries, neuroscientific evidence was incorporated at all three phases of a criminal proceeding. Yet, it was most widely applied in all countries during the sentencing phase.[18] At all phases, the most common purpose for neuroscientific evidence was to mitigate the level of the crime for which a defendant was charged (for example, to lessen a murder down to manslaughter) or to reduce a defendant's sentence. The exception was Catley and Claydon's study of England and Wales which revealed that, while neuroscientific evidence could mitigate, the evidence was most commonly employed by prosecutors to aggravate a defendant's sentence by specifying the extent of a victim's injuries or cause of death. This author's U.S. study reported that prosecutors applied neuroscientific evidence for a similar purpose (to clarify the extent of the victim's injuries) but with less frequency than was found in Catley and Claydon's research.[19]

The Australian study also noted the use of neuroscientific evidence by prosecutors, explaining that because "prosecutors have a duty to provide all relevant evidence to the court that would assist in a determination of a sentence," they then "have a duty to present neuroscientific evidence at criminal hearings regardless of the influence that it may have on the punishment and whether it may reduce or aggravate the sentence."[20] According to the authors, defense attorneys, therefore, may fail to introduce neuroscientific evidence out of a concern that prosecutors may use it to aggravate the punishment[21]-- a practice also documented in Denno's study. However, it is important to note that other studies may have excluded examining the prosecutor's role in this respect, considering it outside the scope of their focus and therefore leaving a gap in how much this issue differed across countries.

Other country-specific factors drove the use of neuroscientific evidence in court cases. For example, in Denno's U.S. study, nearly one-half of the defendants faced the death penalty, and the other half of the defendants were mostly incarcerated for life or long sentences.[22] Thus, in the U.S., neuroscientific evidence is more widely introduced at the sentencing phase as mitigation evidence, even though US attorneys introduce such evidence at the pretrial and guilt phases too. Regardless,

[18] The study in Australia looked only at the sentencing phase of its selected cases. Alimardani, 'An empirical study of the use of neuroscience in sentencing in New South Wales, Australia' (n 6).
[19] Deborah W. Denno, 'Concocting Criminal Intent' (2017) 105(2) GeoLJ 323.
[20] Alimardani, 'An empirical study of the use of neuroscience in sentencing in New South Wales, Australia' (n 6) 14.
[21] Ibid.
[22] Denno, 'The Myth of the Double-Edged Sword' (n 5) and Denno, 'How Experts Have Dominated the Neuroscience Narrative in Criminal Cases for Twelve Decades' (n 5).

while the countries analyzed in the other studies do not have the death penalty, neuroscientific evidence was most commonly used at the sentencing phase as well.

Lastly, every country addressed some form of brain injury evidence and its impact, as indicated by Tables 2 and 4. Each country appears to treat such evidence differently depending on the goals and perspectives of their respective criminal justice systems. Part II discusses these variations in more depth, emphasizing how each country falls within the framework of a double-edged sword continuum. This progression reflects a combination of weights between mitigation, aggravation, and prospects for defendant rehabilitation.

II. The Special Case of Brain Injury

An overview of how different countries use neuroscientific evidence puts into context the special case of a defendant's brain injury. First, such a focus shows that neuroscientific evidence is not a one-size-fits-all concept, as Table 1 indicates. Criminal justice actors, including judges and juries, may interpret some kinds of neuroscientific factors as more fixed and unchangeable and, therefore, less amenable to rehabilitation. Because a serious brain injury can be a chronic condition that can manifest itself in different ways across a lifetime, it may seem more permanent and predictive of a defendant's future dangerous behavior. Second, this proclivity suggests that attorneys need to learn the intricacies of introducing various types of neuroscientific evidence in court, knowing that criminal justice actors, such as judges and juries, may react along a continuum between the desire to view the evidence as mitigating or aggravating. Lastly, brain injury is a particularly effective vehicle for illustrating the complexities of the double-edged sword effect. As a result, this author conducted a specific study of U.S. brain injury cases, which the following pages describe.

1. The Double-Edged Sword Concept: A Closer Look

The double-edged sword concept refers to the impact of neuroscientific evidence on judicial outcomes that can induce either mitigation or aggravation of a sentence depending on how courts interpret the circumstances. This concept is addressed in some capacity by all the studies this chapter analyzes. A closer look at *Odle v Calderon*,[23] a particularly serious U.S. brain injury case helps explain how multiple types of neuroscientific evidence can clarify or interplay with the impact of a defendant's brain injury and whether that injury may be interpreted as a double-edged sword.

In *Odle*, the defendant, James Odle, was convicted of the first-degree murder of two different people, including a police officer, after he had been drinking and taking drugs.[24] He was then sentenced to death.[25] Odle brought forth an ineffective assistance of counsel claim, which he won on appeal, arguing that his counsel failed to present expert testimony at trial related to Odle's

[23] 919 F. Supp. 1367, 1376 (N.D. Cal. 1996).
[24] *People v. Odle*, 754 P2d 184, 187 (Cal. 1988).
[25] Bob Egelko, 'Double murderer on death row dies,' B3, at Death Row prisoner James Odle, who killed Amber Swartz-Garcia's father, dead at 71' *San Francisco Chronicle* (22 December 2020) <https://www.sfchronicle.com/crime/article/Death-row-prisoner-James-Odle-who-killed-Amber-15820763.php> accessed 30 November 2024.

mental condition and statutory mitigating factors.[26]

That evidence included the results from an EEG test conducted on Odle that suggested Odle suffered from brain damage.[27] As the court noted, Odle was "missing a piece of his brain the size of a grapefruit," and his brain deficits were obvious.[28] EEG results also corroborated expert and lay witness testimony describing Odle's erratic behavior and brain disorders.[29]

Odle's background revealed that his mental deficiencies commenced in 1973 when he was in a car accident and experienced "severe trauma to his brain."[30] As a result, a surgeon "performed a temporal lobe lobectomy, removing a 3 x 3 x 4 inch piece of his brain."[31] According to the defense expert, "Odle's brain injury would probably cause behavioral disturbances beyond his control," a diagnosis "consistent with Odle's complaints, documented during his hospitalizations, that he often felt unable to control his impulses."[32] Indeed, after the surgery, Odle was committed to a mental hospital three times over the course of seven years and twice attempted suicide while in jail or prison before he engaged in the murders in 1980.[33]

Odle was originally determined to be competent to stand trial because he remained calm at trial. Remarkably, neither his attorney nor the trial judge questioned his capacity.[34] Yet, after a federal appellate court reversed that finding of competency, Odle and his lawyers continued to litigate his case to substantiate his ongoing mental disability and prevent his execution. In 2020, with litigation still continuing, Odle died of natural causes on death row.[35]

The varied and unresolvable interpretations of Odle's competency to stand trial illustrate the complexity of the neuroscience of brain injury in criminal cases. First, his own trial lawyer never questioned his competency and therefore withheld from consideration striking evidence of Odle's substantial impairment. Second, the federal court's overturning of Odle's competency decision suggested such information was powerfully mitigating because of the alternative explanations and hypotheses that it could have provided for Odle's crimes. Presumably, without such evidence of brain damage, a jury could have viewed Odle's violent conduct as far more threatening and dangerous.[36]

Odle lies at the core of the "double-edged sword" conflict concerning how the criminal justice system views the intersection of neuroscience and criminal law. In some countries, this tension may even be all the more pronounced in cases involving a defendant's brain injuries. While the introduction of neuroscientific evidence can diminish a defendant's level of blameworthiness because it is humanizing or explains a defendant's behavior, its double-edged sword potential can

[26] *Odle v. Woodford*, 238 F3d 1084, 1089 (9th Cir. 2001).
[27] Ibid 1088.
[28] Ibid 1089.
[29] Ibid 1087-88.
[30] Ibid 1087.
[31] Ibid.
[32] Ibid 1088.
[33] Egelko (n 25).
[34] Egelko (n 25).
[35] Egelko (n 25).
[36] *Odle v. Woodford* (n 26) 1088.

also bolster "judgments about [the defendant's] risk and dangerousness.[37]

Of course, despite the double-edged sword characterization, there are no clean lines here or all-or-nothing determinations. With respect to neuroscientific evidence generally, most studies did not find that court systems fully embraced the concept of a double-edged sword or that prosecutors routinely used neuroscience as an aggravating factor.[38] Nonetheless, evidence of a defendant's brain injury could trigger an exception in some countries, depending on that country's overall philosophy.

2. Country Differences in the Use of the Double-Edged Sword

A comparison of the international studies shows that countries generally appear to operate along an approximate continuum of mitigation and aggravation in terms of their embrace (or not) of the double-edged sword concept with respect to brain injuries. With the help of Table 4, this section examines all countries, starting with those that favor mitigation most and concluding with those that veer closer to aggravation. Within the scope of this continuum, this author found that some countries were more apt to treat a brain injury as mitigating if the defense could show "something more" on the defendant's behalf, such as the defendant's likely success at rehabilitation, in which case this author would label the country as "rehabilitation plus." Of course, this author's overview depends heavily on how other authors characterized their findings and the extent to which they pinpointed brain injury cases.

a. Slovenia: No Double-Edged Sword Effect: Mitigation and Rehabilitation

Of all countries, Slovenia stood out because Hafner detected no double-edged sword effect, and the system focused on mitigation and rehabilitation. In the 89 homicide cases involving neuroscientific evidence that Hafner studied, he reported "no evidence of the double-edged sword of neuroscience effect," and neuroscience was never introduced as an aggravating factor.[39] Instead, about one-fifth of the studied defendants were sentenced to compulsory psychiatric treatment, a disposition purportedly not intended to punish but to protect society (and the defendant) and provide rehabilitative treatment.[40] Similarly, while neuroscientific evidence was used to establish a defendant's future dangerousness in about one-quarter of the cases, this tactic was not used to promote more severe sentences in Slovenia "in the same way as observers of the double-edged sword effect report for other countries."[41]

Hafner's study mentioned a limited number of cases concerning a defendant's brain injury or brain damage. Of those cases, most injuries were attributable to a self-induced or "internal" condition, such as the defendant's extensive drug or alcohol abuse[42] or stroke or cerebral atrophy,[43] rather than an external injury, such as a blow to the head. Regardless, Hafner's account of the Slovenia system suggests that even if these injuries were regarded as chronic or unchangeable,

[37] Chandler (n 7) 574.
[38] Denno 'Vulnerable defendants and neuroscience in courtrooms throughout the world' (n 14).
[39] Hafner (n 10) 239-40.
[40] Ibid 241.
[41] Ibid 241-42.
[42] Ibid 236.
[43] Ibid 244.

they would not be viewed differently from other neuroscientific disorders. As he explained, "courts never presumed in advance that the defendant's dangerous behavior rooting in his neurological condition could not be changed."[44] Likewise, "the criminal justice system never gave up—at least expressly—on the idea of rehabilitation even for the perpetrators of most severe crimes."[45]

b. The United States: No Substantial Evidence of a Double-Edged Sword Effect

In most cases of extreme violence in the United States, the potential of a defendant's rehabilitation is far less, if ever, a factor with respect to neuroscientific evidence because the death penalty or the prospect of a harsh sentence looms. Generally, individuals are either going to be executed, remain on death row for years, or be incarcerated for a lifetime or close to it.[46] Therefore, rehabilitation is not considered relevant in the way it could be in non-death penalty countries where sentences are far less severe.

My U.S. Neuroscience Study also did not show substantial evidence of a double-edged sword framework. In cases in which neuroscientific evidence was an issue, for the most part, defense attorneys wanted to introduce such evidence on behalf of their clients to mitigate their clients' punishment or criminal charges. In contrast, prosecutors wanted to exclude neuroscientific evidence, with the exception of cases in which the evidence pertained to victims' injuries, especially Shaken Baby Syndrome.[47] In the small portion of cases in which prosecutors used neuroscientific evidence to suggest aggravation, that evidence was predominantly introduced by defense attorneys in ineffective or damaging ways, only to be used against their clients by prosecutors. For example, if the testimony of a defense expert indicated that the defendant's behavior could be possibly problematic at some point, a prosecutor could take that information and argue that the defendant could be a future danger, therefore suggesting that the death penalty or life in prison without the possibility of parole would be the best outcome.[48]

In reviewing the various empirical studies discussed in this chapter, brain injuries stood out for providing insights into the double-edged sword effect that was not as apparent when considering the impact of neuroscientific evidence generally. For the purposes of this chapter, I wanted to know if the concept of a double-edged sword would be more pronounced in cases involving a brain injury in my U.S. Neuroscience Study, given that brain injuries could be viewed as less mitigating. Therefore, this author examined all listed head injury scenarios in my Study's universe of 7,776 defendant cases during the twelve decades from 1900 to 2020.[49] There were four key findings:

- While a substantial percentage of incarcerated individuals have brain injuries,[50] a defendant's brain injury will not always be one of the items listed in a criminal case

[44] Ibid 242.
[45] Ibid 242.
[46] Denno, 'The Myth of the Double-Edged Sword' (n 5).
[47] Deborah W. Denno, 'How prosecutors and defense attorneys differ in their use of neuroscience evidence', (2016) 84 *Fordham Law Review*, 453-79; Denno, 'Concocting Criminal Intent' (n 19).
[48] Denno, 'The Myth of the Double-Edged Sword' (n 5).
[49] See Denno, 'How Experts Have Dominated the Neuroscience Narrative in Criminal Cases for Twelve Decades' (n 5) for a fuller description of the twelve-decade neuroscience study.
[50] See the articles listed in (n 4).

involving neuroscientific evidence from Westlaw or Lexis because so many other factors may be more relevant. Of the 7,776 defendant cases in the Neuroscience Study, 601 (7.73 percent) were found to raise information about a defendant's brain injury.[51]

- Not surprisingly, cases mentioning a brain injury increased over time (from 1990 to 2020). Either brain injuries among defendants have increased, or they have become medically more detectable, or cases are more apt to include "brain injury" in their list of neuroscientific evidence. Regardless, from 1900 to 1980, cases mentioned a defendant having a brain injury only four or five percent of the time, whereas that number grew incrementally over the decades to 14 percent by 2020.[52]
- A comparison of brain injury cases to cases in which no brain injury was mentioned revealed no difference in prosecutors' willingness to argue that a defendant was a future danger. In both categories of cases, a future dangerousness issue related to neuroscience was rare, occurring in only four percent of the time. For example, only 26 cases (4%) of the 601 brain injury defendant cases concerned future dangerousness.[53]
- Of these 26 future dangerousness cases brain injury cases, 17 (65%) cases had a future dangerousness issue that was related specifically to the defendant's brain injury, and 9 (35%) cases had a future dangerousness issue that was not related to the defendant's brain injury and instead pertained to another neuroscientific condition that the defendant possessed.

While there was no substantial evidence of a double-edged sword effect in the U.S. Neuroscience Study, including in brain injury cases, that does not mean it did not exist. A prosecutor's strong and successful future dangerousness argument could provide powerful sway. When relevant, such an approach would highlight the intractability of a defendant's brain injury. For example, in *People v. Buss*,[54] the prosecution successfully contended that the defendant's brain injury and neurological issues stemming from it served as aggravating evidence of the defendant's potential for future dangerousness. At trial, testimony was presented that the defendant "suffered from parental neglect, a lack of social skills, learning difficulties, and abnormal brain functioning because of a head injury as an infant."[55] According to the prosecution, this information showed that Buss was a danger to society, noting that one state expert depicted the defendant as "a 12 on a scale of 1 to 10 for dangerousness."[56] The court concluded that while the defendant demonstrated "little violent behavior while incarcerated," even his own experts testified that the defendant's calm was due to the prison's controlled environment. In addition, the defendant's own experts concluded "he is dangerous to himself and others and suffers from neuropsychological problems that cannot be remedied."[57]

[51] Information on file with the author.
[52] Information on file with the author.
[53] A future dangerousness issue related to neuroscience was presented in 343 (4%) of the 7,776 defendant neuroscience cases. The 343 number comes from adding the 26 brain injury-related future dangerousness cases and the 317 non-brain injury-related future dangerousness cases. The 4% figure remained stable even when the I subtracted out the 26 cases from the 343 cases.
[54] 718 N.E.2d 1 (Ill. 1999).
[55] Ibid.
[56] Ibid.
[57] Ibid.

Such an argument was attempted but unsuccessful in *United States v. Runyon*.[58] There, the court dismissed a claim of ineffective assistance of counsel when defense counsel omitted key neuroscientific information on the defendant's behalf. On appeal, defense expert testimony suggested that Runyon's history of head injuries, including car accidents and a blast injury, may have caused mild, diffuse brain damage, particularly in the brainstem and frontal lobe.[59] Defense counsel also tried to dampen any suggestion of Runyon's future dangerousness with mitigating expert testimony stating that Runyan posed little risk of violence while incarcerated.[60] Yet the prosecution countered that strategy, stating that Runyon's evidence of brain injury was "weak and, even if the jury credited it, 'was double-edged,' as it 'could have strengthened government arguments about Runyon's dangerousness.'"[61] While the court found that the defense counsel's actions were reasonable and did not violate Runyon's Sixth Amendment rights, "given the double-edged nature of the defendant's brain injury,"[62] on appeal the Circuit Court concluded differently, remanding the case on the basis that counsel failed to investigate Runyon's mental health evidence and should have.[63]

Overall, *Buss* and *Runyon* demonstrate how a double-edged sword interplay works because both cases consider mitigation and future dangerousness arguments, albeit with differing outcomes. While the cases are outliers--future dangerousness is infrequent when neuroscience is involved--it bears emphasizing how much the U.S. differs from a country like Slovenia, where there is optimism not just towards mitigation but also rehabilitation.

c. Australia: A Double-Edged Sword Plus Effect: Mitigation with Rehabilitation

Both Australian studies (2019, 2023) specifically addressed the double-edged sword concept in the criminal cases they examined. According to the 2019 study, Australia has acknowledged the concept of a double-edged sword involving neuroscientific evidence "since at least 1979."[64] Likewise, the 2019 study noted two "highly cited judgments," where evidence of the defendant's brain damage was both a mitigating factor that reduced the defendant's culpability and an aggravating factor that bolstered arguments that the defendant was a future danger to society.[65] In balancing both factors, the courts seemingly reached a compromise verdict, finding the defendant guilty of manslaughter while "acting under a substantial abnormality of the mind arising from his brain damage."[66]

In the 2023 study focusing solely on sentencing cases in South Wales, the discussion noted that neuroscientific evidence was "substantially" more mitigating than aggravating.[67] In those cases where neuroscientific evidence impacted the sentence, the sentence was far more apt to support leniency (85%). In turn, Alimardani explained that there was only one case in which

[58] 994 F.3d 192, 204 (4th Cir. 2021).
[59] Ibid.
[60] Ibid 214, 220.
[61] Ibid 204.
[62] Ibid.
[63] Ibid. 207-10.
[64] Alimardani, 'Neurolaw in Australia' (n 6) 263.
[65] Ibid (citing Veen v. R and Veen v. R (No 2).
[66] Ibid.
[67] Alimardani, 'An empirical study of the use of neuroscience in sentencing in New South Wales, Australia' (n 6) 5.

neuroscientific evidence was associated with a harsher sentence and did not also support a more lenient sentence. Only a small percentage of cases (5%) concluded that "neuroscience tended towards both mitigating and aggravating the sentence."[68]

The Australian criminal justice system also considers a defendant's potential for rehabilitation. A brain injury that was closely associated with the defendant's criminality may suggest that the defendant is a future danger; yet, if the court considers the injury treatable and the defendant amenable to rehabilitation the court may view the defendant as someone who is unlikely to offend again.[69] While the Australian studies appear less optimistic generally than the Slovenia study regarding rehabilitation, the Australian findings do seem to suggest an overall positive attitude toward rehabilitation for brain injury, thereby fitting into the "mitigation plus" category.

Perspectives toward the double-edged sword concept may also be inconsistent depending on the institution evaluating it. According to one Australian report, for example, courts hold a "concerning attitude . . . towards rehabilitation of offenders with an acquired brain injury, that nothing works for them (ie, therapeutic nihilism), while there are many studies that suggest otherwise."[70] Indeed, while there are two aggravating factors regarding neuroscientific evidence that worry courts -- the protection of society and specific deterrence-- courts more commonly cite protection of society in those cases where neuroscientific evidence appears to prompt a harsher sentence.[71]

Regardless, it is clear that courts consider the rehabilitative potential of neuroscientific evidence in brain injury cases. In *R v Peterson*, for example, the defense successfully argued for a partial defense for self-defense based on brain damage in a case in which the defendant was accused of murdering his friend.[72] Described as "a man of limited intellectual ability," two psychiatrists explained that the defendant also suffered from "executive dysfunction caused by frontal lobe damage," which impaired his capacity to control his behavior and foresee the consequences of his actions.[73] To reach a partial defense, the Supreme Court of Western Australia considered the medical evidence explaining the defendant's frontal lobe injury, especially in their evaluation of the reliability, voluntariness, and fairness of admissions he made to the police.[74]

Ultimately, the 2023 Australian study found that in most cases, neuroscience evidence primarily led to mitigation and was "rarely used as evidence for the offender's risk of recidivism."[75] Indeed, even when courts viewed the defendant as a potential danger, they considered his prospects for rehabilitation and whether the injuries were so severe the defendant could not recidivate.

d. The Netherlands: A Double-Edged Sword Plus Effect: Aggravation Unless with Rehabilitation

[68] Ibid 10.
[69] Ibid.
[70] Ibid 5.
[71] Ibid 7.
[72] Alimardani,'Neurolaw in Australia' (n 6).
[73] Ibid 529.
[74] Ibid 260.
[75] Ibid 263.

The Netherlands study by de Kogel and Westgeest noted the presence of a double-edged sword effect in some cases yet stressed that the impact would likely be strongest "in cases with a high risk of severe violence."[76] Likewise, the Dutch courts were amendable to evidence showing that defendants could potentially reduce their risk of recidivating. As noted in one of the cases the authors discussed, the experts found a defendant's organic brain defects as generally untreatable but could see the defendant's chances for improvement with rehabilitation efforts that may reduce the defendant's risk of recidivism.[77] Indeed, in some circumstances, courts viewed cases involving brain damage differently, suggesting that such defendants could be "extra vulnerable" to an extreme emotional state and that attorneys could cater their defenses accordingly.[78]

De Kogel and Westgeest reviewed a number of brain injury cases involving pre-frontal brain damage in which courts consider that the consequences of such damage could affect a defendant's behavioral choices, and therefore be mitigating. For example, in one case,[79] the court determined that the defendant's pre-frontal brain damage negated his level of premeditation for stabbing and killing his wife, thus reducing his sentence from murder to manslaughter. The court relied heavily on the neurologist's expert testimony concluding that the defendant could not control his impulses and therefore could not stop his behavior after it began.[80] While the court explained that typically a defendant would have sufficient time to ponder his actions in such a situation, the court instead credited the neuroscientific testimony for concluding otherwise, noting that "premeditation was not proven."[81]

Overall, The Netherlands study suggests that the concept of the double-edged sword is especially pronounced in brain injury cases. Because brain damage can mitigate the defendant's blameworthiness but aggravate the defendant's sentencing due to his purportedly untreatable condition, the circumstance creates a recidivism risk. That said, there is also a doubled-edged sword "plus" effect, indicating that mitigation is still possible despite a recidivism risk. Dutch courts are especially amenable to evidence of "opportunities of improvement" that may decrease the recidivism risk and alter the nature of this two-sided balance.

e. Canada: *A Double-Edged Sword Plus Effect: "Aggravation and Risk of Dangerousness"*

For a range of reasons, neuroscientific evidence was most commonly introduced in Canada to diagnose conditions related to a defendant's fetal alcohol spectrum disorders (FASD) and their resultant brain-damaging effects.[82] While Chandler acknowledges that evidence of other types of

[76] de Kogel (n 9) 601.
[77] Ibid 594.
[78] Ibid 596-97.
[79] Ibid 593 (discussing Court's Hertogenbosch Sept. 5, 2007, ECL:RBSHE:2007:BB2861).
[80] Ibid 593.
[81] Ibid 593. In addition, de Kogel and Westgeest surveyed a range of other brain injury cases in which courts recognized either that a defendant could potentially recidivate because of their condition and resultant lack of impulse control, or be amendable to rehabilitation therefore a reduced sentence, all highly dependent on the conclusions and recommendations of expert witnesses.
[82] Chandler (n 7) 557. For a thorough discussion of this association, see Denno 'Empirical Use of Neuroscientific Evidence in Criminal Justice' (n 14).

brain injury was not frequently introduced into court,[83] that statistic did not mean that such injuries did not exist in the criminal population, only that prenatal alcohol exposure was "more commonly raised and better documented."[84]

Likewise, in Canada, neuroscientific evidence created risks for the defendant if it were introduced because the likelihood of mitigation as opposed to aggravation was nearly equivalent.[85] Focusing on cases involving prenatal alcohol syndrome, evidence of resulting brain damage could be mitigating but judges also perceived it as "a source of increased risk of recidivism or pessimism about treatment,"[86] especially for more serious crimes where there were potential public safety concerns.[87]

It is challenging to determine how much of Canada's criminal justice system was influenced by the dominance of cases involving FASD because it was a factor present in so many cases. Likewise, it is difficult to assess whether judges are responding pessimistically to the FASD matter itself or to the condition of brain injury because the influences are so tightly intertwined. One particular case provides a clue. In *R. v. Steppan*, the defendant presented a lack of a specific FASD diagnosis and seemingly received a more lenient sentence as a result. As Chandler explains, for Steppan, "the hope for success in treatment may have been tied to the evidence that his cognitive limitations were not too severe, but it may also have been positively affected by the lack of an FASD diagnosis."[88] Chandler emphasizes that additional research is needed to assess "whether an explicit diagnosis of brain damage as an explanation for cognitive limitations and behavioral problems produces greater pessimism about rehabilitation than the observation of those symptoms alone."[89]

Regardless of this association, the double-edged sword analysis is alive and well in Canada. While neuroscientific evidence "tends to reduce moral blameworthiness . . . it also tends to increase judgements about risk and dangerousness, given the view (expressed often in the cases reviewed here) that brain injuries can sometimes be managed but not cured."[90] The dearth of existing alternatives to incarceration in Canada aggravates this dilemma. Even when Canadian judges view a defendant's brain damage as mitigating, appropriate services for treatment and containment simply do not exist, especially for brain-damaged defendants who may considered more dangerous.[91] Thus, the system remains stuck in a double-edged sword warp even as other countries stress the benefits of rehabilitation.

f. England and Wales: *A Double-Edged Sword Effect*

Catley and Claydon's study of England and Wales did not explicitly address the concept of

[83] Chandler (n 7) 558.
[84] Ibid 557.
[85] Ibid 569 (noting that neuroscientific evidence either hindered (34%) or mitigated (38%) sentencing decisions in criminal cases similarly).
[86] Ibid 564.
[87] Ibid 564.
[88] Ibid 572.
[89] Ibid 572.
[90] Ibid 574.
[91] Ibid 574.

a "double-edged sword" concept, although their findings explained how the prosecution and defense both used neuroscientific evidence. Like other studies, the defense incorporated neuroscientific evidence to mitigate a defendant's culpability and punishment. Yet, overall, the prosecution (not the defense) was more likely to introduce neuroscientific evidence generally--not about the defendant per se but instead to examine the extent of a *victim's* brain damage to better bolster a case against the defendant.[92] By detailing the victim's injuries or cause of death, the prosecutor would have more information to support their recommended sentence.[93]

Defendant brain injury cases involving neuroscientific evidence illustrate the complexity of information concerning a range of different factors and influences. For example, in *R v. Hendy*, a diminished responsibility case in which a jury convicted the 16-year-old defendant of murder,[94] testifying experts explained that Hendy's earlier brain injury from a road accident may have led to temporal lobe damage and affected his ability to control his behavior.[95] The circumstances were exacerbated all the more by Hendy's heavy drinking.[96] Further testing of Hendy, by way of an E.E.G. test indicating left temporal lobe damage, as well as later neuropsychometric testing, convinced the Court of Appeal to overturn Hendy's murder conviction and substitute a manslaughter conviction due to diminished responsibility.[97] However, Hendy was not acquitted but rather provided with a hospital order during sentencing under the Mental Health Act of 1983,[98] an outcome that the authors found troubling and suggests a double-edged sword perspective. As the authors explained, the neuroscientific evidence introduced on Hendy's behalf allowed him to avoid a criminal conviction. Yet, it also enhanced the impression of his risk of harm, leading to the court's "imposition of a restriction order without limit of time."[99]

It's unclear whether this outcome was less punitive for Hendy. While such an outcome could be viewed as mitigating especially compared to the solutions other countries provide through rehabilitation, in England and Wales the prosecution is still more likely than the defense to introduce neuroscientific evidence and the countries have a limited capacity for rehabilitation. Thus, England and Wales fall on the furthest extreme on the double-edged sword continuum regarding the use of neuroscientific evidence.

Conclusion

This chapter's analysis of how the criminal justice systems of six different countries use neuroscientific evidence puts into context the special case of a defendant's brain injuries. As evidenced in this chapter, judges and juries may interpret some kinds of neuroscientific factors, such as a brain injury, as more permanent and unchangeable and, therefore, defendants more dangerous and less treatable. Likewise, a focus on defendants' brain injuries reveals greater insights into the double-edged sword phenomenon of sentencing. With this perspective, countries can be theoretically placed on a double-edged-sword continuum on where they may fall in terms

[92] Catley (n 8).
[93] Ibid.
[94] Ibid 525-526 (discussing *R v. Hendy* [2006] EWCA 819).
[95] Ibid 526.
[96] Ibid.
[97] Ibid 527.
[98] Ibid; see Mental Health Act of 1983, ss 37 and 41.
[99] Catley (n 8) 527.

of mitigating or aggravating sentences which is heavily influenced by their embrace of rehabilitation. Given the prevalence of brain injuries in criminal populations and the growing evidence that such injuries are far more amendable to recovery than previously believed,[100] it is incumbent on criminal justice actors to become aware of the latest science and recognize that different types of neuroscientific evidence may have a substantially disparate impact in court in terms of mitigation or aggravation of a sentence.

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[100] *See* Hunter (n 4) 539–565; Colorado Division of Criminal Justice, '*OVP: Victims of a Violent Crime Brain Injury Task Force*', (2024) <https://dcj.colorado.gov/dcj-offices/ovp/vic-vilnt-crime-brain-injury-tf> accessed 7 December 2024 ; Liontas (n 13).

Table 1 Study Methodologies

Study	***Timespan & Cases***	***Database Used***	***Definition of "Neuroscience"***
Australia Alimardani & Chin (2019) Alimardani (2023)	All available criminal cases up to 2019 779 cases initially considered All available criminal sentencing cases up to 2016 331 cases	CaseLaw, Australasian Legal Information Institute ("AustLII"), and the Australian Neurolaw Database	Adopted a broad definition that included neuroimaging evidence and non-neuroimaging evidence
England & Wales Catley & Claydon (2015)	2005-2012 (8 years) 204 cases	Lexis Library	Cited the Royal Society's definition which is described in part as "the study of the brain and nervous system," and pinpointed cases with a basis in cognitive neuroscience
Canada Chandler (2015)	2008-2012 (5 years) 133 cases	LexisNexis Quicklaw	Excluded a definition but focused on cases involving evidence of brain injury or cognitive impairment linked to a neurological cause
United States Denno (2015) - (2022)	1992-2012 (20 years) 800 cases 1900-2020 (120 years) 8,358 cases	Westlaw & Lexis	Used a broad definition that included neuroimaging tests, non-neuroimaging tests, and expert testimony
Slovenia Hafner (2019)	1991-2015 (24 years) 89 cases	Slovenian case law database 'sodnapraksa.si' used initially, then requested cases directly from courts	Examined cases discussing brain damage, neurological diseases and dysfunctions, or organic mental, personality, and behavioral disorders
The Netherlands de Kogel & Westgeest (2015)	2000-2012 (12 years) 231 cases	Dutch case law database 'Rechtspraak.nl'	Defined as involving assessments of the brain, neuropsychological assessments, or neurobiological predisposition or brain damage; also included a separate definition for behavioral genetic information

Table 2 Types of Neuroscientific Evidence Introduced into Court

Study	*Type Of Crime*	*Types of Evidence Introduced*
Australia Alimardani & Chin (2019) Alimardani (2023)	Not specified	Neuropsychological testing; neuropsychiatric test, psychometric testing; Frontal lobe abnormality; Hemorrhage; **Brain injury; Head injury**; Cerebral Insult
England & Wales Catley & Claydon (2015)	Homicide; Crimes of violence; Crimes of dishonesty; Sexual offenses; Drug offenses; Driving offenses; Other	Neuroimaging; **Head injury & brain damage**; Family history; Cognitive impairment; Developmental immaturity; Alcohol dependency syndrome
Canada Chandler (2015)	Homicide; Crimes of violence; Sexual offenses; Drug offenses; Driving offenses; Property offenses; Other	Prenatal alcohol exposure; Neuropsychological testing; **Traumatic brain injuries**; Neuroimaging; Dementia; Epilepsy; Birth trauma; Parasomnia; Tumor
United States Denno (2015) - (2020)	Death Penalty; Homicide; Crimes of violence; Sexual offenses; Drug offenses; Driving offenses; Property offenses; Crimes involving children; Other	**Brain damage; Head injury**; Low IQ/mental retardation; Toxic exposure; Neuroimaging; Adult personality/ behavioral disorders; Mental/ behavioral disorders due to psychoactive substance abuse; Organic mental disorders; Schizophrenia, schizotypal, and delusional disorders
Slovenia Hafner (2019)	Homicide only	**Brain damage**; Age-related impairments; Neurological diseases and dysfunctions; Organic mental disorders; Organic personality disorders; Behavioral disorders; Neuroimaging
The Netherlands de Kogel & Westgeest (2015)	Crimes of violence; Sexual offenses; Drug offenses; Property offenses; Other	Neuroimaging; Neuro-endocrinological assessment; Neurobiological predisposition; **Damage to the brain**; Heritability factors; Genetic predisposition; Family history indicating biological origin; Addiction

Table 3 Purpose and Use of Neuroscientific Evidence in Criminal Proceedings

Study	***Phase of Criminal Proceedings where Neuroscience was Used*** **** Phase most used***	***Most Common Purpose for Neuroscientific Evidence***	***Most Common Purpose for Mitigating Neuroscientific Evidence***	***Prosecutor's Use of Neuroscientific Evidence***
Australia Alimardani & Chin (2019) Alimardani (2023)	Pre-trial; Trial/guilt; Sentencing *(did not specify where most used)	Mitigation	Used for leniency in sentencing (relating to moral culpability and general deterrence)	Stated that regardless of the impact (mitigation or aggravation), prosecutors have a duty to provide all relevant materials to the court that would assist in the determination of a sentence with any evidence, including neuroscience evidence
England & Wales Catley & Claydon (2015)	Pre-trial; Guilt; *Sentencing	Aggravation by way of victim evidence	Drawn upon to quash convictions, to lead to convictions for lesser offenses, and to lead to reduced sentences with the most successful application during appeals of sentence	Employed by the prosecution to provide evidence of a victim's injuries or cause of death or injury; however, the study's focus concerned the defense's use of mitigating evidence
Canada Chandler (2015)	Pre-trial; Guilt; *Sentencing	Mitigation	Employed for assessing moral blameworthiness during the sentencing phase, particularly for violent crimes	Excluded any discussion of the prosecution's use of neuroscientific evidence
United States Denno (2015) - (2020)	Pre-trial; Guilt; *Sentencing (mostly for death penalty cases)	Mitigation	Implemented to mitigate punishments, especially during the penalty phase for death penalty cases	Prosecutors rarely use neuroscientific evidence but if used it is in these two ways: to suggest a defendant's propensity to commit crimes and as evidence of a victim's injuries or cause of death
Slovenia Hafner (2019)	Pre-trial; Guilt; *Sentencing	Mitigation	Applied to mitigate or reduce sentencing	Excluded any discussion of the prosecution's use of neuroscientific evidence, but did report that neuroscientific evidence was never used as an aggravating factor
The Netherlands de Kogel & Westgeest (2015)	Pre-trial; Guilt; *Sentencing	Mitigation	Incorporated to show diminished accountability for the offense	Excluded any discussion of the prosecution's use of neuroscientific evidence

Table 4 - Brain Injury, Rehabilitation, and the Double-Edged Sword Effect

Study	Brain Injury as a Mitigating Factor	Brain Injury as an Aggravating Factor	Existence of a Double-Edged Sword Effect for Brain Injury
Australia Alimardani & Chin (2019) Alimardani (2023)	Mitigating for culpability	Aggravating for risk of recidivism and danger to society	A Double-Edged Sword Plus Effect: Mitigation with Rehabilitation
England & Wales Catley & Claydon (2015)	Mitigating for culpability	Aggravating for dangerousness posed to the public	A Double-Edged Sword Effect
Canada Chandler (2015)	Mitigating for culpability	Aggravating for risk of recidivism	A Double-Edged Sword Plus Effect: Aggravation with Risk of Dangerousness
United States Denno (2015) - (2020)	Mitigating for culpability	Rarely used as an aggravating factor, but if it was raised, it was in the context of future dangerous	No Substantial Evidence of a Double-Edged Sword Effect
Slovenia Hafner (2019)	Mitigating for culpability	No formal finding for aggravation but could be considered aggravating with regard to requiring compulsory treatment due to potential dangerousness	No Double-Edged Sword Effect: Mitigation and Rehabilitation
The Netherlands de Kogel & Westgeest (2015)	Mitigating for culpability	Aggravating for risk of recidivism	A Double-Edged Sword Plus Effect: Aggravation Unless with Rehabilitation