The Use of Neuroscience for Mitigation During Sentencing in Non-Capital Cases

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Dissertation submitted in partial fulfillment of
the requirements for the degree of Doctor
of Philosophy in the Department of
Psychology & Neuroscience in the Graduate School
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ABSTRACT

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Abstract

Neuroscience is increasingly used during sentencing in criminal courtrooms to mitigate punishment. However, neuroscience is not presented in a vacuum—it is generally used to describe a defendant's neuropsychological state in the context of other mitigating circumstances. It is important to explore how decision-makers reason about neuroscience information in the courtrooms given the consequences of sentencing decisions. The present studies examine how neuroscience information presented across different mitigating contexts impacts legally relevant perceptions, including judgments of control over behavior and punishment decisions. Study 1 used qualitative methods to explore how judges and lawyers use and reason about neuroscience information in the courts. Study 2 investigated whether neuroscience information, when paired with potentially mitigating circumstances about a defendant, differentially impacts legally relevant judgments. Study 3 assessed how the mitigating context in which neuroscience information is introduced differentially impacts causal attributions about a defendant's behaviors. These studies offer novel insights about the use of neuroscience in the courtroom and demonstrate that the context in which this information is presented matters for the formation of legally relevant judgments.

Dedication

This dissertation is dedicated to my mom, Cecilia, who is so excited for me to *finally* get my Ph.D.

Contents

List of Tables

List of Figures

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There are several people who have helped and supported me throughout this process that deserve acknowledgment.

Aaron Kay took me in as a graduate student orphan and welcomed me into his lab. For this I am extremely grateful.

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1. Introduction

"The capacity to evaluate the consequences of one's actions is central to one's culpability. This is why we consider the defendant who commits a crime during a momentary lapse in judgment less blameworthy than the defendant who commits a crime after a period of sober calculation…Simply put, we expect those with a better capacity for decision making to make better decisions." – Hon Mark Bennett (*US v Hendrickson*, 2014)

The use of neuroscience[1] evidence in the criminal justice system to inform decision-making is expanding. This is due, in part, to the growing concern with an offender's decision-making capabilities, eloquently captured by the quote from Judge Bennett. The defendant in this case was charged with one count of possession of stolen firearms and was sentenced to 31 months in prison—6 months below the low end of the sentencing guidelines recommendations. Judge Bennett decided to vary from the standard guideline range because of the defendant's history and characteristics, which included a long history of drug addiction and other mental health issues. Citing relevant studies on the neurobiological bases of addiction, Judge Bennett ultimately concluded that, "addiction mitigates a defendant's culpability…By physically hijacking the brain, addiction diminishes the addict's capacity to evaluate and control his or her

[1] Throughout this dissertation I will use the term neuroscience to refer to a broad set of neuropsychological processes. This is because the boundaries between psychology and neuroscience are fuzzy (Shen, 2016). For example, many advances relevant to the legal field are taking place in cognitive neuroscience, an emerging discipline that combines neuroscience—a traditionally biomedical field—and cognitive science—a field of study that seeks to understand mental processes using philosophy and psychology (Purves, Cabeza, Huettel, LaBar, Platt, & Woldorff, 2013). I will use this broad view of neuroscience to talk about information, evidence, or testimony that has to do with a person's mind, mental states, brain, or related behaviors, as other neurolaw scholars have similarly done in the past (Farahany, 2016; Shen, 2016; Denno, 2015; Denno, 2016).

behaviors" (*US v. Hendrickson*, 2014, pg. 7). Neuroscience is giving this judge information about how abnormal brain circuitry and brain trauma impacts complex behaviors.

One can imagine how other brain-based abnormalities can also "hijack" the brain and subsequent behavior. Researchers are beginning to understand how impaired brain circuitry and abnormalities in brain structures are related to cognitive processes such as attention, memory, and motivation in people with mental illnesses. These neural abnormalities lead to impaired cognitive processes that are often reflected in complex behaviors, including impulsive decision-making and problems with cognitive flexibility and reasoning.

Criminal responsibility relies heavily on the evaluation of a person's mental states; consequently, information about how the brain influences decision-making could be a game-changer for a defendant. What happens when evidence is proffered at trial that a defendant suffers from a mental health issue with known biological and environmental risk factors that result in symptoms associated with impulsivity and aggression (e.g. antisocial personality disorder)? And how are judges and lawyers using this brain-based information about a defendant's impaired decision-making?

Because neuroscience has the potential to improve legal decision making and influence policy, the Presidential Commission for the Study of Bioethical Issues—an advisory panel of the nation's leaders in bioethical issues—has identified the use of neuroscience in the law as one of the most important topics

at the intersection of neuroscience, ethics, and society (Presidential Commission, 2015). Emerging neurotechnologies and advances in our understanding of brain and behavior could lead to changes in penal policy and change normative assumptions about criminal responsibility. Many scholars in the field of neurolaw have begun to address important questions regarding culpability, control, and free will. However, some scholars have questioned whether neuroscience will really bring a transformative change to legal concepts and processes (Morse, 2006; 2007).

Yet neuroscience evidence—particularly about an offender's capacity for decision-making—*is* beginning to impact judges and lawyers' assessments of an offender's actions and is challenging assumptions about culpability and sentencing. Though neuropsychological testing has been used in courtrooms since the early 19th century, forensic psychiatrists—who evaluate how a mental disorder or defect impacts a defendant's decision making capacities—recognize the added value of neuroscience evidence when describing a defendant with mental health and related issues (Meynen, 2013; Silva, 2007; Toole, 2012). Data from real legal decisions suggest that around 20-30% of claims that introduce neuroscience evidence are successful in the U.S. criminal court system (Farahany, 2016). Close analyses of judicial decision making suggest that neuroscience evidence can play a big role in determining guilt or punishment. In fact, several studies now indicate that neuroscience evidence is increasingly introduced for mitigation purposes (Farahany, 2016; Catley & Claydon, 2015;

Chandler, 2015; Gaudet & Marchant, 2015; Denno, 2015), suggesting that neuroscience is somehow contributing to explanations of diminished culpability.

Although neurolaw scholarship has begun to examine and document the use of neuroscience evidence and its effects on sentencing in the real world and in experimental settings, these studies often focus on high-stakes capital crimes, which represent a small proportion of the crimes that are committed. The focus on capital cases may stem from the belief that neuroscience may be more effective as a last-ditch option in these scenarios (Shen, 2016). Capital cases are also more flexible regarding the rules about mitigating evidence, requiring lawyers to introduce *any* possible mitigating circumstance—including neuroscience evidence about a defendant's mental states—during sentencing. Focusing on these high-stakes cases has provided many preliminary insights about the use of neuroscience for legal decision making.

However, neuroscience evidence is frequently being used in non-capital cases as well (Denno, 2015; Farahany, 2016). Understanding how lawyers and judges are using neuroscience information across non-capital cases, where the law about sentencing and mitigation is less flexible, can provide valuable insights into how legal decision makers (e.g. lawyers, judges) use neuroscience in the context of the law to reason about a defendant's decision-making capacities. Moreover, examining how neuroscience is being used for non-capital mitigation purposes could shed light on perceptions of statutory and non-statutory

mitigating circumstances, providing a more consistent framework for the assessment of mitigating circumstances.

Three studies were conducted to examine the use of neuroscience information in non-capital sentencing procedures and its effects on legally relevant perceptions of the defendant and sentencing decisions. Before describing these studies, I first explain how neuroscience was thought to influence decisions in the legal system. I then describe how neuroscience is currently used in courtrooms, focusing on its use for mitigation purposes. I briefly address how legal standards and guidelines govern the use of mitigating evidence in the legal system, and how those guidelines are interpreted by judges. Finally, I describe the psychological and cognitive underpinnings that may underlie the use of neuroscience in the courtroom. The first study conducted as part of this dissertation—an empirical qualitative assessment of judicial opinions—elucidates how neuroscience is being used in non-capital cases and how neuroscience is placed in the context of sentencing standards. The second and third experimental studies will assess how neuroscience influences the thought processes underlying its use in the courtroom, focusing on how neuroscience changes the way people think about a defendant's control over his actions.

1.1 How Neuroscience is Thought to Influence Legal Decisions

Criminal law necessitates that legal decision-makers make inferences about an offender's mind and mental states to determine guilt and responsibility.

Neuroscience could provide relevant information about those inferences (Greene & Cohen, 2004; Erickson, 2010; Maoz & Yaffe, 2015; Morse & Newsome, 2013; Penney, 2012; Snead, 2007). For example, neuroscience may influence views on whether a defendant's thoughts or actions were predetermined (Gazzaniga & Roskies, 2006; Steven, 2005), whether a defendant behaved intentionally (Aggarwal, 2009; Morse, 2006; Pizarro, 2011), and whether a defendant is dangerous or can be rehabilitated (Greene & Cohen, 2004; Brown & Murphy, 2010). These issues, which have frequently been addressed in the literature, seem to be the most directly relevant to how neuroscience could be used—and is being used—in the courts today. However, there have been a few other lines of inquiry regarding the mechanism by which neuroscience affects perceptions that require some mention.

One concern that scholars have with the introduction of neuroscience into the courtroom is that it may "dazzle" judges and juries and unduly influence verdicts (Perlin, 2010; Khoshbin & Khoshbin, 2007; Kulynych, 1996; Tancredi & Brodie, 2007). Many of these concerns mimic an oft-cited line of research on the "seductive allure" effect of neuroscience information—a bad explanation with neuroscience is more satisfying than a good explanation without neuroscience (Weisberg et al, 2008). The argument is that legal decision-makers may be biased by neuroscience evidence because it provides an explanation of criminal behavior, regardless of whether the neuroscience is actually relevant to the case.

Several follow-up studies have probed the seductive allure effect, both in legal and non-legal contexts. In a direct follow up of the original study, the authors demonstrated that psychological explanations (unrelated to the law or legal system) were more satisfying when they contained neuroscience information, even after accounting for the length of the explanation and the amount of jargon used (Weisberg et al., 2015). Other research has similarly found that superfluous neuroscience information increased perceptions of the quality of arguments (Fernandez-Duque, Evans, Christian, & Hodges, 2015; Rhodes, Rodriguez, & Shah, 2014). In general, the seductive allure effect appears to be driven by a general preference for reductive explanations (Hopkins, Weisberg, & Taylor, 2016).

Scholars also proposed that the type of neuroscience information may affect this seductive allure, such that neuroimages themselves may be even more persuasive than neuroscience information via text. And indeed, some researchers have found that adding neuroimages to descriptions of research leads to higher ratings of scientific reasoning (McCabe, & Castel, 2008), increases the likelihood of not guilty by reason of insanity verdicts (Gurley & Marcus, 2008), and reduces responsibility and sentencing judgments for defendants who were described as being psychopathic (Saks, Schweitzer, Aharoni, & Kiehl 2014). Other researchers, however, have failed to replicate the alluring effect of neuroimages on perceptions of scientific research (Schweitzer, Baker, & Risko, 2013) and the effect of neuroimages on verdicts for the insanity

defense (Schweitzer, & Saks 2011). Given the inconsistent results across studies, we cannot draw any conclusions about the effects of neuroimages over and above neuroscience information more generally in legal or non-legal contexts (Roskies, Schweitzer, & Saks, 2013; Farah, & Hock 2013). It is entirely plausible that neuroscience in the courtroom is providing some sort of seductive allure.

Lastly, rapid advances in neuroscience technology have led scholars to hypothesize about how neuroscience technology itself may influence legal decision making. The most popular technologies mentioned are brain scans—particularly those using functional magnetic resonance imaging—that could be used for lie detection in the courtroom (Schauer, 2009; Church, 2012; Schauer, 2010; Shen, 2011; Meixner, 2015). To date, a handful of lawyers have attempted to introduce neuroscience-based lie detection evidence, although using neuroscience in this way is very rare. Some lawyers who have tried using neuroscience as lie detection have sought the services of No Lie MRI, a company that advertises that it provides “unbiased methods for the detection of deception and other information stored in the brain” (noliemri.com). However, judges have been reluctant to admit this evidence into the court of law given the rigorous rules of admissibility for scientific evidence (Woodruff, 2014).

The use of neuroscience to gain access to someone’s brain and inner thoughts for legal purposes—perhaps against this person’s will—sparked interesting and compelling debates about the potential of neuroscience to violate

the fourth and fifth amendments (Pardo, 2006; Farahany, 2012). Although it does not seem like this specific technological advancement has reached the critical level of scientific reliability needed to progress in the court system, these conversations will need to be revisited as these neuroscience technologies continue to evolve.

1.2 How Neuroscience is Being Used in Criminal Courtrooms Today

A few empirical analyses of neuroscience in courtrooms in the U.S. and abroad have been conducted that shed light onto how neuroscience is being used in real cases (Catley & Claydon, 2005; Chandler, 2015; de Kogel & Westgeest, 2015; Denno, 2015; Gaudet & Marchant, 2016; Farahany, 2016;). These analyses begin to document how neuroscience is being used in courtrooms, and how legal decision makers sift through neuroscience evidence and reason about its relevance to criminal cases. These analyses are important because they begin to give us a glimpse into how neuroscience evidence may change perceptions about responsibility, moral blameworthiness, and punishment, just as scholars have said it could. Moreover, understanding how legal decision makers reason about neuroscience evidence could improve how legal decision makers apply the law and could change normative perceptions about criminal responsibility and punishment (Ginther, 2016).

The limitations of these empirical analyses must be acknowledged before describing their results. The methodology used for these analyses—which

involves identifying a set of relevant keywords and using legal databases to find judicial opinions or cases—results in biased case selection, as the authors of these studies themselves aptly note. These databases may accidentally exclude relevant opinions, do not have cases in which neuroscience was introduced before (and sometimes during) the trial phase, and result mostly in the analysis of appellate opinions. Introducing neuroscience evidence is also costly, meaning that defendants with sufficient resources or those who can get resources from the state will be more likely to introduce this kind of evidence. Furthermore, most criminal cases do not even make it to trial. As a result, these samples represent the very small proportion of cases that went to trial, failed during the initial trial phase, and then chose to appeal.

Judicial opinions represent the thoughts of judges but can be written either by the judge or edited from the law clerk's draft, and vary greatly in terms of content and style (Posner, 2013). Importantly, these judicial opinions and cases often will not have a full record of the decision-making process, since appellate courts generally defer to the trial courts' decisions and summarize the proceedings of the lower courts. This is another reason why the results of these studies are very skewed, likely underrepresenting the use of neuroscience evidence and over-representing failed attempts to use of neuroscience evidence, although this cannot be confirmed with the present data. Yet even with these limitations, the empirical analyses contribute to our understanding of the use of neuroscience in the court.

The largest analyses thus far have been conducted using U.S. cases (Farahany, 2016: analyzed 1585 judicial opinions from 2005-2012; Denno, 2015: analyzed 800 cases from 1992-2012). Companion analyses have looked at cases from England and Wales (Catley & Claydon, 2015: analyzed 204 cases from 20015-2012), Canada (Chandler, 2015: analyzed 279 cases from 2008-2012), and the Netherlands (de Kogel & Westgeest, 2015: analyzed 207 cases from 2000-2012). Though each study used various keywords to use in their preliminary search for cases and their own inclusion criteria, for the most part these studies have broadly defined neuroscience to incorporate imaging tests (e.g. PET scan, MRI) or evaluations conducted by medical professionals to assess a defendant's brain and mental states.

Across these studies, the researchers have found that the introduction of neuroscience evidence is steadily increasing over time. Neuroscience is often presented alongside claims of brain injury, mental illness, or cognitive impairment, although it is also used to describe a victim's injuries (Catley & Claydon, 2016; Denno, 2015; Chandler, 2015).

These studies also demonstrate that neuroscience is used broadly in courtrooms: in competency proceedings, during evaluations of guilt, and for sentencing purposes. However, neuroscience seems to be used most frequently during sentencing proceedings, often for mitigation purposes. This may be partially explained by the fact that neuroscience is frequently raised in cases

where defendants are facing severe sentences (e.g. death) or have committed serious offenses.

The studies reveal that legal decision makers believe that (a) the information neuroscience provides is important for legally relevant determinations, and (b) neuroscience information can change a legal decision maker's mind. This is demonstrated by the frequent use of ineffective assistance of counsel (IAC) claims made in the U.S. (Farahany, 2016; Denno, 2015; Denno, 2016). Generally, the defendant asserts, on appeal, that his counsel failed to adequately investigate a history of brain defects or mental disorders and that this lack of investigation or preparation could have prejudiced the outcome of the case. Defendants who raise IAC claims must show that their counsel's performance fell beyond reasonable standards and that the jury or judge might have reached a substantially different decision if that evidence had been presented.

In a recent analysis of 39 capital cases, over 25% of IAC claims related to neuroscience were successful—a five-fold increase over the general rate of success (5%) for all IAC claims (Denno, 2016). The prevalence and relative success of these claims suggests that legal decision makers place a high value on neuroscience information, and that depriving defendants of introducing or using this evidence is viewed as an egregious error that could result in unfavorable outcomes for the defendant.

Although lawyers seem to be expected to use neuroscience evidence when available, the informtation neuroscience conveys about a defendant or his behavior are still unclear. The fact that neuroscience is often used in IAC claims suggests that neuroscience would likely be viewed as a mitigating factor during sentencing. However, neuroscience could act as a double-edged sword in that it could have an aggravating impact on the defendant's sentence, perhaps because the neuroscience is perceived as evidence of a defendant's future dangerousness (Aspinwall, Brown, & Tabery, 2012; Barth, 2007; Cheung & Heine, 2015; Snead, 2007). Because legal decision makers must weigh many factors before making sentencing decisions—including the need to protect the public from an offender (USSC, 2016)—evidence of a defendant's future dangerousness, proclivities for violent behavior, or potential for recidivism weigh heavily in sentencing decisions. And it seems that in some cases neuroscience may contribute to these determinations.

For example, in Canada, neuroscience evidence is frequently used to designate an offender as a dangerous or long-term offender (Chandler, 2015) and is used to indicate pessimism about a defendant's potential for rehabilitation or about public safety concerns, thoughts that are echoed in the U.S. system and in the Netherlands (de Kogel & Westgeest, 2015; Farahany, 2016;). Although Denno's (2015) analysis of U.S. cases found that claims of future dangerousness are infrequently based on neuroscience evidence, she did find that legal decision makers rarely provide scientific justifications in these conclusions and rely heavily

on aggravating factors. Even if legal decision makers do not use neuroscience as direct evidence of future dangerousness, these findings suggest that neuroscience factors into the considerations of both mitigation and aggravation.

In sum, courts are increasingly using neuroscience in the criminal courtroom, often to make a case for mitigation. Given the nature of neuroscience information, neuroscience is often presented in conjunction with claims about mental health or brain injury. It appears that neuroscience is high-value evidence and is expected to be used when available. However, the inferences made about a defendant when presented with neuroscience information and how neuroscience factors into judicial reasoning remains unclear.

1.2.1 Current Standards Regarding Mitigation in the U.S.

Determining a defendant's sentence in the U.S. is by no means an easy task. In the 1930s, recognizing the difficulties in determining appropriate levels of punishment, the U.S. attempted to streamline the decision process by creating statutory guidelines (Tonry, 2013). To date, the Federal Sentencing Guidelines (USSC, 2016) are used to standardize sentencing decisions. The current guidelines recommend using a grid-like sentencing scheme based on offense-type and criminal history (USSG §1B1.1). Thus, legal decision makers typically make sentencing decisions based on the offense (e.g., murder, burglary) and on a defendant's criminal history score (i.e. a higher score means that a person has committed more offenses). This rigid sentencing scheme is intended to limit discretionary decision-making—decision making that goes beyond the prescribed

guidelines (Fischman & Schanzenbach, 2012)—to prevent risking "correspondingly broad disparity in sentencing" (Commission, 2015).

It is impossible to identify and narrow down all special circumstances about the crime or the defendant into guidelines for others to follow (Wang, 2015). Consequently, there can be circumstances about a specific case that are not accounted for in the sentencing scheme. When this occurs legal decision makers can use their discretion to consider either mitigating circumstances that reduce sentence severity or aggravating circumstances that increase sentence severity. These mitigators and aggravators can be used to justify sentences at the low or high end of the prescribed sentencing range, or can be used to depart from the guideline range entirely.

For the most part, there are no standard definitions of mitigators and aggravators and these factors have emerged without a clear objective reason for their use (Ashworth, 2011; Bagaric, 2014; Roberts, 2011;). In general, however, mitigators and aggravators fall into two broad categories: offense-based—dealing with aspects of the crime itself—or defendant-centered—dealing with personal aspects of the defendant (Jacobson & Hough, 2007; 2011). Some mitigating and aggravating circumstances have been codified into statutes and sentencing guidelines in an attempt to prevent arbitrariness in sentencing (Wang, 2015). An analysis of sentencing guidelines in state statutes or state sentencing guidelines reveals that on average states list twice as many aggravating circumstances than mitigating circumstances (see Appendix A).

The Federal Sentencing Guidelines explicitly state that certain defendant-centered circumstances should not be given excessive weight in sentencing determinations, aware that judgments based on a defendant's personal characteristics could lead to discriminatory practices (28 U.S.C. § 994(d) and USSG §5G1.3; Bagaric, 2014). For example, race, sex, national origin, creed, religion, and socioeconomic status are characteristics that are prohibited from consideration when imposing a sentence. Lack of guidance as a youth and similar circumstances (§5H1.12) are "not relevant" in determining departures, while education and vocational skills (§5H1.2), drug or alcohol dependence or abuse (§5H1.4), employment record (§5H1.5), and family ties and responsibilities (§5H1.6) are "not ordinarily relevant." Factors that "may be relevant" in determining departures from the guidelines include age (§5H1.1), mental and emotional conditions (§5H1.3), physical condition (§5H1.4), and military, civic, or public service (§5H1.11). Factors that are relevant in determining the applicable guideline range include a defendant's role in the offense (§5H1.7), criminal history (§5H1.8), and dependence upon criminal activity for a livelihood (§5H1.9).

The Federal Sentencing Guidelines are central in non-capital proceedings because the relevance of mitigation evidence in non-capital cases is placed into the context of the statutory sentencing factors and guidelines. If mitigating circumstances are brought up during a trial, judges—the triers of fact in most non-capital cases—must weigh the mitigating circumstances against the aggravating circumstances and use their professional judgment when

determining whether a mitigating circumstance is or is not relevant to a case (Mundy, 2011).

The rules for sentencing in capital offenses are slightly different. Mitigating circumstances are a crucial component of capital cases and need not rely on statutory or guideline authority when being introduced. If the defendant was found guilty of a capital offense during the guilt phase of the trial, then *any possible* mitigating circumstance must be presented during the penalty phase. In stark contrast to non-capital proceedings where defense lawyers are often not trained to conduct investigations into mitigating evidence and often do not even have the necessary resources to do so, defense lawyers in capital cases bring in mitigation specialists to help the defense make a strong case for mitigation. The defense team uses mitigating factors to tell a compelling story to the jury, who then decides whether the mitigating circumstances were enough to support a sentence of life imprisonment, or whether the defendant deserves death. The jury does not have to refer to the sentencing guidelines when making its decision.

The interpretation of the Federal Sentencing Guidelines—and the mitigating circumstances outlined in them—are thus particularly important in non-capital cases. Defense lawyers do not have the luxury of presenting what they believe to be mitigating evidence just because they can. They must make a reasoned case about why that evidence should be mitigating, and hope that the judge interprets the evidence and the guidelines in their favor. Fortunately for the

defense, current practices and beliefs by judges suggest that consideration of mitigating factors may not be as inflexible as the guidelines presuppose.

1.2.2 Current Practices Regarding Mitigation in Non-Capital Cases

Although the Federal Sentencing Guidelines were created to limit discretionary sentencing decisions, judges seem to be interpreting mitigating factors with more latitude than what Congress may have originally intended.

A study conducted by the Sentencing Commission revealed that roughly 50% of district judges surveyed believe that defendant-centered mitigators are "ordinarily relevant" for within-range sentence determination (USSC, 2010). For example, 49% of respondents stated that lack of guidance as a youth is ordinarily relevant to within-range determinations, a factor that is currently classified as "not relevant" for sentencing. Other circumstances that are "not ordinarily relevant" for sentencing but that were judged by respondents as being ordinarily relevant include: employment record (62%), family ties (57%), drug (50%) and alcohol dependence (48%), and education (46%). These rates are similar to the rates for circumstances that the guidelines state "may be relevant" to sentencing, including mental condition (65%), age (57%), civic or public service (52%), emotional condition (51%), and physical condition (51%). The results from this survey also indicated that 70% of the district court judges surveyed said that the guidelines manual does not contain a departure provision that adequately reflects the reason for a sentence outside the guideline range (USSC, 2010).

Moreover, data from federal judges indicated that the top reason for granting a downward departure or for sentencing below the guideline range in 2015 across non-capital cases is the "nature and circumstance of offense/history of defendant," a broad, catch-all factor in the U.S. penal code (isb.ussc.gov, Table 25A and 25B). Although these data are limited because judges do not always list the reasons for sentencing below the guideline range, they reveal that judges are using mitigating circumstances about a defendant that have been deemed "not ordinarily relevant" or sometimes relevant for sentencing to decrease punishment. A closer inspection of the data demonstrates that many other defendant-centered circumstances are cited as reasons for deviating below the guidelines as well (e.g. mental or emotional conditions, physical condition, employment record, family ties and responsibilities).

There seems to be a disconnect between Congress's views of how defendant centered circumstances should be used in mitigation and how legal actors responsible for sentencing decisions use these circumstances in their mitigation considerations. Part of the disconnect may stem from the fact that the guidelines do not have provisions for how to *weigh* mitigating evidence. Moreover, mitigating evidence that has to do with a defendant's personal circumstances requires legal decision makers to make complex judgments about how a defendant's circumstances are connected to his or her behaviors. Legal decision makers must make causal attributions regarding the mitigating circumstances (e.g., a defendant's mental health problem, his traumatic brain

injury, his mental retardation, his history of childhood abuse) and the defendant's behavior at the time of the crime. This is not a straightforward task.

1.3 The Connection Between Neuroscience and Mitigation

Neuroscience information regarding a defendant may guide decision makers when reasoning about mitigation. Several studies have shown that neuroscience explanations of behavior affect legally relevant judgments, including verdicts, imposition of death sentences, impressions of the defendant, and inferences regarding whether the defendant had control over his actions (Greene & Cahill, 2012; Cheung & Heine, 2015; Kim, Boytos, Seong, & Park, 2015; Schweitzer, Saks, Murphy, Roskies, Sinnott-Armstrong, & Gaudet, 2011; Appelbaum & Scurich, 2014; Scurich, & Appelbaum, 2015). A closer look at these studies sheds light on the psychological and cognitive mechanisms that may be at play in the courtroom when legal decision makers assess neuroscience information.

For instance, neuroscience and behavioral genetics information seem to impact perceptions of a defendant's control over his actions (Aspinwall, Brown, & Tabery, 2012; Cheung & Heine, 2015; Greene & Cahill, 2012; Schweitzer et al., 2011). Although each study's methods vary, scientific evidence leads people to say that an offender has less control over his actions. Greene and Cahill (2012) found that ratings of a defendant's ability to control his behavior were lower when a defendant's diagnosis of psychosis was described using neuropsychological test results with or without neuroimages. Cheung and Heine (2015) found that

describing a defendant's predisposition to violence using genetic explanations reduced perceptions of control. Even judges cite lack of control as a mitigating factor when a defendant is presented with a biomechanistic explanation of a mental health issue (Aspinwall, 2012).

Some studies find that scientific evidence lessens punishment severity (Greene & Cahill, 2012; Aspinwall, Brown, & Tabery, 2012; Kim, Boytos, Seong, & Park, 2015; Schweitzer et al., 2011), although punishment results vary across studies. Interestingly, perceptions of control mediate the relationship between scientific evidence and punishment severity in the studies that have found effects of scientific evidence on punishment severity (Schweitzer et al., 2011; Cheung & Heine, 2015). This relationship is complex, with one study finding that even though perceptions of control may mediate the relationship between scientific explanations and punishment, scientific explanations also lead people to attribute the cause of behavior as internal to the defendant, leading to longer prison sentences (Cheung & Heine, 2015).

A major caveat of these studies is that neuroscience and scientific information is often presented alongside a mental health diagnosis (Greene & Cahill, 2012; Kim, Boytos, Seong, & Park, 2015; Schweitzer et al., 2011) or antisocial tendencies such as violent predispositions and impulsivity (Cheung & Heine, 2016; Scurich & Appelbaum, 2015; Appelbaum & Scurich, 2014; Appelbaum & Scurich, 2015). The influence of a mental disorder on a defendant's decision making processes affects people's perceptions of that

defendant's responsibility and moral blameworthiness (Meynen, 2013; Meynen, 2009; Chandler, 2016). Indeed, the law has long recognized that a defendant's ability to choose whether to commit a crime influences punishment[2] (Penney, 2012).

The methodology used across these studies echoes the way neuroscience is presented in the courtrooms. But this methodology also places neuroscience in a very specific legal context. Mental health issues are not only perceived to be one of the most mitigating circumstances (Barnett, Brodsky, & Price, 2007) but *are* statutory mitigating factors as well (USSG §5H1.3). Although neuroscience evidence is always introduced in courtrooms to bolster or challenge claims about cognitive processing and behavior, it is misleading to say that the neuroscience evidence *itself* is driving effects across these studies. The results of these studies could demonstrate either an effect of neuroscience information, as indicated, or an effect of the specific context in which the neuroscience information was used (i.e., mental health issues).

Further complicating matters, these studies included many other factors that could be perceived to be aggravating. For example, some studies varied the heinousness of the assault (a statutory aggravating factor), or manipulated the presentation of the defendant's future dangerousness or criminal history (also aggravating factors) (Scurich & Appelbaum, 2015; Kim, Boytos, Seong, & Park,

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[2] An early articulation of this idea is the M'Naghten rule, which states that certain kinds of punishment are not justifiable if the defendant cannot appreciate the wrongfulness of his actions due to mental illness. This ruling came from M'Naghten's case in 1843.

2015; Appelbaum & Scurich, 2014; Schweitzer et al., 2011). These manipulations likely introduce variance in the results, particularly when the empirical courtroom studies and sentencing data from judges suggest that it is very difficult to weigh and balance aggravating and mitigating factors. Neuroscience evidence may be influencing judgments and decisions, but from the data thus far we cannot say with certainty that these effects are due to neuroscience information or if neuroscience effects exist across non-mental health related contexts.

2. Study 1: An Empirical Qualitative Assessment of Neuroscience Used to Mitigate Sentencing in U.S. Criminal Courts

The first study in this dissertation is an empirical qualitative assessment regarding the use of neuroscience as mitigating information during sentencing in non-capital cases. This study builds directly on the Farahany (2016) study and investigates the use of neuroscience specifically for sentencing purposes. First, this study narrows in on one of the major reasons why neuroscience seems to be introduced into courtrooms: to mitigate punishment. Given that the majority of courtroom studies have focused broadly on the introduction of neuroscience in mostly high-stakes cases, this study specifically looks at the reasons for using neuroscience as mitigation in non-capital cases, where mitigation standards are more stringent and rule-based. Thus, the purpose of this study was twofold: first, to document how neuroscience influences reasoning during sentencing judgments and decisions in non-capital cases, and second, to assess how neuroscience is used in the context of mitigating circumstances generally.

2.1. Analytic Method and Research Questions

I used an applied thematic analysis (ATA) approach to establish the set of procedures to examine themes in the qualitative data. The ATA approach adapts aspects of qualitative approaches from the social sciences to create a rigorous methodological framework for applied research contexts (Guest, MacQueen, & Namey, 2012). The ATA approach is useful when text serves as a proxy for

experience, where the researcher is interested in people's perceptions and behaviors as they are represented in the text. This exploratory inductive analysis addressed the following research questions:

1. What is the relationship between neuroscience and mitigating circumstances?
2. How is neuroscience being used during sentencing for mitigation?
3. How do judges reason about neuroscience and potentially mitigating evidence?

The purpose of this analysis was to evaluate how neuroscience influences legal reasoning about mitigating circumstances and sentencing.

2.2. Data Collection and Processing

The data for this study were judicial opinions—documents written by judges in the United States about the outcome of cases. Judicial opinions primarily function to provide an explanation for legal decisions in an attempt to streamline the decision process and ensure consistency across cases (Wald, 1995). Moreover, judicial opinions establish precedent in the law. That means that these opinions become the law and are used as guidelines in future similar cases. Exploring the reasons and justifications made by judges about the use of neuroscience in these documents allow us to gain an understanding of the decision-processes made by trained legal actors.

Judicial opinions were taken from a dataset collected by Nita Farahany and colleagues that explored the use of neuroscience evidence in capital and

non-capital cases (Farahany, 2016). The opinions were found using a keyword search in Westlaw, an online legal research database. The keywords (and related variations) narrowed judicial opinions to cases that used or introduced neuropsychological evidence. The keywords were as follows: neuroscience, frontal lobe, hereditary, head injury, pet scan, EEG, fMRI, CT Scan, Brain Disorder, Cognitive Impairment, MEG, NIRS, Brain Scan, Brain, Diffusion Tensor, Heritable, Hereditary, Genetic, Biological, Memory, Frontemporal, and qEEG. This search left Farahany with 1800 judicial opinions from the years 2005-2012. Ongoing data collection has revealed 1,450 more cases from 2013-2015.

Judicial opinions were coded to explore 84 variables, including basic demographic information (e.g. state, opinion type, offenses) and more nuanced variables (e.g. purpose of neuroscience evidence, degree to which neuroscience was discussed). Trained coders twice-coded the variables to ensure reliability across coding.

I examined a subset of the 2013-2015 judicial opinions found in the Farahany study. These opinions were screened to ensure the following: no cases received capital punishment, the defendant was tried as an adult offender, and the cases were labeled as containing neuroscience for mitigation. Cases were then assessed for eligibility to ensure that the mitigation was about sentencing (i.e. punishment) rather than mental state (i.e. charge, competency). This left 143 cases that use neuroscience for mitigation purposes in non-capital sentencing between 2013-2015. Figure 1 provides a detailed view of the inclusion process.

Data were coded using NVivo, a qualitative analysis tool developed by QSR International, and MAXQDA, a qualitative analysis tool developed by VERBI Software.

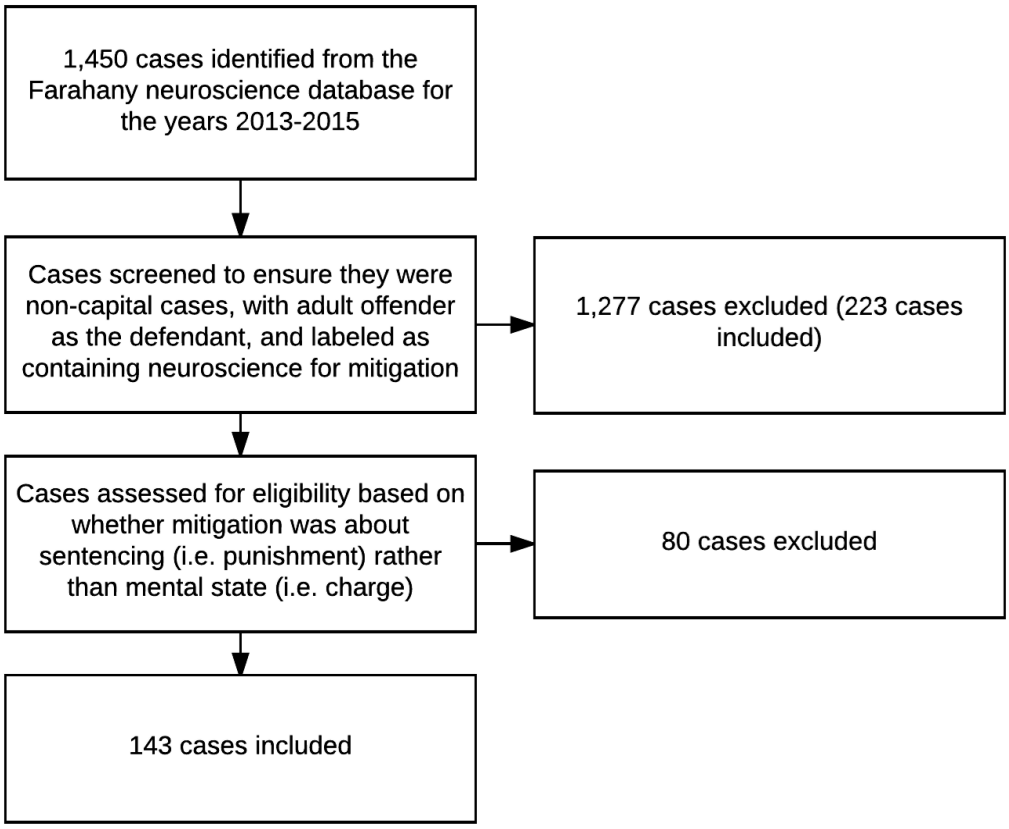

Figure 1: Inclusion Process for Judicial Opinions Used In Study 1.

2.3. Creating the Codebook

Creating a codebook is an iterative process that is modified as new insights are discovered within the text. The codebook encompasses major themes that may contain relevant subcategories. The major themes that were coded in the following analysis were: decision making and reasoning about

mitigation by defense, decision making and reasoning about mitigation by the court, neuroscience testimony or evidence, and mitigating circumstances. The mitigating circumstances theme documented the mitigating factors that were discussed in the opinion and contained the following subcategories: disadvantaged background, childhood trauma, substance abuse, history/characteristics, mental retardation/low IQ, head trauma, physical health condition, and mental health. The codebook also enumerates a list of new variables that were coded and incorporated into a classification sheet. Some of these variables included the amount of punishment received by the defendant and whether this was in the high, mid, or low end of the guideline range (if mentioned) and the way in which mitigation was used in the opinion (i.e. was it part of a claim on appeal, was mitigation generally described when talking about sentencing, etc.). A full list of the themes and variables can be found in the codebook (Appendix B).

2.4. Limitations

There is potential for bias in qualitative research, as in all research contexts (Guest, MacQueen, & Namey, 2012; Horsburgh, 2003). Several measures were taken to minimize bias in this study, including generating a comprehensive codebook to ensure that outside coders could arrive at the same codes and using existing data and research about legal decisions, mitigation, aggravation, and sentencing practices to guide the thematic structures and to

accurately bound the coding context. Twice-coders did not double check my work during the inclusion process or for coding.

As previously discussed, the nature of judicial opinions severely limits the analysis and conclusions that can be drawn from the results. A keyword search was used to find relevant judicial opinions in the Westlaw database. Relevant opinions may have been accidentally excluded using this search method, and cases where neuroscience was introduced before and during the trial phase may not have been captured by the selection process.

Furthermore, the cases may not be an accurate representation of what is occurring in the legal system. First, most criminal cases do not make it to trial, suggesting that these cases are of a different category in and of themselves. Second, introducing neuroscience evidence is costly, meaning that defendants with sufficient resources, or those that can get resources from the state will be more likely to introduce neuroscience, which could skew the sample. This sample represents a small proportion of cases that went to trial, failed during the initial trial phase, and then chose to appeal.

Judicial opinions represent the thoughts of judges but can be written either by the judge herself or edited from a law clerk's draft, and vary greatly in terms of content and style (Posner, 2013). Importantly, these judicial opinions and cases often do not have a full record of the decision-making process, because appellate courts generally defer to the trial courts' decisions and summarize the proceedings of the lower courts. In brief, the results of this study are likely

skewed, underrepresenting the use of neuroscience evidence and over-representing failed attempts at the use of neuroscience evidence.

2.5. Results

2.5.1. The Relationship Between Neuroscience and Mitigating Circumstances

2.5.1.1. Most Frequently Presented Mitigating Circumstances

Eight major categories of mitigating circumstances were introduced across this sample. These included: mental health (e.g. depression, schizophrenia, antisocial personality), head trauma (e.g. traumatic brain injury or instances of brain structure abnormalities like having an undersized brain), history and characteristics (broadly defined mitigating circumstances that are found in the sentencing guidelines or specifically mentioned as mitigating by the defense or court, including education or employment status, accepting responsibility, showing remorse, lack of criminal history, age, other background information), substance abuse (e.g. alcohol and drug addiction issues), childhood trauma (e.g. neglect or abuse of a defendant as a child), physical health conditions (e.g. autoimmune disorder, diabetes), low IQ (e.g. mental retardation or borderline intellectual functioning), and disadvantaged background (personal circumstances about the defendant's life as an adult, such as being homeless) (see Figure 2).

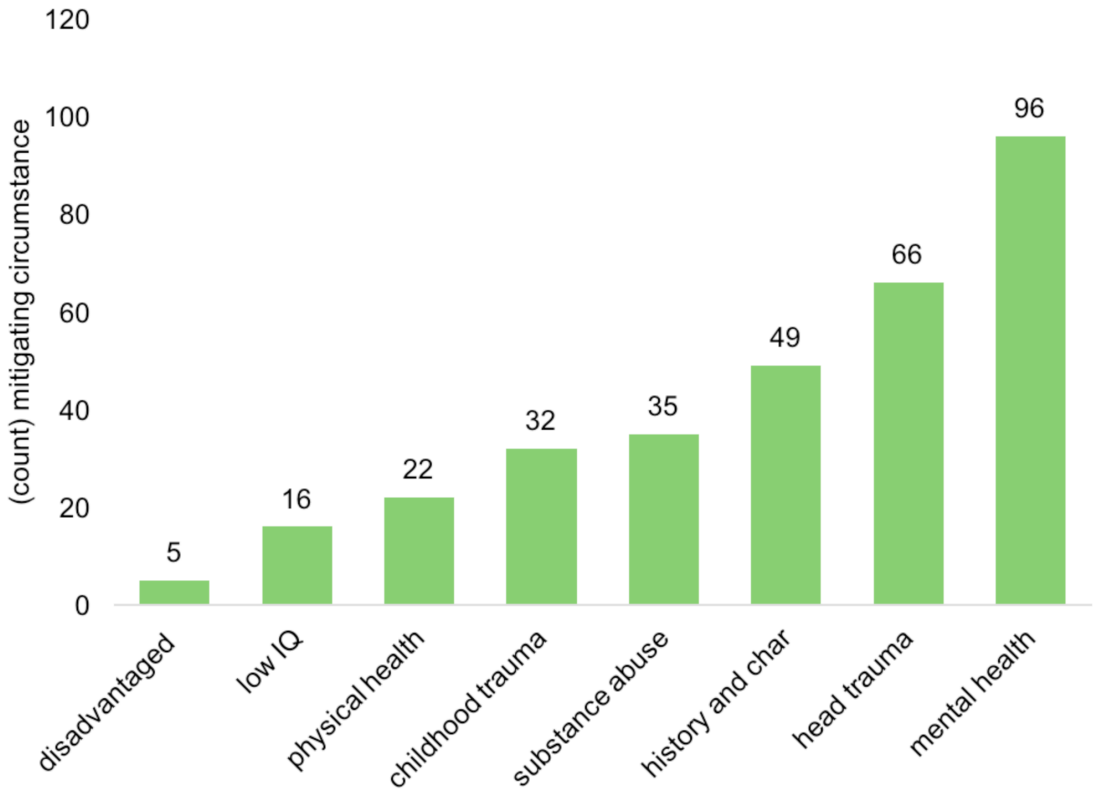

Figure 2: Frequently Mentioned Mitigating Circumstances.

Most cases introduced more than one of these mitigating circumstances for sentencing purposes (see Figure 3).

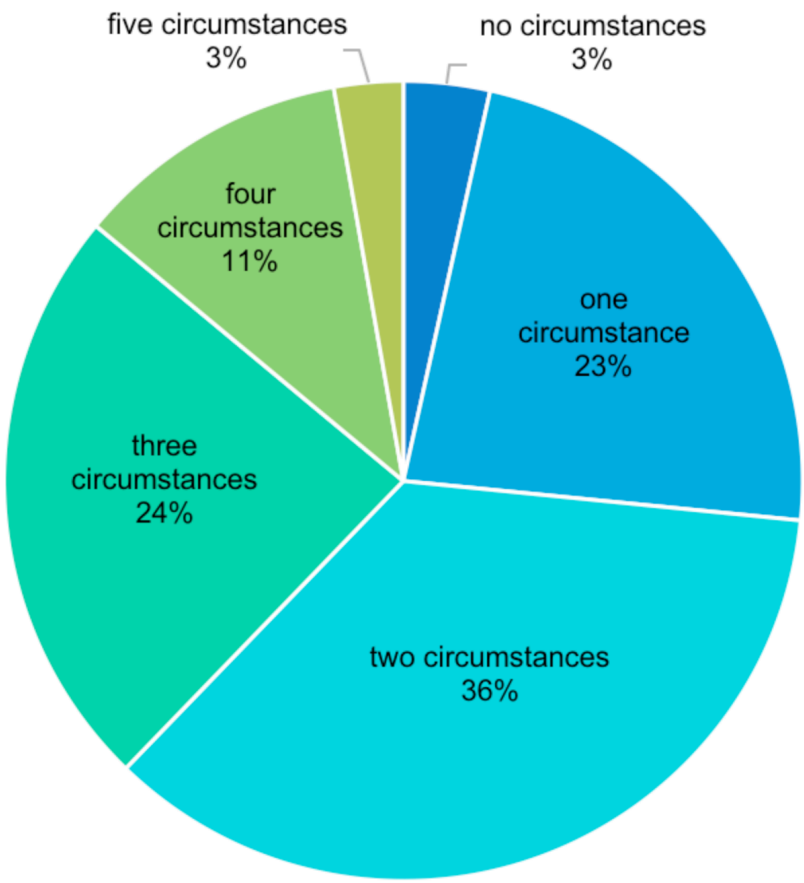

Figure 3: Number of Mitigating Circumstances Per Judicial Opinion.

2.5.1.2. Relevance of Neuroscience to Mitigating Circumstances

Fifty-seven of the 143 cases (40%) were previously coded by the Farahany team as having specific neurological testing introduced in the opinion (e.g., neuropsychological testing, brain scanning, scientific validation of the claim of brain injury) as opposed to just a passing mention of neuroscience without reference to any tests. The relevant neuroscientific testing was coded in this

study to see how frequently the neuroscience testing coincided with a reference to mitigating circumstances. The results are found in Table 1.

Most neuroscience testing was presented in conjunction with mental health and substance abuse claims, although there were several instances where neuroscience was used to talk about head trauma, low IQ, childhood trauma, and physical health. Although history and characteristics were frequently introduced as part of mitigation, neuroscience testing was rarely used to refer to those circumstances.

Table 1: Number of Judicial Opinions That Contained Neuroscience Testing That Was Mentioned in Relation to Mitigating Circumstances.

Instances in which the coded text that represented neuroscience testing also encompassed a coded mitigating circumstance. Numbers represent the count of co-occurrences of codes.

	neuroscience testing
mental health	19
substance abuse	13
head trauma	7
mental retardation/low IQ	6
childhood trauma	5
physical health	4
history/characteristics	1
disadvantaged background	0

A similar analysis revealed the co-occurrence of the word “brain” or a word with the stem “neuro” across the mitigating circumstances. The word “brain” most frequently occurred when talking about head trauma, while the word stem “neuro”

occurred less frequently, but across a broader range of mitigating circumstances (Table 2).

Table 2: Frequency of "Brain," or "Neuro" Co-occurring with Mitigating Circumstances codes.

Instances in which the sentence containing the coded mitigating circumstance contains the word “brain,” or the word stem “neuro.” Numbers represent the count of co-occurrences.

	brain	neuro
head trauma	45	7
mental health	9	11
physical health	2	3
mental retardation/low IQ	1	3
history/characteristics	4	1
substance abuse	0	3
childhood trauma	0	2
disadvantaged background	1	0

2.5.2. How Neuroscience is Being Discussed In Relation to Mitigation Across Judicial Opinions

The use of neuroscience for mitigating a sentence was discussed in three general ways across the 143 opinions. In most of the opinions (83%), neuroscience-based mitigation was brought up as part of a defendant’s claim, or reason, for appeal. A much smaller number of opinions mentioned mitigation during sentencing more generally, without introducing the mitigation as part of a specific claim that was raised by the defense on appeal. The last category represents documents that were filed about sentencing that mentioned mitigation or mitigating circumstances. Only 11 opinions fell into this category, and 9 of those were sentencing orders—a record to the court documenting the sentence

that was imposed. The other two were a motion to vacate a sentence—a document expressing the views of a judge about why he granted a defendant's motion to dismiss—and a sentencing memorandum which expressed the views of a defense lawyer about why a defendant should get a sentence below the guideline range.

To capture how neuroscience was used or discussed for mitigation purposes, these three categories were broken down into whether there was a reference to neuroscience by the defense. The results are shown in Figure 4.

More than 75% of the opinions made a direct reference to neuroscience when discussing sentencing related mitigation. This means that the text directly referenced mental health issues, mental deficiencies, brain trauma, or related issues for mitigating purposes.

About 12% of the opinions were unclear about the connection between neuroscience and mitigation. These were generally instances in which there was a reference to neuroscience, but the connection between the neuroscience and the defendant's mitigating claim was unknown. For example, the defense may have argued that a sentence was inappropriate without providing an explanation as to why the sentence was inappropriate. Later in the text the court mentions that it considered mental health issues. However, there was not a direct or clear link between mental health issues and the mitigating claim.

There were several instances of indirect references to neuroscience when defendants raised sentencing claims on appeal. Indirect references to

neuroscience indicate that defense counsel mentioned mitigating circumstances, but it became apparent that the mitigating circumstances contained or were related to neuroscience only upon reading the court's reasoning which directly referred to the neuroscience related mitigating circumstances.

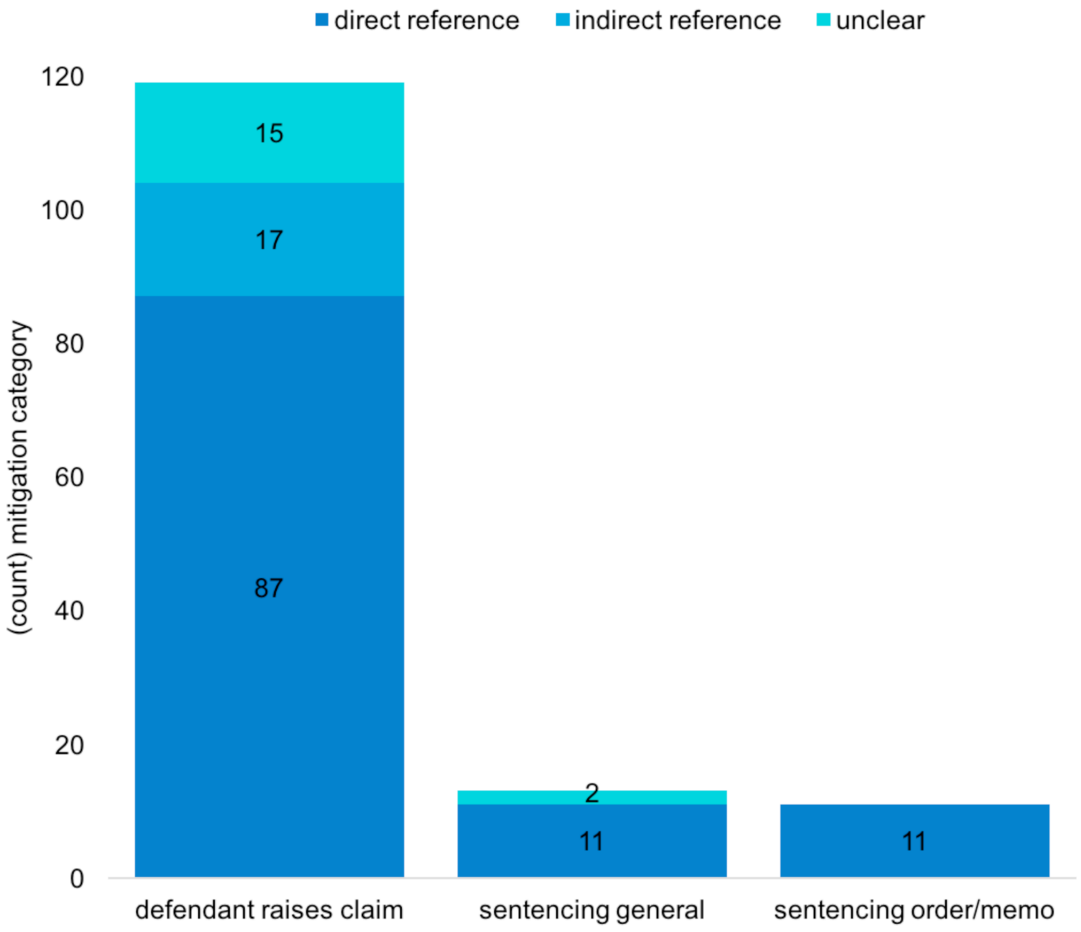

Figure 4: How Neuroscience Was Discussed in Relation to Mitigation in the Judicial Opinions.

Defendant raises claim = opinions that mentioned the defendant raised a neuroscience-based claim to mitigate sentencing. *Sentencing general* = opinions that mentioned the use of neuroscience-based mitigation for general sentencing purposes. *Sentencing order/memo* = opinions that were written in the form of sentencing orders or sentencing memoranda. *Direct reference* = neuroscience was directly mentioned in the text as being relevant for mitigation. *Indirect reference* = neuroscience was indirectly mentioned as being relevant for mitigation. *Unclear* = the role of neuroscience and mitigation was unclear. *Note: sum adds up to total number of cases.*

2.5.2.1. Specific Mitigation Claims Raised By Defendants

Taking a closer look at mitigation claims raised by the defense revealed that lawyers use many approaches to argue for mitigation in sentencing (Figure 5). The most common claim presented to a judge is ineffective assistance of counsel (IAC) for failing to adequately present a case in mitigation, which consists of several sub-categories regarding the failure to present or investigate mitigating evidence (FTPM) (see Denno, 2015). This finding is consistent with the data from the Denno (2015) and Farahany (2016) studies that demonstrate the prevalence of IAC claims across both capital and non-capital cases. IAC FTPM claims were the most common IAC claims, though other IAC claims included claims for failing to bring the section of the penal code for downward variance to the attention of the court or for failing to argue that incarceration would leave a defendant unable to receive mental health treatment.

Other common claims made by the defense were that that the sentence imposed on the defendant was excessive, that the court abused its discretion during sentencing, or that the sentence was not appropriate. Some defendants even attempted to reduce sentences by requesting that the court strike prior strike convictions under the Three Strikes law. These defendants argued that their neuropsychological deficits should preclude them from the Three Strikes law because—given their mental health status— they are not the type of offender the legislature had in mind when enacting the law.

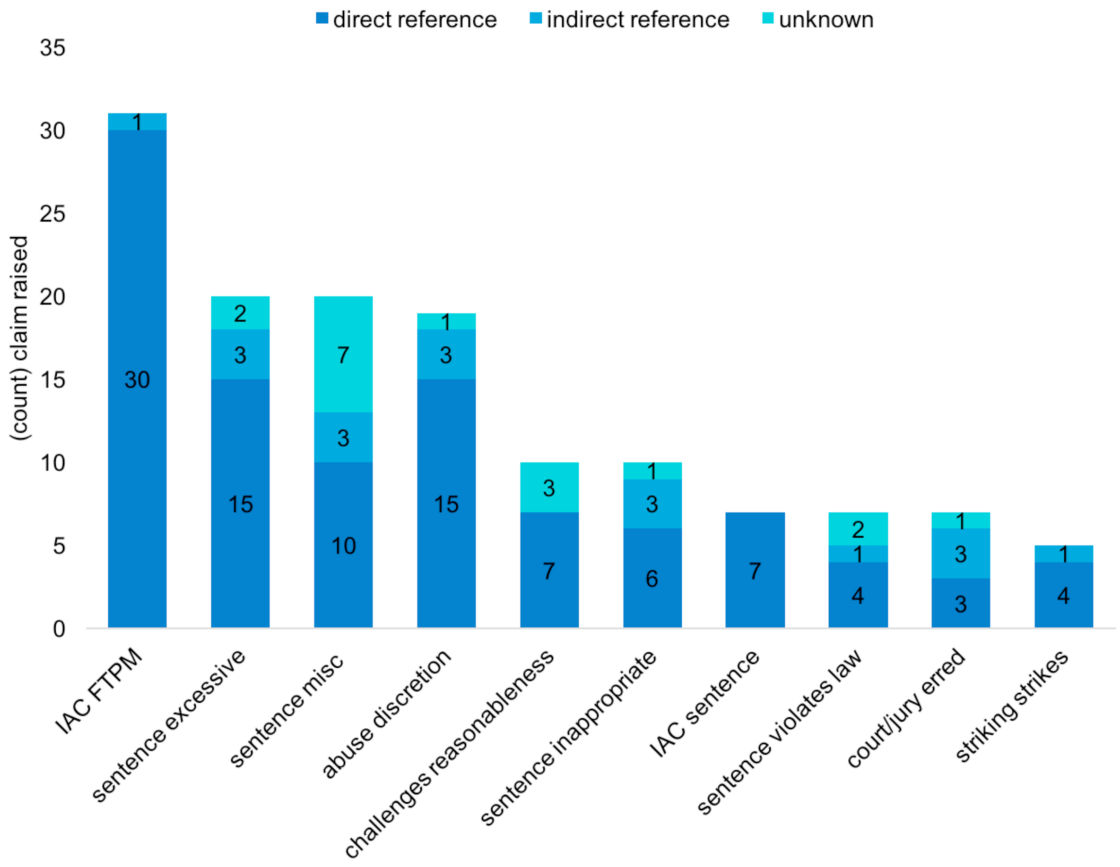

Figure 5: Claims Raised by Defendants to Argue for a Mitigated Sentence.

IAC FTPM = claims of ineffective assistance of counsel for failing to present mitigating evidence. *Sentence excessive* = claims that the sentence was excessive. *Sentence misc* = sentencing claims that did not fit into broader categories, for example, claiming that the court did not consider mitigating circumstances, or that the defendant received an improper consecutive sentence. *Abuse discretion* = claims that the court abused its discretion for sentencing. Challenges reasonableness = claims that challenge the reasonableness of the imposed sentence. *Sentence inappropriate* = claims that the sentence was inappropriate. *IAC sentence* = ineffective assistance of counsel claims other than for failing to present mitigating evidence. *Sentence violates law* = claims that the sentence was unconstitutional. *Court/jury erred* = claims that the court or jury erred during sentencing. *Striking strikes* = claims that the court failed to consider mitigating circumstances when not striking prior convictions. *Note: more than one claim may have been presented per judicial opinion.*

2.5.2.2. Relative Success of Neuroscience for Mitigation

Overall, lawyers in this sample were unsuccessful at using neuroscience-based claims to get a sentence reduced on appeal. However, that does not indicate that neuroscience was not helpful to defendants. The majority of opinions (55%) did not discuss the sentencing guideline range, but of those that did reference the guideline ranges (45% total), 20% mentioned that the defendant received a sentence below or on the low end of the guidelines range, as opposed to the 15% that received a mid-range sentence, and 10% that received high end sentences (see Figure 6).

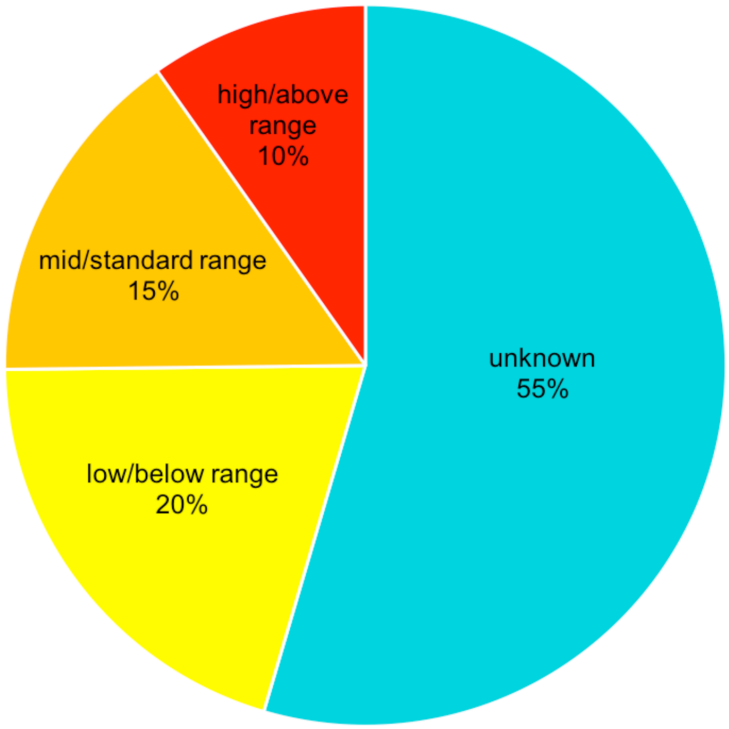

Figure 6: Total Number of Judicial Opinions that Mentioned the Guideline Range Sentence.

Unknown = opinion did not mention guideline range. *Low/below range* = defendant sentenced at the low end or below the guideline range. *Mid/standard range* = defendant sentenced near the middle of the guideline range. *High/above range* = defendant sentenced at the high end of the guideline range or above the guideline range.

2.5.3. How Judges Reason About Neuroscience-Based Mitigation for Sentencing

2.5.3.1. Direct Claim-Centered Refutations of Mitigating Claims

Many of the opinions (106 opinions total, approximately 74% of cases) directly refuted mitigation claims made by defendants by pointing to evidence

presented during the trial that contradicted the claims (86 of 143 opinions) or by pointing to procedural problems with the defendants' claims (20 of 143 opinions) (see Figure 7). These refutations often contained very direct evidence against the defendants' claims. Consider, for example, the case of Mr. Spaur, who was convicted of possession of equipment and chemicals to manufacture methamphetamine and was sentenced to 84 months imprisonment. He argued that his counsel failed to provide effective assistance by failing to provide or discuss the defendant's psychological report. The court pointed out that his claim was inconsistent with the fact that his lawyer phoned, called, and wrote letters to Mr. Spaur 55 times, and that his lawyer filed several motions regarding forensic evaluations and psychological reports during the proceedings (*Spaur v. US, 2013*).

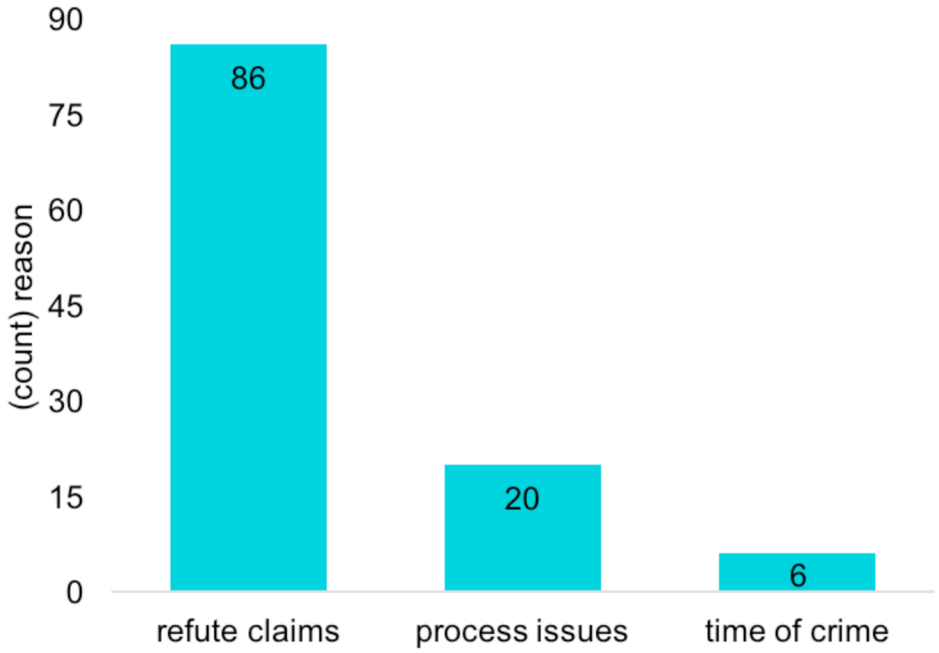

Figure 7: Judicial Reasoning about Neuroscience-Based Mitigating Claims (Claim-Centered Reasons)

Reasons why neuroscience-based claim mitigation was not successful for a defendant. *Refute claims* = the court directly pointed to evidence that contradicts a defendant's claim. *Process issues* = the court cannot address the claim because of procedural problems with how mitigation was used. *Time of crime* = the court noted that neuroscience evidence was not directly relevant for actions committed at the time of the crime. *Note that a judicial opinion may have mentioned more than one category of reasons and the numbers on the figure represent total count of category mentions.*

Although the previous courtroom studies indicated a high success rate for IAC claims, the IAC claims across these non-capital cases were less successful. In these cases, the courts often believed that the defendant's counsel had taken steps to present the mitigating evidence.

For instance, Ronald Kiser claimed ineffective assistance based on failure to present evidence in mitigation at sentencing. The court noted, however, that

Mr. Kiser's counsel had argued about his youth, his abuse as a child, that he worked and was married, that he had received a debilitating head injury that caused brain damage and seizures, that he attempted suicide, and that he lived with his parents. The court even noted that counsel called multiple character witnesses to testify on Mr. Kiser's behalf. The court found that the defendant was in no manner prejudiced by his counsel, and that, "…counsel was highly effective in achieving a very favorable result, to wit, counsel avoided a conviction on the distribution count, which would have resulted in much more severe punishment" (*Kiser v. U.S., 2013*, pg. 4). It should come as no surprise that Mr. Kiser's claim did not grant him a reduced sentence.

Another example of the court flatly refuting a defendant's claim comes from the case of Mr. Gormont, who was charged with driving under the influence of a controlled substance. He received an indeterminate sentence of 1-3 years imprisonment. Mr. Gormont argued on appeal that (a) his sentence exceeds what is necessary to protect the public and rehabilitate him and that (b) the court failed to consider several mitigating circumstances that he had raised during his hearing, including his long-existing drug addiction, that he had been self-sufficient since 16 because of family problems, and that he had a traumatic brain injury.

In response, the court pointed to a procedural issue with the claim—namely that the claim amounted to a review of discretionary aspects of his sentence that cannot be reviewed by the appellate court. The court went on to

say that even if it were to review his claims based on the merits, he would not be entitled to relief because the sentence was within the trial court's discretion—the sentence fell within the guideline range, and the courts weighed all relevant factors during sentencing and post-sentencing proceedings. (*Com v. Gormont,* 2014). About 12% of opinions mention the guideline range sentence as part of their sentencing justification (see Figure 8).

Though scholars have claimed that using neuroscience will be limited by the fact that it is hard to prove that the neuroscience-based condition was present at the time of the crime (Morse & Newsome, 2013; Smith, 2012; Miller, 2013), only 4% of the opinions mention the link between time and neuroscience evidence to refute mitigation claims. In *State v. Fuller* for example, the court noted that "even if [the defendant] had diminished brain function or dementia now, this does not mean he suffered either of those conditions at the time of sentencing" (*State v. Fuller,* 2014, pg. 2). To further emphasize this fact the court pointed to the plea hearing proceedings, where the defendant denied having difficulty understanding the court, and to the presentence investigation report, which concluded that Mr. Fuller denied having treatment for mental health concerns.

2.5.3.2. Addressing Mitigating Claims Using Indirect Defendant-Centered Reasons

The majority of claims seem to be directly refuted by the record, yet the courts frequently bring up ancillary reasons and justification that have more to do

with the defendant's personal traits, characteristics, or behaviors. These reasons and justifications are frequently based on observations and discretionary aspects of the sentencing process, and are aggravating in nature (see Figure 8).

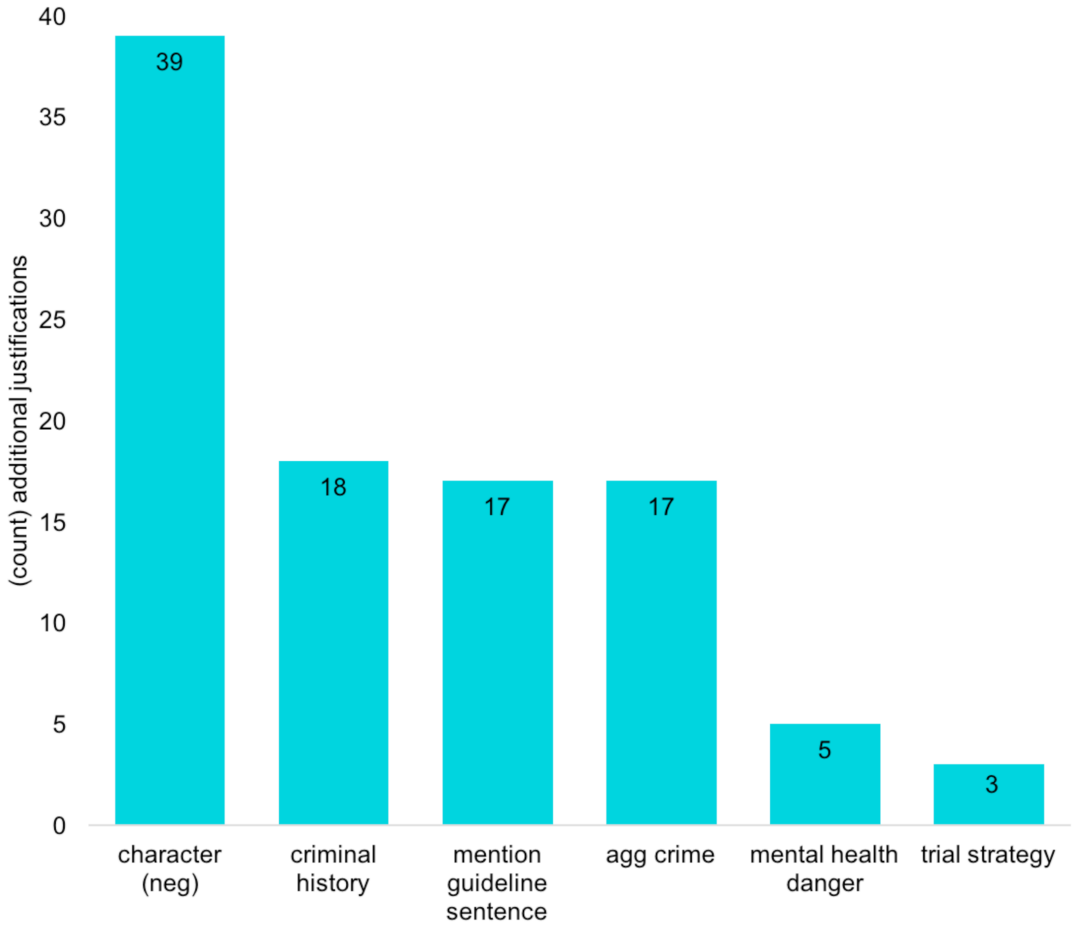

Figure 8: Judicial Reasoning about Neuroscience-Based Mitigating Claims (Defendant-Centered Reasons).

Reasons (or justifications) about defendant-centered circumstances introduced by the courts to refute the use or validity of neuroscience-based mitigation for sentencing. *Character (neg)* = personal observations that have something to do with a defendant's character, traits, personalities, or observable behaviors. *Criminal history* = justifications that are related to a defendant's criminal history. *Mention guideline sentence* = the courts mentioned the guideline range sentence. *Agg crime* = discussion of the aggravating nature of the crime. *Mental health danger* = neuroscience is viewed as presenting the defendant as potentially dangerous. *Trial strategy* = the courts mention that the lawyers trial strategy was sound.

In about 3% of opinions (5 of 143), the courts stated that sentencing would not be mitigated because the mental health issues were aggravating rather than mitigating. In three of the opinions, the courts stated that the defendant's inability to curb his addiction problems made him dangerous or that he was prone to violence during relapses. Two opinions mentioned that a traumatic brain injury, which caused impulsive behavior, could not be improved, thus demonstrating that the prospects for rehabilitation in the future were dim.

Similarly, 3 of the 143 opinions mentioned that counsel used a reasonable trial strategy when they did not present neuroscience related mitigating evidence (these were all IAC FTPM claims). The reasons given by the court were that the evidence would portray the defendant as someone who was dangerous, or would have called into question positive characteristics about the defendant or other mitigating circumstances (e.g. using the neuroscience would have called into question a defendant's sincerity when he accepted responsibility for the crime).

For instance, Tanya Anderson was charged with bank robbery. Ms. Anderson claimed her counsel failed to investigate the circumstances of a car accident that left her with a brain injury, which could have explained her behavior. She further claimed that her counsel told her not to emphasize the brain injury anyway because the court would think that she was failing to take responsibility for the crime. The court pointed to the record that contradicted Ms. Anderson's claims, demonstrating that her counsel had obtained many medical records regarding her brain injury. Moreover, the court noted that arguing that Ms.

Anderson was so affected by her brain injuries would have been counterproductive, given that Ms. Anderson took great care when committing the bank robbery. The court noted that she wore heavy makeup, glasses, and a hat, evidence that "undercuts the notion that the robbery was a spur of the moment idea by an irrational person" (*Anderson v. US,* 2014, pg. 2).

In 27% of opinions, the courts mentioned something negative about the defendant to refute the potentially mitigating factors. The courts' own perceptions of a defendant's behaviors or traits were used to contradict neuroscience-based mitigating claims. This type of discretionary behavior is not typically sanctioned by the sentencing guidelines. These judgments and justifications varied significantly from case to case, but shared common themes.

In some cases, the courts reasoned that the defendant seemed to have control over his actions and made conscious choices, which—in the opinion of the judge—invalidated the neuroscience claims. For example, Mr. Le was convicted on several counts of forgery and theft of property. Over the course of the trial, Mr. Le wanted his attorney to investigate a previous head injury that Mr. Le said changed his whole personality. A psychiatrist who was contacted said that the head injury "might very well" have altered Mr. Le's mental functioning and impulse control. Unfortunately, the psychiatrist was unable to be present at the sentencing hearing and was thus unable to present to the court. Mr. Le argued that the court committed an error and abused its discretion by not allowing a continuance of the sentencing hearing. However, the court concluded

that even if the psychiatrist's tentative conclusions were true (that Mr. Le suffered a loss of impulse control due to his prior head injury), it would not have made a difference to the court's sentencing decision. The court justified this conclusion in the following way:

> "[Le's] behavior in this case, as well as all the behavior I've seen from Mr. Le [in court], is measured; it is considered. He decides how to behave: he ratchets up when things aren't going his way, and he calms down when he gets his way.... I don't think that's compulsion. I think that [it] might be a character trait or a personality defect or something like that, but it's not compulsion." (*Le v State*, 2015)

Although the courts had scientific reason to believe that the defendant's head injury could have led to a loss of impulse control, the court valued its own judgments of the defendant's behavior over an expert's.

Another frequently used sentence justification that suggests the defendant was in control of his actions occurred when considering mental health treatment and substance abuse problems. The case of Mr. McCray highlights the issues surrounding this type of reasoning.

Mr. McCray was convicted for attempted voluntary manslaughter and assault with a deadly weapon. Mr. McCray appealed his case, contending that the court abused its discretion for failing to find his mental health diagnosis of paranoid schizophrenia as a factor when considering his prior convictions (part of the Three Strikes law). Mr. McCray had received treatment for nearly 20 years but stopped because of a divorce. Despite his illness, he remained employed. His probation report stated that his criminal history derives from his mental illness

and that the court had found him legally incompetent twice. Mental health professionals said that Mr. McCray would benefit from regular and continuous mental health treatment.

Although it seems like the defendant had a strong case about why his mental health should be mitigating, the court looked outside of the probation report to the actions and behavior of the defendant. The court said:

> "What defendant ignores, however, is the probation officer's report that even though defendant is aware that the medication helped him and prevented him from getting into trouble with the law, he had not consistently taken his medication. Moreover, defendant has for years apparently attempted to self-medicate with marijuana, cocaine, methamphetamine and alcohol, but denies that he has a drug or alcohol problem." (*People v McCray*, 2015)

The court reasoned that even though Mr. McCray had an opportunity for treatment, he didn't use the opportunity wisely and remains a violent criminal.

The courts also relied on observations about the defendant's behavior in court to refute neuroscience claims. These ranged from not showing remorse during trial, calling the crime an accident when it was a willful act, or not appearing to be as mentally impaired as the neuroscience evidence suggested.

In *US v Kennebrew* (2015), Mr. Kennebrew argued that his sentence was unreasonable because the court failed to properly weigh the severity of his mental health issues, which included a low IQ of 61(borderline mentally retarded) characterized by significant deficits in intellectual functioning. This, he argued, made him easily victimized by others. However, when the court was discussing the reasons for the sentence, it mentioned that the IQ measurement of 61 seemed low given Kennebrew's ability to take part in basic interactions at court.

The court also described Kennebrew as a “fully present, aware, and intelligent person” and found that he functioned effectively with other people. Mr. Kennebrew’s claim was dismissed.

Approximately 24% of opinions mentioned something about a defendant’s criminal history or the aggravating nature of the crime. These are judgments that are sanctioned by the guidelines. In fact, both criminal history and type of crime are the two axes of the U.S. sentencing grid. Neuroscience as mitigation seems to have little weight when placed in the context of an extended criminal history or extreme conduct (i.e. unusually heinous, cruel, brutal, or degrading to the victim, §5K2.8). That is, the courts use criminal history or violent encounters to justify giving neuroscience information less weight than what a defendant would have liked.

In the case of *People v Gray* (2014), the defendant claimed that the court gave insufficient consideration to his mental illnesses when denying his *Romero* motion, which allows defendants to plead to the court to not allow the prosecution to introduce prior felony convictions. Mr. Gray’s mental illnesses included a schizophrenic condition with evidence of antisocial behavior and poly-substance abuse. The court, however, disagreed with the defendant’s characterization of the record. The court said:

> “…in emphasizing the mental health issues that are part of his background, defendant either ignores or minimized other aspects relevant to the Romero motion that were unfavorable to him. The current offenses involved great violence, namely, the defendant bashing the victim’s skull repeatedly with a rock, and a defendant’s history of serious and violent convictions, incarcerations, and the

> commission of new offenses within short periods of time after being released." (*People v Gray*, 2014, pg. 3)

Similarly, Mr. Spells was convicted of attempted murder, and asserted during appeal that his lack of a violent criminal record and history of mental illness (he was diagnosed with bipolar disorder and depression) should have been given mitigating weight. The court noted that:

> "…Spells was hostile and aggressive from the outset, that he had no reason to draw or fire at Officer Brown, and that firing the gun in a populated neighborhood showed an extreme disregard for the welfare of the public at large…The State further argues that Spells's character is abysmal… Spells's lack of character is established by his willingness to engage in violence and to use a deadly weapon in the manner in which he did." (*Spells v. State*, 2015, pg. 4)

Another case highlights how perceived control, criminal history, and extreme conduct counteracted neuroscience information in the context of substance abuse. Mr. Webb was convicted of aggravated burglary and assault, employing a firearm during the commission of a felony, and aggravated cruelty to animals. During the trial, Mr. Webb introduced testimony from an expert in the field of internal medicine and addiction, Dr. Smith. Dr. Smith testified that Mr. Webb struggled with addiction to narcotics most of his life and that he remained sober for nine years until he was prescribed temazepam by a veteran's hospital. The temazepam triggered Mr. Webb's craving for both it and alcohol, and soon after Mr. Webb suffered a full relapse for temazepam, alcohol, marijuana, Xanax, Valium, and cocaine. The veteran's hospital continued to prescribe him temazepam despite Mr. Webb reporting that he was abusing drugs. Dr. Smith

also testified that Mr. Webb had preexisting brain damage from a motorcycle accident that impaired “the area of defendant’s brain associated with judgment” (*State v. Webb*, 2015, pg. 4).

When it came to sentencing, the trial court imposed a lengthy 20-year sentence, which Mr. Webb objected to in his appeal. The court responded that it rejected Mr. Webb’s mental condition as a mitigating factor, since such a condition cannot be the result of voluntary intoxication, and found no proof that Mr. Webb was suffering from a relapse of his addiction. The trial court found that Mr. Webb treated the animal in question (someone’s pet dog) with unusual cruelty and did not hesitate in committing the crime. The court also pointed to Mr. Webb’s four misdemeanor convictions and affirmed the sentence of the lower court.

2.6. Discussion

The findings from this analysis suggest that neuroscience information can be a central component in defendants’ claims to mitigate sentencing and that defense lawyers believe that information regarding neuroscience should be used as a factor to reduce sentences in non-capital cases.

Defendants were unsuccessful when they used neuroscience-based mitigating claims in non-capital cases. This suggests that neuroscience will likely lead to larger sentencing gains for the defense when the stakes of punishment are high, as legal doctrine implicitly acknowledges (“death is special,” *Furman v Georgia*, 1972).

Even though these results at first glance suggest that neuroscience is not effective in non-capital cases, a closer look at the judges' and courts' reasons and justifications for their sentencing behavior reveals a more complex picture.

When the judicial opinions mentioned how the sentence the defendant received compared to the guideline range, neuroscience information was cited as a reason for sentencing below or at the low end of the guideline range, suggesting that although mitigation claims during sentencing are not successful, the neuroscience information itself is likely having a mitigating effect.

This analysis also suggests that neuroscience is infrequently viewed as a double-edged sword, as others have pointed out (Denno, 2015; 2016). In the few cases that do describe the double-edged nature of the neuroscience, it is generally within the context of substance abuse problems.

These data also point to the challenges faced by decision makers when weighing mitigating neuroscience related circumstances in the context of aggravating circumstances that are often about a defendant's behaviors and traits. The behaviors or traits mentioned by the judge are frequently viewed as a reason or justification to doubt the uncontrollability, or impulsivity, of the defendant's behavior. Statutory aggravating circumstances are also used as a different measure of impulsivity by looking for patterns of criminal behavior (criminal history), or patterns of depraved behavior in the commission of the act itself.

3. Study 2: The Role of Mitigating Circumstances and Neuroscience Information on Sentencing Related Judgments

The qualitative study demonstrated that neuroscience information is frequently being introduced by the defense for appeals claims to mitigate sentencing. Moreover, it seems that neuroscience information can work in the defendant's favor to get a sentence at the low end of the sentencing guideline range. Judging from the courts' responses to neuroscience information, the defense seems to be attempting to use neuroscience information to convey that the defendant may have had less control over his actions, which would diminish his culpability. Neuroscience was used—albeit less frequently—in various other contexts, such as to talk about the effects of head trauma, physical health conditions, or childhood trauma.

While these data tell us how lawyers and judges use and reason about neuroscience information in the courtroom, many questions remain regarding the role of neuroscience information on sentencing related judgments. For example, how important is it to provide a link between brain and behavior when describing some of these mitigating circumstances? Is telling the judge that you have antisocial personality disorder enough to mitigate sentencing? Does explaining how a defendant's schizophrenia prevents him from behaving rationally help a defendant's case?

Past studies that manipulate neuroscientific expert testimony have not found differences across the presentation of different kinds of expert testimony

(Schweitzer et al., 2011). This could be because the testimony was described to decrease levels of intentionality or because it was presented in the context of a mental health disorder. Yet the seductive allure literature contends that neuroscience information—specifically brain and reductive information—can provide more convincing explanations of phenomena. The following study assessed the role of neuroscience information—presented as neuropsychology testimony without reference to the brain versus brain-based neuropsychology—across mitigating circumstances on perceptions of control and other legally relevant judgments. The purpose of this study was to disentangle the effects of neuroscience information across mitigating circumstances. Furthermore, this study assessed whether neuroscience information presented as it frequently is in the courtroom—describing neuropsychological function without reference to the brain—has a different impact than when neuroscience contains information about neuropsychological function *plus* a reference to the brain.

3.1. Method

3.1.1. Participants

A total of 1,085 participants completed the survey. Participants were recruited from MTurk. Sixteen participants were excluded for failing to provide a valid answer on a manipulation check. The sample analyzed consisted of 1,069 participants (56% male, 44% women, approximately 70% between the ages of 25-64). Participants were 18 or older and residents of the United States. Participants were compensated $0.75 upon completion of the survey.

3.1.2. Procedure and Design

A 3 (information about behavior: no information, neuropsychology information, neuropsychology plus brain-based information)[3] x 8 (mitigating circumstance: none present, employment record, SES, disadvantaged background, childhood abuse, mental/emotional condition, physical condition, substance abuse) between-subjects design was used to test the effects of information across mitigating circumstances. The mitigating circumstances were chosen based upon circumstances mentioned in the sentencing guidelines and those mentioned in the qualitative study. Each participant was randomly assigned to an information and mitigating circumstance condition.

Participants read an informed consent form describing the procedures of the study and indicated their voluntary consent to participate by agreeing and advancing to the next page. Participants were then taken to the instructions screens and then advanced to read a summary of a criminal case. The summary described a case about a man who was convicted of aggravated assault (Appendix C). The summary included a statement of facts about the crime and additional information from the defense. The additional information included the neuroscience information and mitigating circumstance manipulations (Appendix D).

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[3] For the sake of simplicity, I refer to the information conditions as "neuropsychology" versus "brain-based," although both contain neuropsychological information. Note that the difference between conditions is that in the "brain-based" condition includes language that directly references the brain.

The mitigating circumstance manipulation was composed of two sentences: the first described the mitigating circumstance (e.g. *the defense presented evidence that Hall had a traumatic upbringing and cited that Hall suffered abuse in his childhood, including that Hall's father forbid Hall from taking showers and sexually abused him, and Hall's mother regularly forgot to feed him*); and the second sentence made a reference to using the circumstance as mitigation (e.g., *the defense argued that Hall's childhood abuse should mitigate punishment and result in a lesser sentence*). The three information conditions were as follows:

No information (no info) *control condition, no neuropsychological or brain-based information presented to participants*

Neuropsychological information (psyc)

A psychologist, Dr. Eric Tackett, assessed Hall using a number of psychological tests. Dr. Tackett testified that Hall has deficits in general cognitive ability. Dr. Tackett also testified that Hall exhibits lack of behavioral control, poor impulse inhibition, and deficient problem-solving skills, which he opined could result in intensified aggressive urges.

Neuropsychological Plus Brain-Based information (brain)

A neuropsychologist, Dr. Eric Tackett, assessed Hall using a number of psychological tests. Dr. Tackett testified that he performed an MRI test and a PET test that both showed frontal system damage in Hall's brain, consistent with Hall's deficits in general cognitive ability. Dr. Tackett also

testified that the abnormalities in Hall's brain could cause lack of behavioral control, poor impulse inhibition, and deficient problem-solving skills, which he opined could result in intensified aggressive urges.

The neuroscience information was always couched within the mitigating circumstance manipulation, and the neuroscience did not directly reference the mitigating circumstance:

> The defense presented evidence that Hall had a traumatic upbringing and cited that Hall suffered abuse in his childhood, including that Hall's father forbid Hall from taking showers and sexually abused him, and Hall's mother regularly forgot to feed him. *A psychologist, Dr. Eric Tackett, assessed Hall using a number of psychological tests. Dr. Tackett testified that Hall has deficits in general cognitive ability. Dr. Tackett also testified that Hall exhibits lack of behavioral control, poor impulse inhibition, and deficient problem-solving skills, which he opined could result in intensified aggressive urges.* The defense argued that Hall's childhood abuse should mitigate punishment and result in a lesser sentence*.*

Participants then answered a series of questions on a 7-point Likert scale. The questions were presented in random order. Questions about the defendant and his actions included[4]: "Do you believe that the defendant was in control of his

[4] A series of questions were also asked about the denial of human nature and denial of human uniqueness, measures that have been previously validated and form a measure of dehumanization (Bastian & Haslam, 2010; Bastian, Denson, & Haslam, 2013). However, one scale question was accidentally omitted from the survey, and a factor analysis of the questions

actions at the time of the crime?" (1 = *not at all*; 7 = *complete control*); "How much do you think the defendant's moral character influenced his criminal actions?" (1 = *not at all*; 7 = *completely*); "How much do you think the defendant's cognitive abilities influenced his criminal actions?" (1 = *not at all*; 7 = *completely*); and "How strongly would you blame the defendant's brain for his criminal actions?" (1 = *not at all*; 7 = *completely*).

Questions about the defendant were (1 = *not at all* to 7 = *extremely well*): "To what extent do the following statements apply to the defendant? The defendant is morally responsible for his actions; The defendant is a threat to society; The defendant is likely to reoffend; The defendant is likely to be rehabilitated if given the opportunity; The defendant has mental health issues."

Questions about the mitigating circumstances included: "How often do you think the defendant's [circumstance] affects his decision-making processes" (1 = *never*; 7 = *always*); "In general, do you think a defendant's [circumstance] should be considered as a factor to reduce a defendant's sentence" (1 = *should never be considered*; 7 = *should always be considered*).

The question about sentencing was: "In the United States, sentencing decisions are calculated using sentencing guidelines, which offer a range of months for incarceration. Any number can be chosen from within the given

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that were asked did not yield the anticipated two factor solution. This measure was subsequently removed from further analysis.

range. The defendant in this case has been convicted of aggravated assault, which can have a range from 15 to 21 months in prison. How severely do you think the defendant be punished" (Likert-scale values labeled as *15 months*; *16 months*; *17 months*; *18 months*; *19 months*; *20 months*; *21 months*).

To ensure that participants read and understood the vignette, a manipulation check was included that asked participants to summarize the case. Lastly, participants answered demographic questions.

3.2. Study 2 Hypotheses

Previous studies have not investigated the role of neuroscience information on legal judgments across mitigating circumstances. However, circumstances that have been identified by jurors as being mitigating in nature, such as coming from a disadvantaged background, having been abused as a child, mental retardation, and of course, mental and emotional disturbances (Garvey, 1998), as well as circumstances regarding head injuries, are likely perceived to diminish the defendant's responsibility for his actions. Neuroscience information, whether that information contains brain-based language or not, was hypothesized to impact judgments across those characteristics.

Substance abuse, deeply stigmatized in today's society, is viewed as a controllable condition despite experts' opinions to the contrary (Volkow, Baler, & Goldstein, 2011; Garvey, 1998). Hence the interaction of any kind of neuroscience information with substance abuse will likely differ for the aforementioned circumstances.

The effects of neuroscience information on SES, employment, and physical condition also remain unknown, although neither neuropsychology or brain-based information should have an effect across these circumstances because the information is not directly relevant to the mitigating circumstances. However, if the seductive allure effect exists in a legal context, then we would expect brain-based information to change perceptions across those irrelevant circumstances.

3.2.1. Hypotheses About the Defendant and His Actions

Both the neuropsychology information and brain-based information conditions should lead participants to view the defendant as less in control of his actions. These predictions are based on previous findings that found that scientific (i.e. neuroscience, neuropsychology, genetic) explanations decreased judgments of control over behavior (Greene & Cahill, 2012; Aspinwall et al., 2012; Schweitzer et al., 2011; Cheung & Heine, 2015).

Because the neuropsychology and brain-based information conditions indicate that the defendant has deficits in general cognitive abilities, I hypothesized that both neuropsychology and brain-based information would lead participants to perceive the defendant's cognitive abilities as influencing his actions more than the control condition across mitigating circumstances. This would parallel research that demonstrates that defendants with mental health disorders are more likely to be found not guilty by reason of insanity when there neuroscience testimony is present (Gurley & Marcus, 2008) and that participants

are more likely to judge a defendant to be “brain damaged” or “crazy” when there is neuropsychology or neuroimaging testimony (Greene & Cahill, 2012; Montgomery, Ciccone, Garvey, & Eisenberg, 2005). Similarly, across circumstances, brain-based information should lead participants to ascribe more blame to the brain and less to his moral character.

3.2.2. Hypotheses About the Defendant

Studies have found that diagnostic neuroscience evidence (e.g. neuropsychology) reduces perceptions of a defendant’s responsibility (Greene & Cahill, 2012; Graham, Weiner, & Zucker, 1997). Both neuropsychology and brain-based information should lead to lower perceptions of moral responsibility across circumstances that could be causally related to the defendant’s behavior (i.e., coming from a disadvantaged background, having a history of childhood abuse, or struggling with depression). However, for conditions that are not as directly linked to the mitigating circumstance (i.e., SES, employment, physical condition, substance abuse) responsibility judgments should be similar to the control condition.

Though genetic information seems to increase perceptions of recidivism (Aspinwall et al., 2012), other studies have shown that scientific evidence decreases perceptions of threat when coupled with information about a defendant’s traumatic background (Kim et al., 2015). Perceptions of recidivism and threat tend to increase when a defendant’s circumstances are viewed as uncontrollable (such as having psychopathy vs schizophrenia, Mowle, Edens,

Clark, & Sorman, 2016; Saks et al., 2014). Because the current study design had no information about future dangerousness and did not include circumstances that are uncontrollable, both neuropsychology information and brain-based information should decrease perceptions of recidivism. Moreover, neuropsychology and brain-based information should increase perceptions that a defendant has mental health issues. The one exception is with the substance abuse circumstance, which, as previously mentioned, is often viewed negatively and seen as "controllable."

3.2.3. Hypotheses About Mitigating Circumstances

The only other study that used a defendant's circumstance as a manipulation (childhood trauma) demonstrated that when scientific evidence was present in the context of having an abusive family, sentences decreased, suggesting that participants view the combination of background and scientific evidence as mitigating (Kim et al., 2015). Both neuropsychology and brain-based information should lead participants to say that disadvantaged background, childhood abuse, and mental/emotional condition will affect a defendant's decision-making process more frequently than when the mitigating circumstance is presented on its own. There should be no such effect across SES, employment, physical condition, and substance abuse. However, if there is an effect across these conditions it would suggest that the "seductive allure" effect can extend into judgments about decision-making capabilities.

3.2.4. Hypotheses About Punishment

Studies have found that the inclusion of expert evidence and scientific evidence leads to shorter sentence length (Schweitzer et al., 2011; Cheung & Heine, 2015). I predict that across circumstances, neuropsychology information and brain-based information will lead to shorter sentences.

3.3. Results

The results of this study show that neuroscience information, when presented as information about neuropsychological functions with or without direct reference to the brain, plays an important role in judgments and decisions about legally relevant variables. The results replicate previous findings regarding perceptions of control over actions, moral responsibility, and punishment. The results of this study indicate that neuropsychology information with and without brain-based information differentially impact judgments and decisions across mitigating circumstances, such that neuropsychology information and brain-based information impact judgments and decisions when the circumstance is a mental/emotional condition or a physical condition. However, only neuropsychological information that references the brain affects judgments and decisions across SES and employment record. A summary of the results is presented in Table 3.

Table 3: Summary of Results for Study 2.

Results across the dependent variables for Study 2. Y = yes there was a statistically significant effect at $p < .05$. N = no statistically significant effect. Values in parentheses represent effect sizes using partial eta squared values.

	Circumstance Main Effect	Information Main Effect	Interaction
Do you believe that the defendant was in control of his actions at the time of the crime?	Y (.03)	Y (.09)	Y(.03)
How much do you think the defendant's moral character influenced his criminal actions?	Y (.02)	Y (.06)	N
How much do you think the defendant's cognitive abilities influenced his criminal actions?	N	N	N
The defendant is morally responsible for his actions.	N	Y (.07)	Y (.03)
The defendant is a threat to society.	Y (.02)	Y (.01)	N
The defendant is likely to reoffend.	Y (.03)	N	N
The defendant is likely to be rehabilitated if given the opportunity	Y (.02)	N	N
The defendant has mental health issues.	Y (.05)	Y (.06)	N
How often do you think the defendant's [*circumstance*] affects his decision-making processes?	Y (.17)	Y (.02)	Y (.03)
How strongly would you blame the defendant's brain for his criminal actions?	N	N	N
How severely do you think the defendant should be punished in this case?	Y (.02)	Y (.03)	Y (.02)
In general, do you think a defendant's employment record should be considered as a factor to reduce a defendant's sentence?	Y (.14)	Y (.02)	N

3.3.1. Results About the Defendant and His Actions

A multivariate analysis of variance (MANOVA) was conducted to protect against Type I errors on conceptually related dependent variables (DVs) that assessed factors about the defendant's criminal actions. If the MANOVA was significant, univariate analyses of variance (ANOVA) were conducted. The DVs included in this analysis were: was the defendant in control of his actions, did the defendant's moral character influence his actions, did the defendant's cognitive abilities influence his actions, and how strongly would you blame the defendant's brain for his actions. Levene's test was significant across all four DVs, and thus the more stringent p-value of .0125 will be used to assess the univariate effects. The multivariate test indicated a significant interaction effect between information and circumstance (PT = .08, $F(56, 4180) = 1.54$, $p = .006$), a significant main effect of circumstance (PT = .07, $F(28, 4180) = 2.51$, $p < .001$) and a significant main effect of information (PT = .11, $F(8, 2086) = 15.62$, $p < .001$).

The univariate effects revealed significant main effects for circumstance ($F(7, 1045) = 5.24$, $p < .001$, $\eta^2 = .03$) and information ($F(2, 1045) = 57.65$, $p < .001$, $\eta^2 = .09$) in the **control DV**, although these main effects were qualified by a significant interaction ($F(14, 1045) = 2.97$, $p < .001$, $\eta^2 = .03$) (see Figure 9). Simple main effects tests revealed significant differences between the neuropsychology information and brain-based information conditions, and neuropsychology information and the no information conditions in the control

circumstance condition ($F(2, 1045) = 7$, $p = .001$), employment record ($F(2, 1045) = 19.58$, $p < .001$), and SES ($F(2, 1045) = 7.60$, $p < .001$) conditions. There were significant differences between the no information and neuropsychology, and no information and brain-based information conditions (but not between no information and neuropsychology) across childhood abuse ($F(2, 1045) = 10.28$, $p < .001$), mental/emotional condition ($F(2, 1054) = 6.1$, $p = .002$), and physical condition ($F(2, 1054) = 23.48$, $p < .001$), suggesting that both neuropsychology information and brain-based information minimized perceptions of control across those circumstances (see Table 4).

Simple main effects tests also revealed significant differences in all three of the information conditions across circumstances (no information: $F(7, 1045) = 4.15$, $p < .001$), neuropsychology: $F(7, 1045) = 4.98$, $p < .001$, brain-based: $F(7, 1045) = 2.07$, $p = .044$). Effects in the no information condition were primarily driven by the substance abuse condition, suggesting that participants believed that a defendant is more in control of his actions if he has substance abuse issues in comparison to all other mitigating circumstances when no additional information is provided.

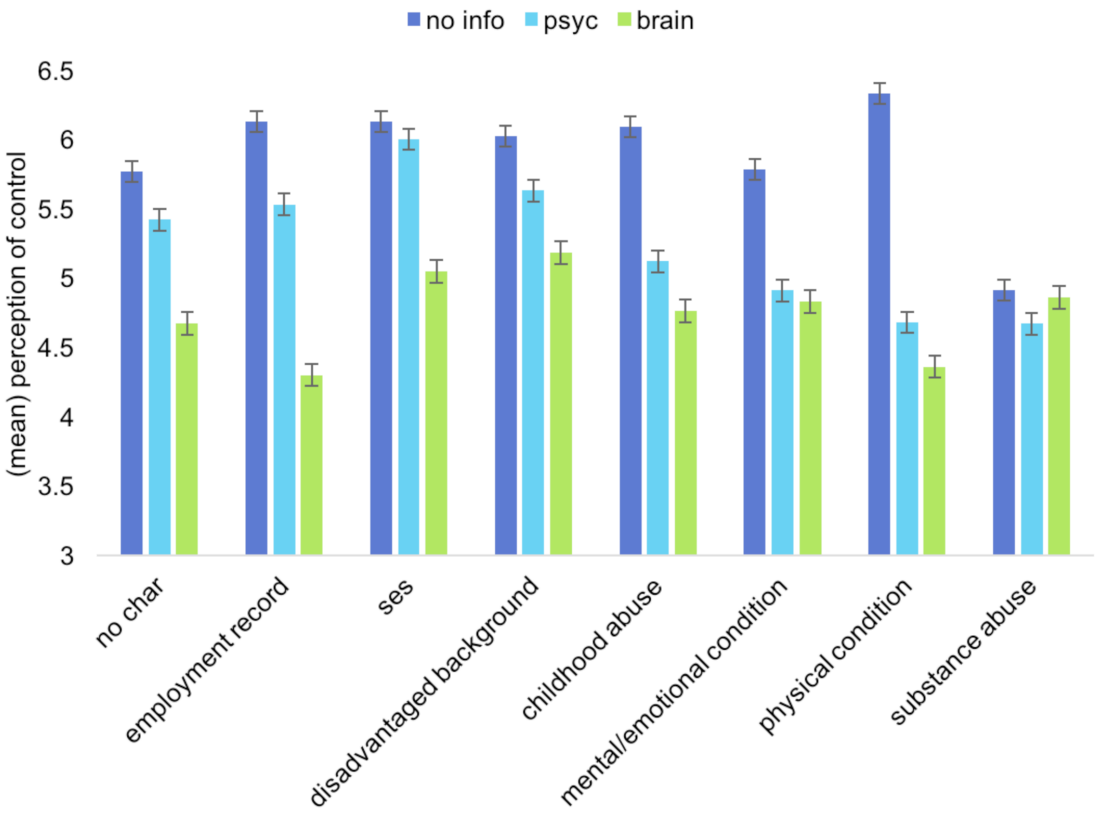

Figure 9: Mean Ratings of Control.

"Do you believe that the defendant was in control of his actions at the time of the crime?" Y-values are mean values, from scale of 1 (*not at all*) to 7 (*complete control*). Errors bars = standard error of the mean.

Table 4: Simple Main Effects Across Information Conditions for Control.

Blue highlighted boxes represent a significant effect was present at $p < .05$. *No info – psyc*: comparisons between the no information and neuropsychology condition. *Psyc – brain*: comparisons between the neuropsychology and brain-based conditions. *No info – brain*: comparisons between the no information and brain-based conditions.

	control actions		
	no info – psyc	psyc – brain	no info – brain
no char			
employment			
ses			
disadvantaged			
child abuse			
mental			
physical			
substance			

Univariate effects revealed significant main effects for circumstance ($F(7, 1045) = 3.01$, $p = .004$, $\eta^2 = .02$) and information ($F(2, 1045) = 32.48$, $p < .001$, $\eta^2 = .06$) on the DV that asked whether the defendant's **moral character** influenced his actions. For the information condition, multiple comparisons tests revealed significant differences between the control information condition ($M = 5.5$) and both the neuropsychology information ($M = 4.8$; $p < .001$) and brain-based information ($M = 4.6$; $p < .001$) conditions, although not between the neuropsychology and brain-based information conditions ($p = .42$).

There were no significant univariate effects for the **cognitive abilities** or **blaming the brain** DVs.

3.3.1.1. Discussion About the Defendant and His Actions

Two hypotheses in the present research were that both neuropsychology information and brain-based information would lead participants to view the defendant as being less in control of his actions and would ascribe less blame to a defendant's moral character. These hypotheses were supported by the results. Both neuropsychology and brain-based information significantly lowered perceptions of control compared to the baseline no information condition. This pattern of results was also found in participants' perceptions about a defendant's moral character influencing his actions.

The results did not support the hypotheses that participants would blame a defendant's cognitive abilities or his brain more in either neuroscience condition. One explanation for this null effect is that participants were not willing to endorse the explicit blaming of an innate feature about the defendant. These results are consistent with a previous study that found that participants indicated that scientific information had no effect on their decision even though the researchers found differences in sentencing recommendations (Kim, Boytos, Seong, & Park, 2015).

Examining the pattern of simple main effects reveals that neuropsychology information and brain-based information impact perceptions differently across mitigating circumstances, such that both neuropsychology information and brain-based information had a significant effect beyond the control no information condition in contexts where the mitigating circumstance could be feasibly related

to the brain (e.g., the mental/emotional condition, the physical condition). Although the physical health condition was originally hypothesized to fall into a group of circumstances that were unrelated to neuroscience, participants may have categorized the physical health condition—which referenced damage to nerves that temporarily paralyzed the defendant—as being related to brain health.

In contexts in which the mitigating circumstance could be perceived to be less related to the brain, the effects of neuropsychology information did not differ from the control condition. These results begin to suggest that brain-based information may produce a seductive allure kind of effect across mitigating contexts that are not about the mind or brain.

3.3.2. Results About the Defendant

A multivariate analysis of variance was conducted to protect against Type I errors on conceptually related DVs that assessed traits about the defendant. The question stem asked “to what extent do the following statements apply to the defendant” and the following DVs were assessed: the defendant is morally responsible for his actions, the defendant is a threat to society, the defendant is likely to reoffend, the defendant is likely to be rehabilitated if given the opportunity, the defendant has mental health issues. Box’s M was significant ($F(345, 453720) = 597.65$, $p < .001$) so we used Pillai’s Trace to assess the multivariate effects. Levene’s test was significant across the morally responsible and mental health DVs, thus the more stringent p-value of .01 was used to

assess those univariate effects. The multivariate test indicated that there was a significant interaction effect between information and circumstance (PT = .1, $F(70, 5225) = 1.46$, $p = .008$), a significant main effect of circumstance (PT = .1, $F(35, 5225) = 3.12$, $p < .001$) and a significant main effect of information (PT = .13, $F(10, 2084) = 14.42$, $p < .001$).

The univariate effects revealed a significant main effect of information for ratings of **moral responsibility** ($F(2, 1045) = 40$, $p < .001$, $\eta^2 = .07$), which was qualified by a significant interaction ($F(14, 1045) = 2.12$, $p = .009$, $\eta^2 = .03$) (see Figure 10). Post-hoc analyses revealed significant differences between the brain-based information ($M_{neur} = 5.3$) and the neuropsychology information condition ($M_{psyc} = 5.6$; $p = .001$), the brain-based and the no information condition ($M_{noinfo} = 6.1$; $p < .001$), and between the neuropsychology and control conditions ($p < .001$), suggesting an incremental effect of brain-based information and neuropsychology information on ratings of the defendant's moral responsibility.

Simple main effects tests revealed significant differences between neuropsychology information and brain-based information conditions, and no information and brain-based information conditions across employment record ($F(2, 1045) = 14.02$, $p < .001$) and SES ($F(2, 1045) = 5.87$, $p = .003$). Significant differences emerged between the no information and neuropsychology information conditions and no information and brain-based conditions across childhood abuse ($F(2, 1045) = 3.63$, $p = .027$), mental/emotional condition ($F(2, 1045) = 4.46$, $p = .012$), and physical condition ($F(2, 1045) = 16$, $p < .001$) (Table

5). Simple main effects tests across the circumstance condition revealed that the statistically significant difference across circumstances was driven by the brain-based information condition ($F(7,1045) = 2.18$, p = .03)

Univariate effects revealed a significant main effect of information ($F(2, 1045) = 3.14$, $p = .04$, $\eta^2 = .01$) and of circumstance ($F(7, 1045) = 38.3$, $p = .005$, $\eta^2 = .02$) on the **threat to society** DV, although post-hoc tests did not reveal significant differences between the information conditions.

Univariate effects also revealed a significant main effect of information ($F(2, 1045) = 36.7$, $p < .001$, $\eta^2 = .06$) and of circumstance ($F(7, 1045) = 7.85$, $p < .001$, $\eta^2 = .05$) for the **mental health** DV. Post-hoc analyses revealed significant differences between the no information condition ($M_{noinfo} = 4.7$) and the neuropsychology conditions ($M_{psyc} = 5.4$; $p < .001$), and between the no information and brain-based conditions ($M_{neur} = 5.6$; $p < .001$). The neuropsychology information and brain-based information conditions did not differ (see Figure 11). This finding suggests that participants were more likely to rate the defendant as having mental health issues whether there was neuropsychology information or brain-based information in the criminal vignette, but brain-based information did not make the defendant appear to have more mental health issues than when there was only neuropsychological information. Follow up contrast tests revealed several significant effects, though across childhood abuse, mental/emotional condition, and substance abuse there were no information condition effects.

Univariate effects revealed a significant main effect of circumstance information on the **likely to reoffend** DV ($F(7, 1045) = 4.47$, $p < .001$, $\eta^2 = .03$) and the can be **rehabilitated** DV ($F(7, 1045) = 3.5$, $p = .001$, $\eta^2 = .02$).

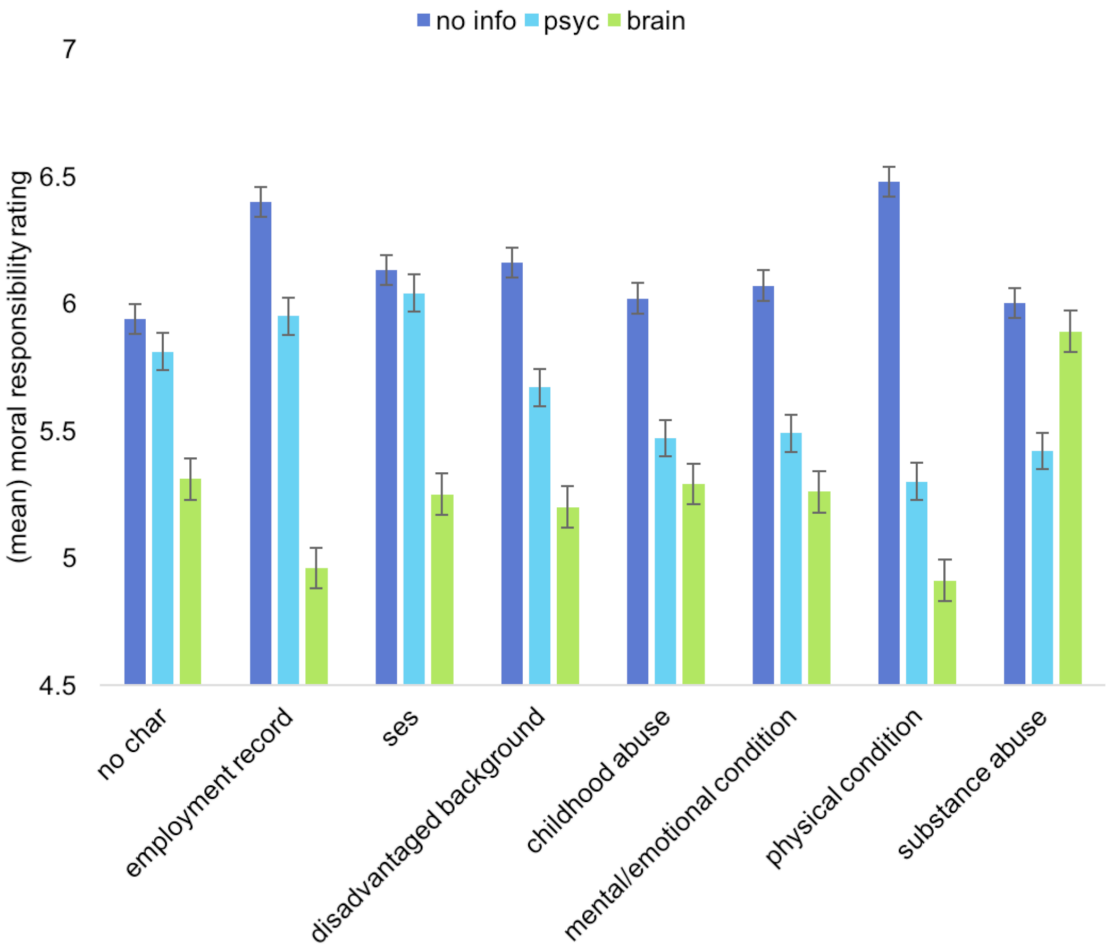

Figure 10: Mean Ratings of Moral Responsibility.

"To what extent does the following statement apply: The defendant is morally responsible for his actions." Y-values are mean values, from scale of 1 (*not at all*) to 7 (*extremely well*). Errors bars = standard error of the mean.

Table 5: Simple Main Effects Across Information Conditions for Moral Responsibility.

Blue highlighted boxes represent a significant effect was present at $p < .05$. *No info - psyc*: comparisons between the no information and neuropsychology condition. *Psyc - brain*: comparisons between the neuropsychology and brain-based conditions. *No info - brain*: comparisons between the no information and brain-based conditions.

	morally responsible		
	no info - psyc	psyc - brain	no info - brain
no char			
employment			
ses			
disadvantaged			
child abuse			
mental			
physical			
substance			

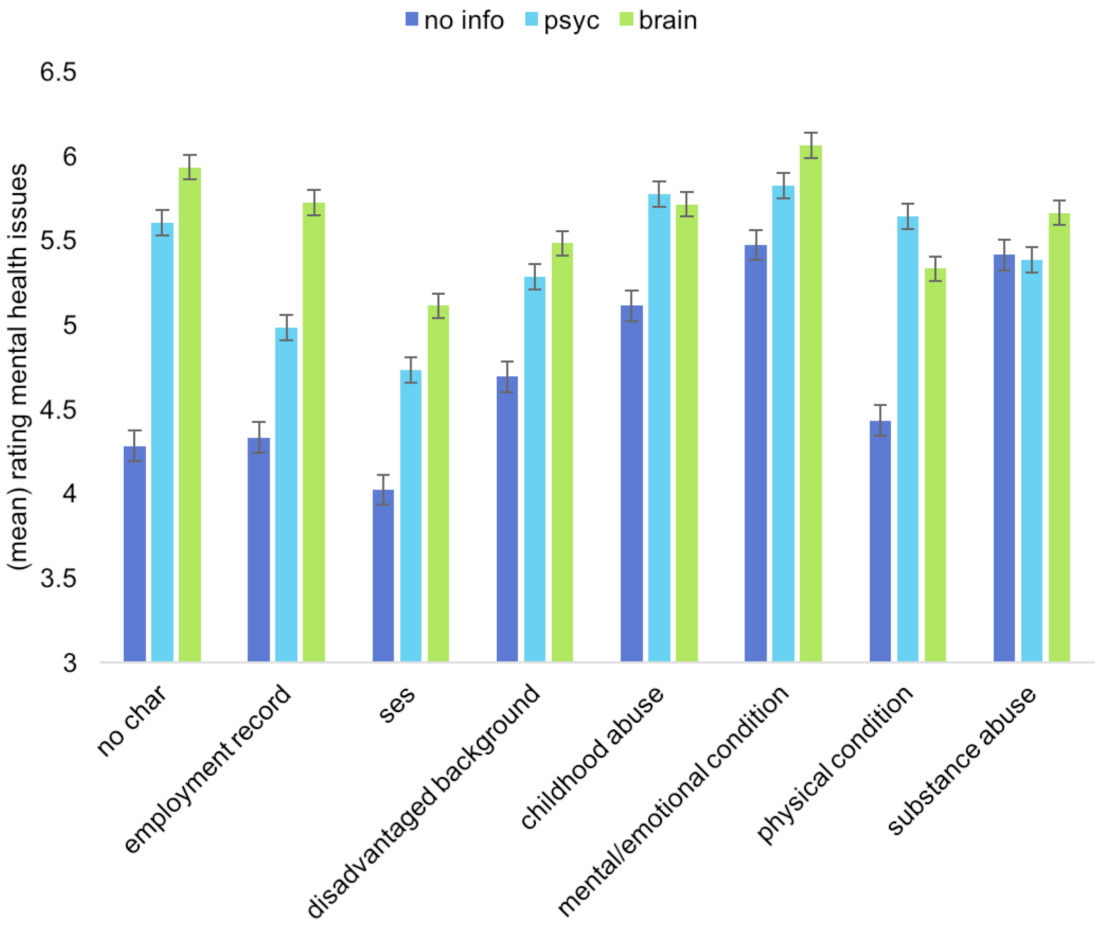

Figure 11: Mean Ratings of Mental Health Issues.

"To what extent does the following statement apply: The defendant has mental health issues." Y-values are mean values, from scale of 1 (*not at all*) to 7 (*extremely well*). Errors bars = standard error of the mean.

3.3.2.1. Discussion About the Defendant

The results partially supported the hypothesis that both neuropsychology and brain-based information will lead to decreased perceptions of moral responsibility across mitigating circumstances. Though the original hypothesis was that this effect would be seen across disadvantaged background, childhood

abuse, and mental/emotional condition, the results demonstrated that neuropsychology and brain-based information result in lower perceptions of moral responsibility in the childhood abuse, mental/emotional, and physical health condition. Brain-based information resulted in lower perceptions of moral responsibility over and above neuropsychology information only in the employment and SES conditions. These patterns of results across the mitigating circumstances are similar to the pattern of results observed in the DVs about the defendant and his actions. Together, these findings suggest that participants likely viewed the employment and SES mitigating circumstances as one kind, and mental/emotional condition, physical health, and perhaps childhood trauma as a different kind.

The results did not support the hypotheses that neuropsychology or brain-based information would affect judgments of recidivism, including future threat, likelihood to reoffend, or potential for rehabilitation. There was, however, a main effect of mitigating circumstance across these DVs, suggesting that circumstances about a defendant play a role in how people think about recidivism.

As predicted, both neuropsychology and brain-based information influenced perceptions of mental health issues. Furthermore, the results demonstrate the variability in perceptions of mental health issues across mitigating circumstances. Both neuropsychology and brain-based information resulted in much greater perceptions of mental health issues in the no

circumstance, employment, SES, disadvantaged background, and physical health conditions, while they didn't greatly influence perceptions of substance abuse or mental/emotional conditions.

3.3.3. Results About Mitigating Circumstances

To control for Type I error, a multivariate analysis of variance was conducted on two conceptually related DVs that assessed how participants thought about the circumstances. The questions were: "how often do you think the defendant's [employment record] affects his decision-making processes" and "in general, do you think a defendant's [employment record] should be considered as a factor to reduce a defendant's sentence." The circumstance in the brackets was substituted across participants to match the conditions. Box's M was significant ($F(60, 910718) = 129.05$, $p < .001$) so Pillai's Trace was used to assess the multivariate effects. Levene's test was significant across the DVs, and thus the more stringent p-value of .025 was used to assess these univariate effects. The multivariate test indicated a significant interaction effect between information and circumstance (PT = .05, $F(24, 1826) = 2.04$, $p = .002$), along with a significant main effect of circumstance (PT = .3, $F(12, 1826) = 27.42$, $p < .001$) and of information (PT = .04, $F(4, 1826) = 8.17$, $p < .001$).

The univariate effects revealed a significant main effect of circumstance ($F(6, 913) = 34.01$, $p < .001$, $\eta^2 = .17$) and of information ($F(2, 913) = 11.57$, $p < .001$, $\eta^2 = .02$) for the DV about how the defendant's circumstance influenced his **decision-making processes**, although these main effects were qualified by a

significant interaction ($F(12, 913) = 3.25$, $p < .001$, $\eta^2 = .03$) (see Figure 12). Simple effects analyses revealed significant differences between the no information condition and both the neuropsychology and brain-based information conditions in the mental/emotional ($F(2, 913) = 7.36$, $p = .001$) and physical conditions ($F(2, 913) = 18.45$, $p < .001$) (Table 6).

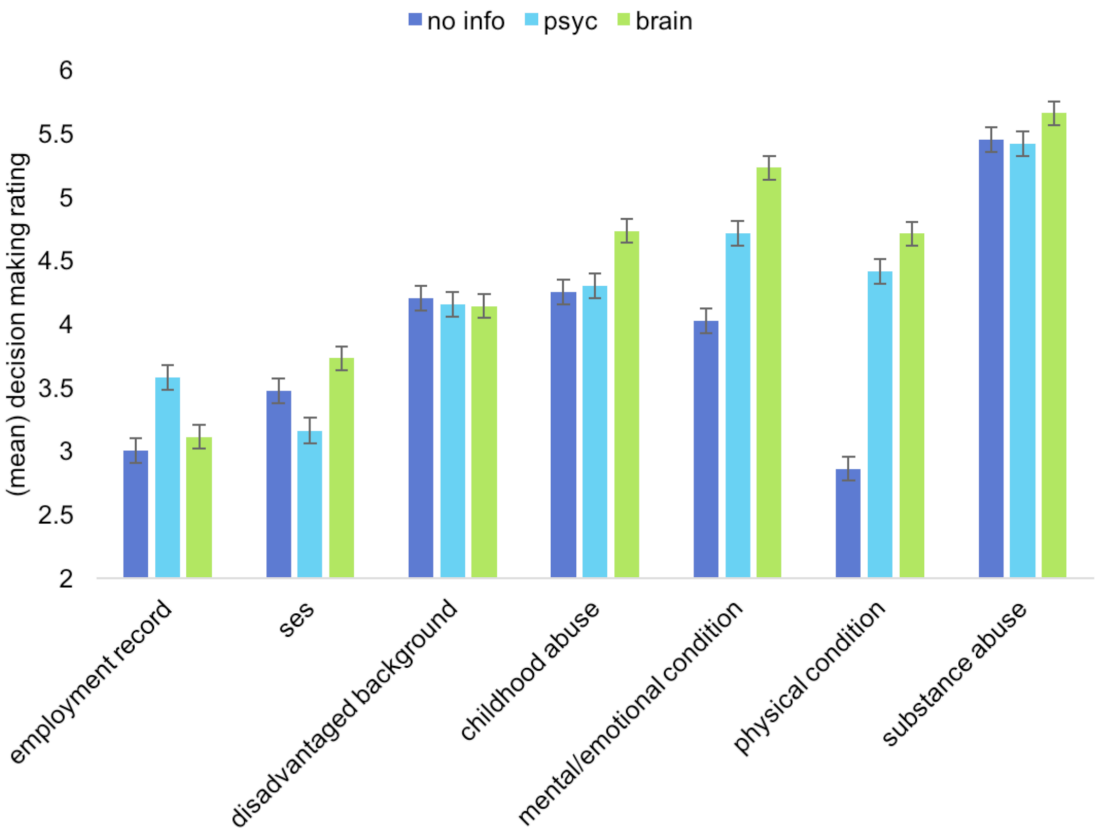

Figure 12: Mean Ratings of Mitigating Circumstances and Decision Processes.

"How often do you think the defendant's [circumstance] affects his decision-making processes." Y-values are mean values, from scale of 1 (*never*) to 7 (*always*). Errors bars = standard error of the mean.

Table 6: Simple Main Effects Across Information Conditions for Decision Processes.

Blue highlighted boxes represent a significant effect was present at $p < .05$. *No info - psyc*: comparisons between the no information and neuropsychology condition. *Psyc - brain*: comparisons between the neuropsychology and brain-based conditions. *No info - brain*: comparisons between the no information and brain-based conditions.

	[circ] decision making		
	no info - psyc	psyc - brain	no info - brain
no char			
employment			
ses			
disadvantaged			
child abuse			
mental			
physical			
substance			

Univariate tests also revealed a significant main effect of circumstance ($F(6, 913) = 25.51$, $p < .001$, $\eta^2 = .14$) and of information ($F(2, 913) = 11.86$, $p < .001$, $\eta^2 = .02$) for the DV about the whether the **circumstance** should **generally be considered to reduce a defendant's sentence**. Post-hoc analyses revealed significant differences between the no information condition ($M_{noinfo} = 3.3$) and both the neuropsychology ($M_{psyc} = 3.8$; $p = .006$) and brain-based information conditions ($M_{neur} = 4.0$; $p < .001$), but there was not a significant difference between the neuropsychology and brain-based information conditions ($p = .28$). This suggests that the addition of both neuropsychology and brain-based

information led participants to say that the mitigating circumstances should more frequently be considered as factors to reduce a defendant's sentence than when this information was not present. SES was the least likely factor to be considered for mitigation, while mental/emotional condition was the most likely to be considered for mitigation. However, the mean across information conditions was barely over the mid-point of the scale, indicating that it is still not considered mitigating most of the times. Means across characteristics are in Table 7.

Table 7: Means for Should Circumstance Be Mitigating.

mitigating circumstance	*mean (SD)*
ses	2.6 (1.5)
employment	2.9 (1.5)
substance abuse	3.6 (1.9)
disadvantaged background	3.6 (1.7)
childhood abuse	4.2 (1.8)
physical condition	4.3 (1.7)
mental/emotional condition	4.7 (1.8)

3.3.3.1. Discussion About Mitigating Circumstances

The hypotheses regarding the mitigating circumstances were partially supported. There was an interaction between neuropsychology and brain-based information across circumstances, although not across all of the predicted circumstances. Participants reported that the defendant's mental/emotional condition and physical condition would more frequently affect his decision-making processes in both the neuropsychology and brain-based information conditions, although this effect was not seen across the other mitigating

circumstances. These results suggest that both neuropsychology information and brain-based information bolster perceptions about control processes across circumstances that are perceived to be related to the mind or brain. However, as expected, neuropsychology information and brain-based information did not impact perceptions of a defendant who has substance abuse issues.

The addition of both neuropsychology and brain-based information led participants to say that the mitigating circumstances should more frequently be considered as factors to reduce a defendant's sentence than when this information was not present. These results suggest that neuropsychology information and brain-based information have a broad and overreaching influence across judgments.

3.3.4. Results About Sentencing

The **punishment** DV asked "how severely do you think the defendant should be punished in this case," and participants could choose punishment from between 15 months to 21 months, the established Federal Sentencing guideline range for an aggravated assault. A univariate analysis of variance revealed a significant main effect of circumstance ($F(7, 1045) = 3.60$, $p = .001$, $\eta^2 = .02$) and of information ($F(2, 1045) = 18.03$, $p < .001$, $\eta^2 = .03$), and these main effects were qualified by a significant interaction ($F(14, 1045) = 1.76$, $p = .04$, $\eta^2 = .02$) (Figure13). Simple main effects tests revealed significant differences between circumstances in the neuropsychology ($F(7, 1045) = 3.06$, $p = .003$) and brain-based information conditions ($F(7, 1045) = 2.19$, $p = .03$). Simple effects tests

also revealed significant differences between the neuropsychology information and brain-based information, and between the no information and brain-based information conditions across employment record ($F(2, 1045) = 10.26$, $p < .001$) and SES conditions ($F(2, 1045) = 5.47$, $p = .004$) (Table 8).

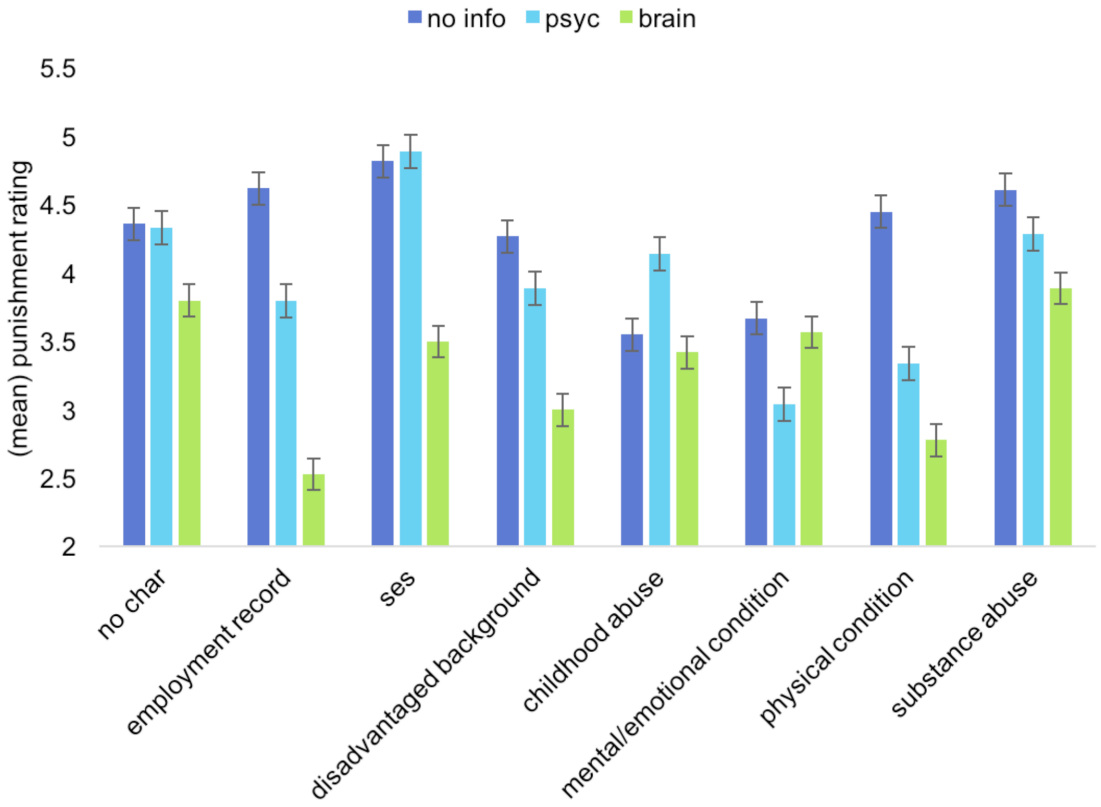

Figure 13: Mean Punishment Ratings.

"How severely do you think the defendant should be punished in this case?" Y-values are mean values, from a scale of 1 (*15 months*) – 7 (*21 months*). Errors bars = standard error of the mean.

Table 8: Simple Main Effects Across Information Conditions for Punishment.

Blue highlighted boxes represent a significant effect was present at $p < .05$. *No info - psyc*: comparisons between the no information and neuropsychology condition. *Psyc - brain*: comparisons between the neuropsychology and brain-based conditions. *No info - brain*: comparisons between the no information and brain-based conditions.

	punishment		
	no info - psyc	psyc - brain	no info - brain
no char			
employment			
ses			
disadvantaged			
child abuse			
mental			
physical			
substance			

3.3.4.1. Discussion of Sentencing

As predicted, both neuropsychology and brain-based information resulted in lower sentence severity, although unexpected patterns emerged across mitigating circumstances. These results again demonstrate the importance of the mitigating circumstance when introducing neuropsychology or brain-based information.

3.4. General Discussion

The findings from this study showed that legally relevant judgments—including judgments about control, moral responsibility, decision making processes, and punishment—were impacted by the presentation of neuroscience

information across different mitigating circumstances. Furthermore, neuroscience information that contained brain-based language did seem to have some kind of "dazzling" effect across mitigating circumstances that are "not ordinarily relevant" for sentencing decisions, such as employment record and SES.

The hypotheses about the mitigating circumstances were based from juror decisions that found that circumstances perceived as having an influence on a defendant's responsibility (disadvantaged background, childhood abuse, and mental/emotional condition) (Garvey, 1998) were more likely to be influenced by neuroscience information generally. Yet this study demonstrated that participants were influenced by both neuropsychology and brain-based information across circumstances that are closely associated with the mind and brain (e.g., mental/emotional and physical health condition). These mitigating circumstances also happen to "maybe" be "relevant" to sentencing decisions according to the sentencing guidelines. The physical health condition results were unexpected, but are attributable to the fact that the manipulation mentioned an autoimmune disorder that affected the defendant's nerves, something closely related to neurological mechanisms. Moreover, as expected, neuropsychology information and brain-based information did not seem to change judgments when a defendant was described as having substance abuse issues, suggesting that causal perceptions of the defendant's behavior might be important.

Mitigating circumstances that were less related to the mind and brain, such as a defendant's employment record and SES—circumstances that are "not

(ordinarily) relevant" for sentencing—were influenced by brain-based information but not by neuropsychology information that did not contain reference to the brain. Even though these circumstances are not generally associated with the brain or biology, the presence of brain-based information in these contexts seems to provide explanations for behaviors. These results are consistent with the seductive allure affect found previously and suggest that not only is the mitigating circumstance in which neuroscience information is presented important for legally relevant judgments, so too is the way in which neuroscience itself is presented. Perhaps defense lawyers would be more successful in non-capital cases if they frequently mentioned the brain or brain based mechanisms in their explanations of behavior.

Taken together, the results suggest that participants used neuroscience information to inform judgments, but that the mechanisms driving the judgments differed depending on different presentations of neuroscience information and across mitigating circumstances.

4. Studies 3a and 3b: How Differences in the Presentation of Neuroscience Information Influence Perceptions of Control Over Actions and Sentencing Decisions

The results from Study 2 indicated that both the neuropsychology and brain-based information conditions differentially influence judgments about control, decision making, moral responsibility, and punishment across mitigating circumstances. Specifically, we see evidence for a seductive allure type of effect across mitigating circumstances that are "not ordinarily relevant" for sentencing decisions, such as SES and employment record. Why might this effect exist?

Recent work on the seductive allure effect demonstrated that participants have a general preference for reductive explanations—explanations that refer to fundamental processes underlying a phenomenon (Hopkins, Weisberg, & Taylor, 2016). This effect is particularly strong when pairing psychology and neuroscience. Providing neuroscience information in a legal context may strengthen essentialist beliefs—beliefs about the innate and biological aspects of traits and behaviors—which could influence perceptions of control. Moreover, given that neuropsychological and brain-based information have a different pattern of effects across mitigating circumstances, the effect of neuroscience information on perceptions of control through essentialist beliefs may be triggered primarily in circumstances that are "not ordinarily relevant" for sentencing decisions, because those are the circumstances where neuroscience

could turn a weak explanation of behavior into a stronger one, mimicking the seductive allure effect.

The following studies assessed the relationship of the brain and biology across mitigating circumstances, and explored whether essentialist beliefs mediate a seductive allure effect across circumstances that are "not ordinarily relevant" for sentencing decisions.

4.1. Study 3a: Testing the Relationship Between Mitigating Circumstances and the Brain

The pattern of results from Study 2 indicated that participants likely viewed the mental/emotional condition and physical health condition as comparable circumstances, while the education and SES conditions were viewed as a different category of circumstances. Interestingly, the pattern of results for disadvantaged background and childhood abuse seemed to differ from the two categories above, even though past work suggests that these circumstances are perceived to be important (in the same category of having mental and emotional issues) when considering mitigation during sentencing (Garvey, 1998).

Perhaps the neuroscience information had differential effects across these circumstances because the mental/emotional and physical health condition are more easily associated with the brain, while SES and employment seem less related to the brain. Furthermore, the direction of the association may differ, such that for circumstances such as SES, employment, and social history circumstances (i.e., disadvantaged background, childhood abuse), the

circumstance itself is what influences the brain, whereas the brain influences the circumstance in health-related phenomena (i.e. mental/emotional condition, physical health conditions).

The following study will assess the hypotheses that people are more likely to associate the mental/emotional and physical health conditions with the brain, while people are less likely to associate SES related characteristics (having a low income, having a low status job) with the brain, and that the causal direction of this association differs across circumstances.

4.1.1 Method

4.1.1.1. Participants

Two waves of participants were recruited[5] using MTurk, each with 50 participants (48% male, 80% between the ages of 25-64). Participants were 18 or older and residents of the United States. Participants were compensated $0.15 upon completion of the surveys.

[5] The original pilot study asked only "How much would you normally associate a person's brain and biology to the following: (1 = *not at all*, 7 = *a lot*)" and asked about the following mitigating circumstances: having inadequate or less than average education, having a low status job, having less money than average, having major depression, which can include having low moods, experiencing loss of interest in normally enjoyable activities, and having feelings of worthlessness and helplessness, having a rare autoimmune disorder that leads to extensive nerve damage and needing to relearn how to walk, having an undersized brain. A within subjects ANOVA was conducted and revealed significant differences across circumstances (WL = .21, $F(5,45) = 34.78$, $p < .001$). Post-hoc tests revealed statistically significant differences between the education, job, and income conditions, versus the depression, autoimmune disorder, and undersized brain condition ($p < .001$). The second study was conducted to assess the effects of other mitigating circumstances and to get a sense of the causal direction of the association. Because the results of the second pilot study replicate the results of the first, the design and results of the second study are described here.

4.1.1.2. Procedure and Design

A within-subjects design was used to test for differences across the following circumstances: coming from a disadvantaged background, having a low status job, having less money than average, experiencing major depressive disorder, experiencing a rare autoimmune disorder that leads to extensive damage and needing to relearn how to walk, having an undersized brain, suffering from childhood abuse, and being a war veteran.

Participants read an informed consent form describing the procedures of the study and indicated their voluntary consent to participate by agreeing and advancing to the next page. Participants were taken to the instructions screen, and then advanced to answer the following question: “to what extent would you say that the circumstances are or could be associated with the brain or biology?” Participants rated the aforementioned circumstances using a Likert scale (1 = *not at all*; 7 = *a lot*), which were presented in a random order.

Participants were then taken to another screen that asked, “If you had to choose, would you say the following circumstances influence the brain and biology, or that the brain and biology influence the circumstances?” Participants were shown the same circumstances (presented in a random order), and answered using the following Likert scale: 1 = *circumstance definitely influences brain and biology*; 2 = *circumstance likely influences brain and biology*; 3 = *circumstances infrequently influences brain and biology*; 4 = *circumstance could influence brain and biology or brain and biology could influence the*

circumstances; 5 = *brain and biology infrequently influence the circumstance*; 6 = *brain and biology likely influence the circumstance*; 7 = *brain and biology definitely influence the circumstance*.

After answering, participants answered demographic questions and were thanked for their participation.

4.1.2. Results

Within-subjects ANOVAs were conducted to test for differences across circumstances. Significant differences across circumstances were observed when participants were asked the extent to which the circumstances could be associated with the brain and biology (WL = .19, $F(7, 43) = 26.51$, $p < .001$) (see Table 9). Having a mental/emotional condition, an autoimmune disorder, or an undersized brain were viewed as having more of an association between brain and biology and were not statistically significant from each other.

Table 9: Means for Association Between Mitigating Circumstances and Brain.

Means that do not share a subscript are significantly different from each other.

mitigating circumstance	*mean (SD)*
disadvantaged background	2.38_{a} (1.9)
income	2.90_{ac} (1.9)
job	3.24_{ab} (1.9)
war veteran	3.38_{bc} (2.3)
childhood abuse	3.52_{bc} (2.2)
mental/emotional condition	6.04_{d} (1.1)
autoimmune disorder	6.10_{d} (1.5)
undersized brain	6.16_{d} (1.3)

There were also significant differences across circumstances when participants were asked to rate whether the circumstances influence the brain or vice versa (*WL* = .24, $F(7, 43) = 19.65$, $p < .001$) (Table 10).

Table 10: Means for Causal Influence of Mitigating Circumstance and Brain.

Means that do not share a subscript are significantly different from each other.

mitigating circumstance	*mean (SD)*
childhood abuse	2.02_a (1.8)
war veteran	2.32_{ab} (1.7)
disadvantaged background	2.40_{ab} (1.7)
income	2.78_{ab} (1.8)
job	3.22_b (1.9)
mental/emotional condition	6.04_c (1.1)
autoimmune disorder	6.10_c (1.5)
undersized brain	6.16_c (1.3)

Looking at the frequency of responses across circumstances reveals that 78% of participants said that childhood abuse definitely or likely influences the brain or biology, 70% said that being a war veteran definitely or likely influences the brain or biology, and 70% said that coming from a disadvantaged background definitely or likely influences the brain or biology. Job and income were the closest to the mid-point value, with approximately 50% of participants responding that having less income than average and a low status job definitely or likely influences the brain or biology. The majority of participants viewed the brain or

biology as definitely or likely influencing having a mental/emotional condition, having an autoimmune disorder, or having an undersized brain.

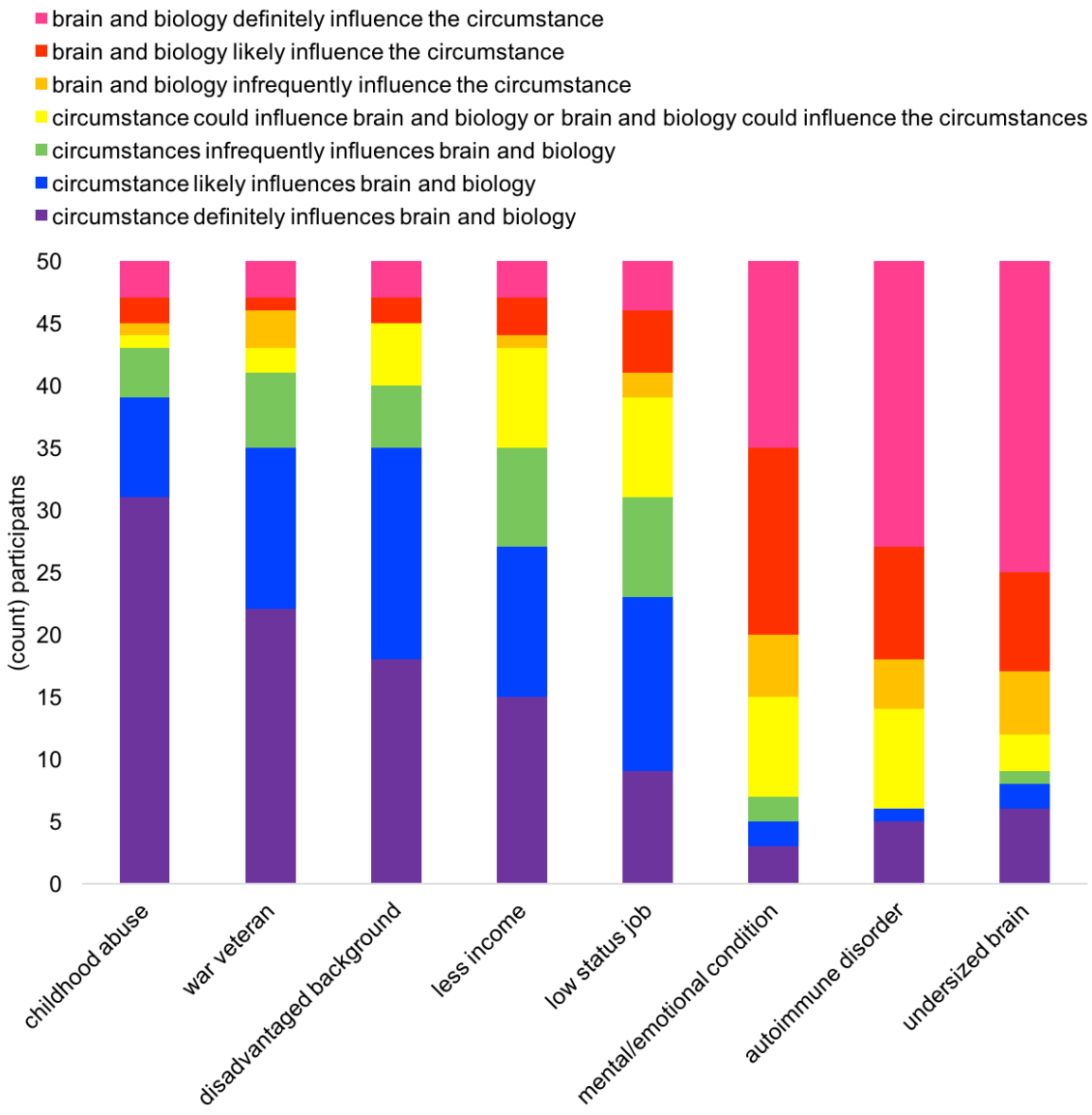

Figure 14: Frequency of Responses Assessing Directionality of Causal Influence Across Mitigating Circumstances.

4.1.3. Discussion

Study 3 confirmed that people are more likely to view health related circumstances (i.e. mental/emotional condition, autoimmune disorder, having an undersized brain) as being more closely associated with the brain. The health-related circumstances were also more likely to be perceived as the result of a person's brain and biology. Participants were less likely to associate the brain or biology with the following circumstances: coming from a disadvantaged background, making less money than average, having a low status job, being a war veteran, and having been abused as a child.

When asked about the causal direction of the association between the varying circumstances and the brain, the majority of participants viewed the brain and biology as influencing health-related characteristics. Although the association between brain and biology was low across the other, non-health related characteristics, an interesting pattern emerged across them when participants were asked about the causal direction of the association. Childhood abuse, being a war veteran, and coming from a disadvantaged background were all more likely to be viewed as influencing the brain or biology. Participants were most ambivalent about the causal influence of the brain across circumstances related to SES (i.e., making less money than average and having a low status job).

These results suggest that certain defendant-centered mitigating circumstances could automatically affect causal perceptions of behavior. Health-

related conditions are viewed as being associated with the brain, which could in turn affect judgments about a defendant's control over his actions. Circumstances associated with one's social history—such as coming from a disadvantaged background, being a veteran, or experiencing childhood abuse—are not typically associated with the brain. However, when asked to think about the influence of these circumstances and the brain, the majority of participants did believe that these social history circumstances likely influence one's brain and biology. This pattern could explain why these circumstances have been viewed by jurors as being potentially relevant for mitigation—if the defendant was exposed to these circumstances, the circumstances could very well have influenced his brain and consequently his behavior.

Circumstances related to SES that have been deemed "not relevant" to sentencing decisions are not typically associated with the brain or biology either. However, these circumstances are less frequently said to influence a person's brain and biology. The effect of brain-based neuropsychology information across these characteristics may be due to the fact that adding this brain-based information in the context of the circumstance strengthens beliefs about the biological nature of a person's characteristics and behaviors.

4.2. Study 3b: How Brain-Based Information Impacts Mitigating Circumstances That Are Not Related to the Brain

The following study addressed several hypotheses. First, the study was designed to replicate the results found in Study 2 that suggest that while both

neuropsychology information and brain-based information influences judgments across health-related circumstances, only brain-based information influences judgments across SES related circumstances. Because Study 2 did not find a consistent seductive allure effect across social history circumstances and Study 3a indicated that these circumstances could represent complex causal relationships to the brain, these circumstances will be omitted from this study.

This study also explored whether brain-based information (versus neuropsychology information) influences perceptions of control via essentialist beliefs—a measure of causal attribution, and a first and necessary step when determining blame (Shaver, 1995). If the relationship does exist, the indirect effect of brain-based information on perceptions of control through essentialist beliefs should be stronger in SES-related (as opposed to health-related) mitigating circumstances (referred to as Model 1).

Relatedly, Study 2 found an interaction between information and mitigating circumstances for ratings of moral responsibility—a judgment used to determine whether the defendant knowingly and voluntarily committed the crime, and that is associated with causality and blame (Shaver, 1985; Weiner, 1995; Alicke, 2000). If neuroscience evidence increases essentialist beliefs, it probably also influences attributions of moral responsibility. Thus, a second model was tested to assess the conditional indirect effect using both essentialist beliefs and moral responsibility as mediators of perceptions of control (Model 2). If essentialist beliefs get stronger in SES-related circumstances, so too may moral

responsibility ratings, such that moral responsibility decreases in SES-related circumstances which could also account for the effect across perceptions of control.

Lastly, a model was tested to assess the conditional indirect effect using both essentialist beliefs and moral responsibility as mediators of punishment ratings (Model 3). Studies have indicated that perceptions of an internal causal locus (perceptions that a behavior is internal to the person) were associated with higher punishment ratings (Cheung & Heine, 2015). However, because the results of Study 1 suggest that neuroscience information decreases punishment, moral responsibility—an attribution that is thought to precede blame—may mediate the punishment effect in SES-related circumstances. The hypothesis was that brain-based information decreases punishment through assessments of moral responsibility in SES-related circumstances.

4.2.1 Method

4.2.1.1. Participants

A total of 605 MTurk participants completed the survey. Five participants were excluded for failing to provide a valid answer on a manipulation check. The total sample analyzed consisted of 600 participants (56% male, 86% between the ages of 25-64). Participants were 18 or older and residents of the United States. Participants were compensated $0.75 upon completion of the survey.

4.2.1.2. Procedure and Design

A 3 (information about behavior: no information, neuropsychology information, neuropsychology plus brain-based information) by 4 (mitigating circumstance: low status job, less than average income, mental/emotional condition, physical condition) between-subjects design was used to test for the effects of information across mitigating circumstances. Each participant was randomly assigned to an information and mitigating circumstance condition. The mitigating circumstances were chosen based upon the results of Study 3a, and final results were collapsed across circumstances to create two variables: health-related circumstances (combined mental/emotional and physical condition) and SES-related circumstances (combined low status job and less than average income). Thus, the final design for analytic purposes was a 3 (information) x 2 (mitigating circumstance: SES-related, health-related) factorial.

Participants read an informed consent form describing the procedures of the study and indicated their voluntary consent to participate by agreeing and advancing to the next page. Participants were taken to the instructions screens, and then advanced to read a summary of a criminal case. The summary described a case about a man who was convicted of aggravated assault, but the vignette differed from the one used in Study 2 (Appendix E). The summary included a statement of facts about the crime and additional information from the defense. The additional information included the information and mitigating

circumstance manipulations (Appendix F). The three information conditions were identical to those used in Study 2.

To assess essentialist beliefs, participants answered three questions using a 7-point Likert scale. The questions were adapted from a scale used in previous studies to measure essentialist beliefs (Haqanee, Lou, & Lalone, 2013; Haslam & Levy, 2006). The questions, which were presented in random order, were, “to what extent do you think the defendant's traits or behaviors are based on innate tendencies,” “to what extent do you think the defendant's traits or behaviors are caused by biological factors,” and “to what extent do you think the defendant can NOT change the traits about himself or alter his behavior” (1 = *not at all*, 7 = *completely*). The three items were combined to form one measure of essentialist beliefs (Cronbach’s alpha = .76).

Three items were created to operationalize perceptions of control over actions. The questions were presented in random order. The items were, “do you believe the defendant was in control of his actions at the time of the crime,” “do you believe the defendant had power over his actions while he was committing the crime,” and “do you believe the defendant could have regulated his actions during the crime” (1 = *not at all*, 7 = *completely*). The three items were combined to form one measure of perceptions of control (Cronbach’s alpha = .93).

To assess moral responsibility, participants answered the question, “is the defendant morally responsible for his actions” (1 = *not at all*, 7 = *completely*). The same question used in Study 2 was asked to assess punishment: “In the United

States, sentencing decisions are calculated using sentencing guidelines, which offer a range of months for incarceration. Any number can be chosen from within the given range. The defendant in this case has been convicted of aggravated assault, which can have a range from 15 to 21 months in prison. How severely do you think the defendant should be punished in this case?" (Likert-scale values labeled as *15 months*; *16 months*; *17 months*; *18 months*; *19 months*; *20 months*; *21 months*).

To ensure that participants read and understood the vignette, a manipulation check was included that asked participants to summarize the case. Lastly, participants answered demographic questions and were thanked for their participation.

4.2.2. Results

4.2.2.1. Replicating the Effects of Study 2

An ANOVA was conducted to test for the effects of information and mitigating circumstances on perceptions of control. Levene's test was statistically significant, suggesting variances across groups are significantly different. The univariate test revealed a significant main effect for information ($F(2, 594) = 13.04$, $p < .001$, $\eta^2 = .04$) and circumstance ($F(1, 594) = 11.72$, $p = .001$, $\eta^2 = .02$). There was no significant interaction effect. The results indicated that participants rated the defendant in the brain-based information condition as having less control over his actions than in the neuropsychology and no information conditions (see Table 9).

Given the hypotheses about the interaction of information and mitigating circumstances, post-hoc analyses were conducted. The results revealed the expected pattern of results across the different mitigating circumstances, indicating significant differences across the SES ($F(2, 594) = 9.51$, $p < .001$) and health conditions ($F(2, 594) = 4.8$, $p = .008$). The SES condition revealed significant differences between the neuropsychology information condition and brain-based information condition ($p < .001$), and between the no information and brain-based information conditions ($p = .008$). The health condition showed significant differences between the no information and neuropsychology information conditions ($p = .02$), and between the no information and brain-based information conditions ($p = .004$) (Table 11). These results replicated those from Study 2 and indicated that perceptions of control are influenced by information.

Table 11: Mean Values Perception of Control.

Numbers in parentheses represent standard deviations.

	no info	psyc	brain
SES-related	6.1 (1.0)	5.8 (1.1)	5.3 (1.5)
health-related	5.7 (1.3)	5.3 (1.2)	5.2 (1.3)

Table 12: Simple Main Effects Across Mitigating Circumstances for Perception of Control.

Blue highlighted boxes represent a significant effect was present at $p < .05$. *No info - psyc*: comparisons between the no information and neuropsychology condition. *Psyc - brain*: comparisons between the

neuropsychology and brain-based conditions. *No info - brain*: comparisons between the no information and brain-based conditions.

	perceptions of control		
	no info - psyc	psyc - brain	no info - brain
SES-related			
health-related			

An ANOVA was conducted to test for the effects of information and mitigating circumstances on ratings of moral responsibility. Levene's test was statistically significant, suggesting variances across groups were significantly different. The univariate test revealed a significant main effect for information ($F(2, 594) = 13.10$, $p < .001$, $\eta^2 = .04$) and circumstance ($F(1, 594) = 13.11$, $p < .001$, $\eta^2 = .02$). The results indicated that participants rated the defendant in the control no information condition as being more morally responsible than in both neuroscience information conditions.

There was a marginally significant interaction effect ($F(2, 594) = 2.37$, $p = .09$, $\eta^2 = .007$), which was further probed given the a priori hypotheses regarding the differences across mitigating circumstances. The results revealed the expected pattern of results across the different mitigating circumstances, indicating significant differences across the SES ($F(2, 594) = 11.42$, $p < .001$) and health conditions ($F(2, 594) = 4.03$, $p = .02$). The SES condition revealed significant differences between the neuropsychology information condition and brain-based information condition ($p < .001$), and between the no information and

brain-based information conditions ($p < .001$). The health condition showed significant differences between the no information and neuropsychology information conditions ($p = .04$), and between the no information and brain-based information conditions ($p = .007$) (Table 13).

Table 13: Simple Main Effects Across Mitigating Circumstances for Moral Responsibility.

Blue highlighted boxes represent a significant effect was present at $p < .05$. *No info - psyc*: comparisons between the no information and neuropsychology condition. *Psyc - brain*: comparisons between the neuropsychology and brain-based conditions. *No info - brain*: comparisons between the no information and brain-based conditions.

	moral responsibility		
	no info - psyc	psyc - brain	no info - brain
SES related			
health related			

Another ANOVA tested the effects of information and mitigating circumstances on punishment ratings. Levene's test was statistically significant, suggesting variances across groups were significantly different. The univariate test revealed a significant main effect for information ($F(2, 594) = 5.38$, $p = .005$, $\eta^2 = .02$) and circumstance ($F(1, 594) = 7.61$, $p = .006$, $\eta^2 = .01$). Participants rated the defendant in the control no information condition as being more morally responsible than across both neuroscience information conditions.

Although there was not a statistically significant interaction effect, planned analyses were conducted given the a priori hypotheses regarding the differences

across mitigating circumstances. The results revealed a significant difference across the health condition ($F(2, 594) = 5.64$, $p = .004$) , but not the SES condition. The health condition showed significant differences in the expected pattern: between the no information and neuropsychology information conditions ($p = .002$), and between the no information and brain-based information conditions ($p = .008$) (see Table 14).

Table 14: Simple Main Effects of Punishment.

Blue highlighted boxes represent a significant effect was present at $p < .05$. *No info - psyc*: comparisons between the no information and neuropsychology condition. *Psyc - brain*: comparisons between the neuropsychology and brain-based conditions. *No info - brain*: comparisons between the no information and brain-based conditions.

	punishment		
	no info - psyc	psyc - brain	no info - brain
SES related			
health related			

4.2.2.2. Testing the Effects of Information on Perceptions of Control via Essentialist Beliefs (Model 1)

An ANOVA was conducted to assess the association between information and mitigating circumstances on essentialist beliefs. A significant main effect of information ($F(2, 594) = 13.32$, $p < .001$, $\eta^2 = .04$) and a significant main effect of circumstance ($F(1, 594) = 37.66$, $p < .001$, $\eta^2 = .06$) were obtained, which were qualified by a significant interaction ($F(2, 594) = 6.59$, $p = .001$, $\eta^2 = .02$). Post-hoc analyses revealed a significant effect across the SES-related circumstances

($F(2, 594) = 18.82$, $p < .001$), but not across the health-related circumstances. Post-hoc tests also revealed significant differences across the no information ($F(1, 594) = 36.63$, $p < .001$) and neuropsychology information ($F(1, 594) = 13.45$) conditions, but not the brain-based information condition. These results suggest that perceptions of control were influenced by essentialist beliefs, and that essentialist beliefs may mediate this effect.

Because of the statistically significant interaction effect observed in essentialist beliefs, the follow up moderated mediation analysis was conducted. The model tested the original hypothesis that the indirect effect of information on perceptions of control is moderated by mitigating circumstance, because mitigating circumstances moderate the effect of essentialist beliefs on perceptions of control (see Figure 12). These effects were tested using the PROCESS macro in SPSS which uses bootstrapping to assess indirect effects (Preacher, Rucker, & Hayes, 2007).

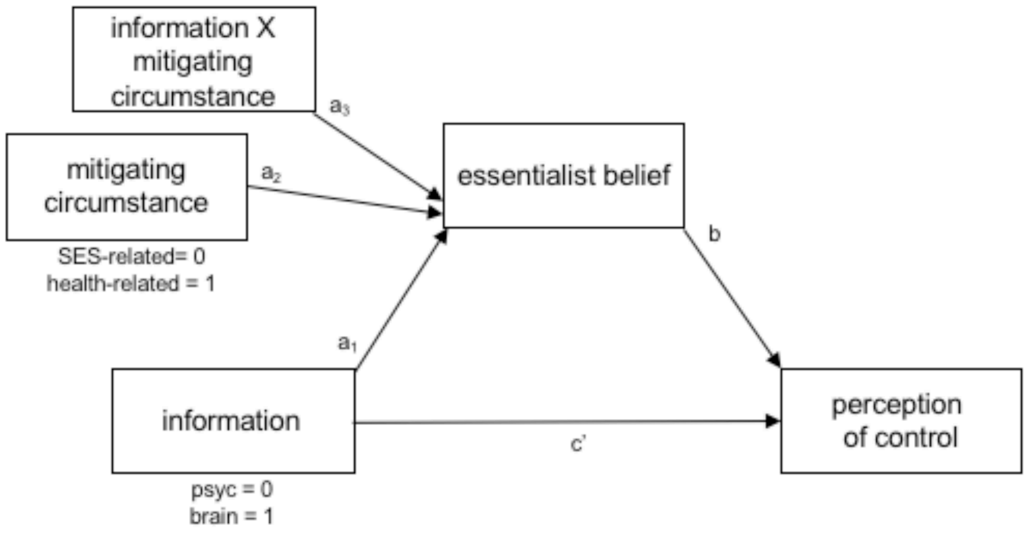

Figure 15: Model 1: Moderated Mediation on Perceptions of Control.

The results showed that the indirect effect of neuroscience information on perceptions of control, through essentialist beliefs, was stronger when the mitigating circumstances were SES-related (index of moderated mediation = 0.25, CI [0.009, 0.25]) in support of the hypothesis. The direct effect of information on essentialist beliefs was significant ($t(395) = 1.12$, $b = .91$, $p = .02$) and the direct effect of essentialist beliefs on perceptions of control was significant ($t(396) = -11.36$, $b = .91$, $p < .001$) (see Table 15 for full list of effects). The statistically significant interaction between information and circumstance

($t(395) = -1.97$, $b = -.48$, $p = .05$) implies that the indirect effect of information on perceptions of control through essentialist beliefs is moderated by mitigating circumstance. The conditional indirect effects reveal that the indirect effect of information on perceptions of control via essentialist beliefs is stronger in the SES-related mitigating circumstances (effect = -.22, CI = [-0.43, -0.04]) than in the health-related mitigating circumstances (effect = .03, CI = [-0.13, -0.18]). A graphical representation of the effect of is shown in Figure 16.

Table 15: Moderated Mediation Effects.

	df	*t*	*b*	effect	*p*-value	CI
a_1	395	2.35	0.91		0.02	[0.15, 1.7]
a_2	395	2.58	1.6		0.01	[0.38, 2.8]
a_3	395	-1.97	-0.48		0.05	[-0.96, -0.01]
b_1	396	-11.36	-0.52		<.001	[-0.61, -0.43]
c’	396	-1.53	-0.17		0.12	[-0.40, 0.04]
c_{ses}				-0.22		[-0.43, -0.04]
c_{health}				0.03		[-0.13, -0.18]

Index of Moderated Mediation for Essentialist Beliefs = 0.25, CI [.009, .25]

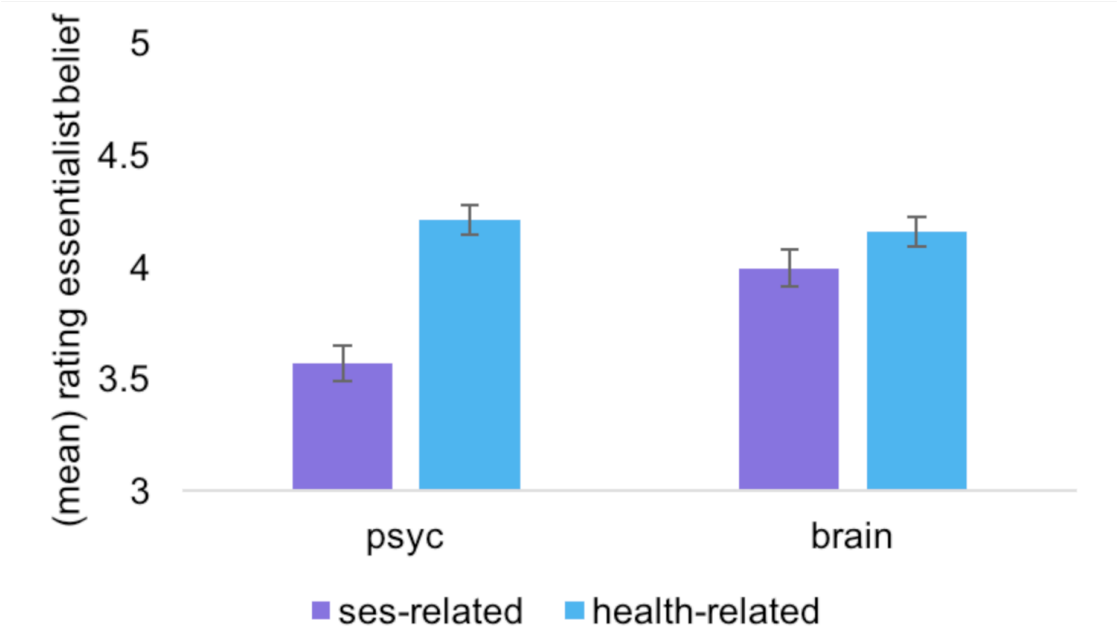

Figure 16: Effect of Psyc v. Brain-Based Information on Essentialist Beliefs.

Essentialist belief questions were “to what extent do you think the defendant's traits or behaviors are based on innate tendencies,” “to what extent do you think the defendant's traits or behaviors are caused by biological factors,” and “to what extent do you think the defendant can NOT change the traits about himself or alter his behavior”. The three items were combined into one measure. Y-values are mean values, from a scale of (1 = *not at all*, 7 = *completely*). Errors bars = standard error of the mean.

4.2.2.3. Testing the Effects of Information on Perceptions of Control via Essentialist Beliefs and Moral Responsibility (Model 2)

A second model was tested that included both essentialist beliefs and moral responsibility as mediators of perceptions of control (Figure 16). The results yielded a significant moderated mediation model across both mediators (index of moderated mediation for moral responsibility = .28, CI = [.01, .56]; index of moderated mediation for essentialist beliefs = .15, CI = [.008, .33]), and only

for the SES-related mitigating circumstances (conditional indirect effect of information on perceptions of control at SES-related circumstance with moral responsibility as mediator = -.33, CI = [-.54, -.16], and with essentialist beliefs as the mediator = -.15, CI = [-.28, -.02]). These results suggest that essentialist beliefs increase with the presentation of brain-based information which accounts for the decrease in perceptions of control across SES-related circumstances, and that brain-based information decreases attributions of moral responsibility which accounts for the decrease in perceptions of control across SES-related circumstances (see Table 16 for full list of effects; a graphical representation of the moral responsibility effect is shown in Figure 18).

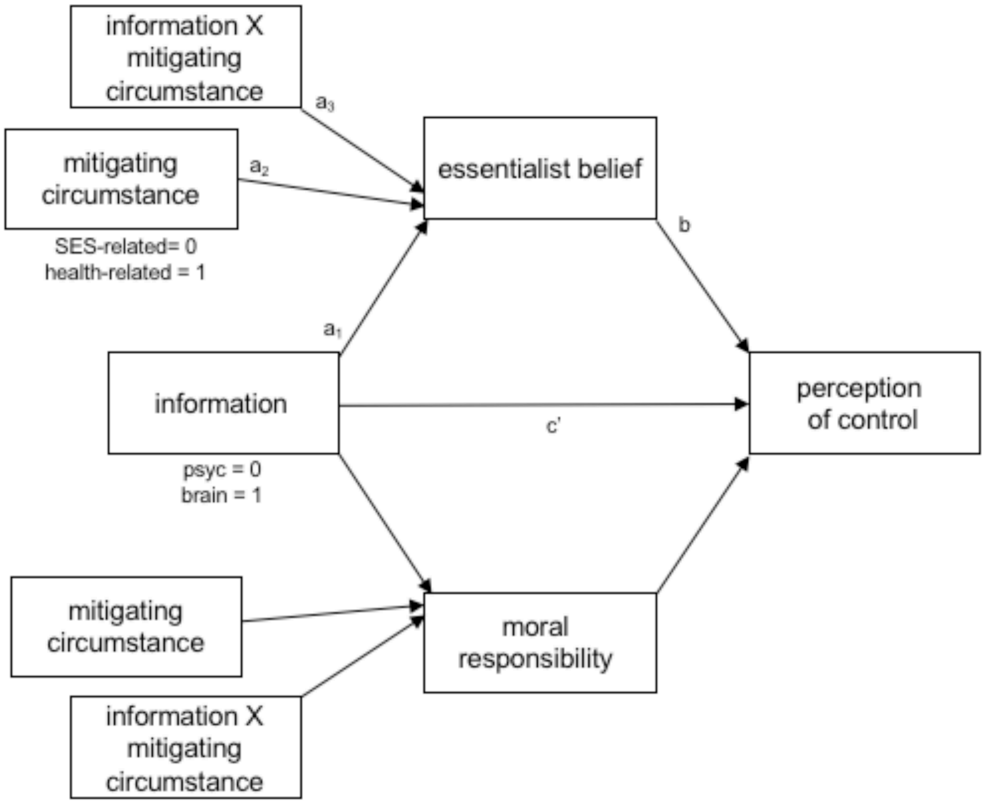

Figure 17: Model 2: Moderated Mediation With Two Mediators on Perceptions of Control

Table 16: Effects of Model 2 on Perceptions of Control

	df	*t*	*b*	effect	*p-value*	CI
$a_{1\ ESS}$	395	2.35	0.91		0.02	[0.15, 1.7]
$a_{2\ ESS}$	395	2.58	1.6		0.01	[0.38, 2.8]
$a_{3\ ESS}$	395	-1.97	-0.48		0.05	[-0.96, -0.01]
$a_{1\ MORAL}$	395	-2.79	-1.01		0.005	[-1.7, -0.3]
$a_{2\ MORAL}$	395	-2.48	-1.45		0.01	[-2.6, -0.3]
$a_{3\ MORAL}$	395	2.01	0.46		0.05	[0.009, 0.91]
$b_{1\ MORAL}$	395	14.03	0.6		<.001	[0.52, 0.68]
$b_{1\ ESS}$	395	-7.91	-0.32		<.001	[-0.39, -0.24]
c’	396	-0.2	-0.02		0.84	[-0.20, 0.16]
$c_{SES\ ESS}$				-0.13		[-0.28, -0.02]
$c_{HEALTH\ ESS}$				0.02		[-0.08, 0.11]
$c_{SES\ MORAL}$				-0.33		[-0.54, -0.16]
$c_{HEALTH\ MORAL}$				-0.05		[-0.24, 0.15]

Index of Moderated Mediation for Moral Responsibility = .28, CI = [.01, .56]
Index of Moderated Mediation for Essentialist Beliefs = .15, CI = [.008, .33]

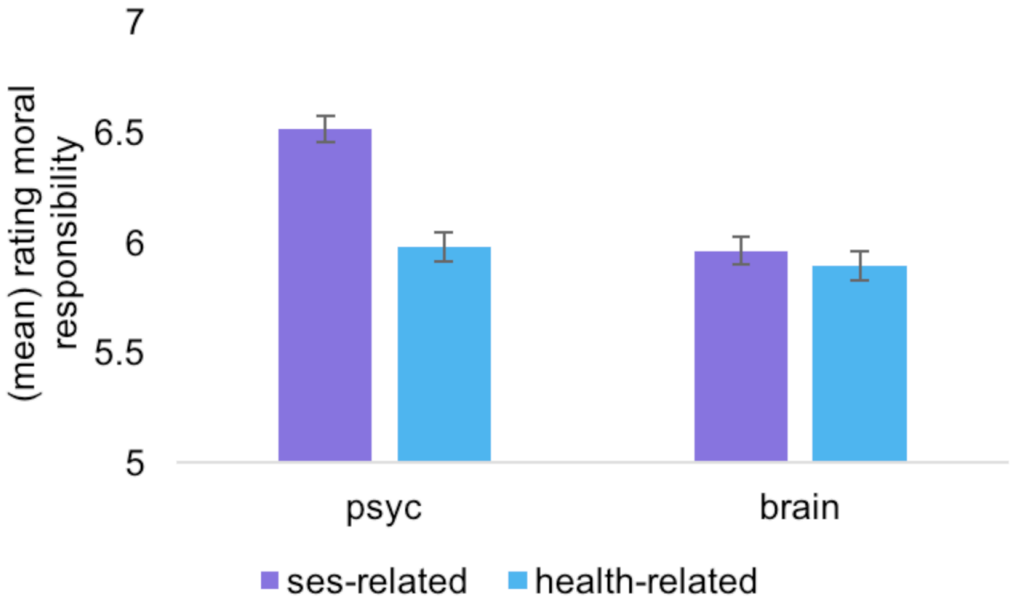

Figure 18: Effect of Psyc v. Brain-Based Information on Moral Responsibility

"Is the defendant morally responsible for his actions?" Y values are mean values, from a scale of (1 = *not at all*, 7 = *completely*). Error bars = standard error of the mean.

4.2.2.4. Testing the Effects of Information on Punishment Ratings via Essentialist Beliefs and Moral Responsibility (Model 3)

The second model was tested using punishment as the dependent variable. The results of the analysis supported predictions: the indirect effect of neuroscience information on punishment was accounted for by moral responsibility judgments, but not by essentialist beliefs, across SES-related circumstances. In other words, essentialist beliefs did not account for the decrease in punishment, rather, moral responsibility accounted for the decrease seen across SES-related circumstances (index of moderated mediation for moral

responsibility = .09; CI = [0.004, 0.25]; index of moderated mediation for essentialist beliefs = .05; CI = [-0.02, 0.22]) (see Table 17 and Figure 19).

Table 17: Effects of Model 2 on Punishment Ratings

	df	***t***	***b***	**effect**	***p-value***	**CI**
$a_{1\ ESS}$	395	2.35	0.91		0.02	[0.15, 1.7]
$a_{2\ ESS}$	395	2.58	1.6		0.01	[0.38, 2.8]
$a_{3\ ESS}$	395	-1.97	-0.48		0.05	[-0.96, -0.01]
$a_{1\ MORAL}$	395	-2.79	-1.01		0.005	[-1.7, -0.3]
$a_{2\ MORAL}$	395	-2.48	-1.45		0.01	[-2.6, -0.3]
$a_{3\ MORAL}$	395	2.01	0.46		0.05	[0.009, 0.91]
$b_{1\ MORAL}$	395	14.03	0.6		<.001	[0.52, 0.68]
$b_{1\ ESS}$	395	-7.91	-0.32		<.001	[-0.39, -0.24]
c’	396	0.47	0.09		0.64	[-0.28, 0.45]
$c_{SES\ ESS}$				-0.04		[-0.18, 0.02]
$c_{HEALTH\ ESS}$				0.005		[-0.02, 0.08]
$c_{SES\ MORAL}$				-0.10		[-0.24, -0.02]
$c_{HEALTH\ MORAL}$				-0.02		[-0.10, 0.04]

Index of Moderated Mediation for Moral Responsibility = .09; CI = [0.004, 0.25]
Index of Moderated Mediation for Essentialist Beliefs = .05; CI = [-0.02, 0.22]

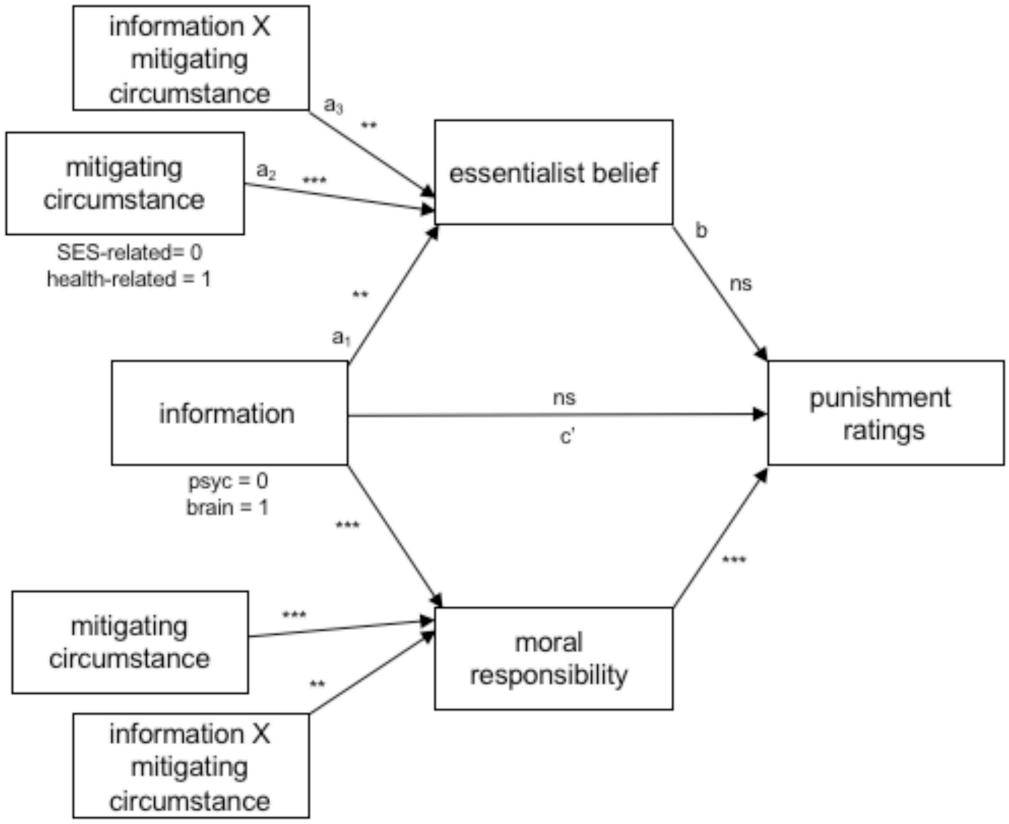

Figure 19: Model 2 for Punishment: Moderated Mediation With Two Mediators.

** = paths statistically significant at $p \leq .05$; *** = paths statistically significant at $p \leq .01$.

4.2.3. Discussion

The results of study 3b replicated the results of Study 2 and began to address how neuroscience influences perceptions of control and sentencing decisions, and when this effect occurs.

The results suggested that brain-based information increases essentialist beliefs while decreasing perceptions of moral responsibility, which in turn leads to lower perceptions of control. However, this effect only occurred only across SES-

related mitigating circumstances, supporting the idea that brain-based neuroscience information turns circumstances that would ordinarily be irrelevant to sentencing into better explanations of behavior.

Interestingly, while the effect of brain-based information decreases perceptions of control through both essentialist beliefs and moral responsibility across SES-related circumstances, it appears that only moral responsibility judgments account for the decrease in punishment ratings across the SES-related circumstances. This suggests that while essentialist beliefs are important when gauging a defendant's control over his actions, brain-based information alone is not sufficient to mitigate punishment across "non-relevant" circumstances.

5. General Discussion

This dissertation has started to document how neuroscience is being used in the criminal courtrooms in non-capital cases, and has explored some of the psychological mechanisms that are at play when people consider neuroscience information in a legal context. Three studies demonstrated that neuroscience is being introduced in non-capital cases to mitigate sentencing and that (a) neuroscience is often used in the context of describing a defendant's control over his or her actions, (b) the context in which neuroscience information is presented matters for legally relevant judgments, and (c) neuroscience information can influence judgments and decisions that are not only associated with traditional mental health related contexts, but also in contexts in which neuroscience information is largely irrelevant. The following sections will summarize the findings and discuss implications of the research, avenues for future study, and potential limitations of the current studies.

5.1 Assessing the Use of Neuroscience to Mitigate Sentencing in Non-Capital Cases

Sentencing in the U.S. is primarily guided by the offense and the offender's past criminal history. This system is in place to reduce disparities in sentencing that may arise from the consideration of individual factors. Yet rule-makers acknowledge that not all crimes—or criminals—are created equally, and that there are circumstances apart from the offense and criminal history that may be relevant for sentencing purposes. The sentencing guidelines articulate a set of

defendant-centered characteristics that should and should not be used for sentencing purposes, many of which are listed in Table 18.

Table 18: "Relevant Offender Characteristics" from Sentencing Guidelines (2016).

"prohibited from consideration" and "not relevant" (28 U.S.C. § 994(d); §5H1.10)	race
	sex
	national origin
	creed
	religion
	SES
"not relevant" (§5H1.12)	lack of guidance as a youth and similar circumstances
"not ordinarily relevant" (§5H1.2; §5H1.4; §5H1.5; §5H1.6)	education and vocational skills
	drug or alcohol dependence or abuse
	employment record
	family ties and responsibilities
"may be relevant" (§5H1.1; §5H1.3; §5H1.4; §5H1.11)	age
	mental and emotional conditions
	physical condition
	military, civic, or public service
"are relevant" (§5H1.7; §5H1.8; §5H1.9)	defendant's role in offense
	criminal history
	dependence on criminal activity for a livelihood

The results from Study 1 demonstrate that many of these circumstances are frequently brought up in the courtroom to mitigate sentencing.

Furthermore, the results from Study 1 showed that neuroscience-based mitigation is being used in the context of circumstances that the guidelines indicate "may be relevant" for sentencing, including circumstances like mental

and emotional conditions, military service (to bring up traumatic brain injury), and sometimes physical conditions. Neuroscience-based mitigation claims are less frequently being used across other mitigating circumstances.

Only about 40% of the opinions discussed neuroscience testing, and generally the testing resulted in using neuroscience to describe how a mental health or brain related condition could lead to impaired decision making or impaired cognitive functioning. Even though many opinions did not outline the reasons for the neuroscience use, the fact that neuroscience-based mitigation claims are being raised by lawyers and defendants suggests that neuroscience could, and *should*, lead to a reduced sentence. Given the fact that many courtroom studies have shown that neuroscience is increasingly raised as part of a defense, future studies should assess whether neuroscience is used for pre-trial decisions and, if so, how. Interestingly, existing pre-trial risk assessments contain questions about factors that are not supposed to be used for sentencing (i.e. family ties, employment stability), while omitting variables related to mental health (Bechtel, Holsinger, Lowenkamp, & Warren, 2016). Although neuroscience was rarely used as an indicator of future risk in this study, neuroscience information may be beneficial when thinking about the rehabilitative potential of an offender—something that could guide pre-trial decision processes.

The judicial writings also revealed the reasons why judges sentence the way they do given the neuroscience-based mitigating circumstances presented to them. Though the courts frequently responded to neuroscience-based

mitigation claims by referring to evidence from prior legal proceedings that directly refuted the claims, courts also tend to mention aspects of the defendant's character and behavior to suggest that the defendant is dangerous or was in control of his actions. For example, earlier I described the case of Mr. Gray, who was diagnosed as a schizophrenic with antisocial behavior and substance abuse issues. The courts referred to Mr. Gray's history of violent crimes to counter the weight of mitigating mental health claims.

Because judicial opinions do not contain every detail about the decision process, we cannot be sure how the defense introduced neuroscience and related it to Mr. Gray's mental health. However, one should note that the symptoms associated with antisocial personality disorders include a failure to obey the law which can result in criminal arrest, impulsive behavior, irritability, aggression, and a blatant disregard for safety (DSM-V, 2013). An avenue of future study would be to see whether explicitly mentioning brain-based evidence to support the behavioral symptoms of mental health issues leads to mitigated sentences.

These results suggest that sometimes decision-makers sometimes value their own interpretations of behavior over those of an expert. While these may be perfectly valid considerations for judges to make, this delicate balancing act could result in the unfair interpretation of a defendant's behavior across offenders. Policy makers may want to take this into consideration as they think about the way current sentencing guidelines are structured.

While this study documents the use of neuroscience in non-capital cases, it still provides a limited picture of how neuroscience is being used for legal decisions. As mentioned, judicial opinions represent only a small portion of cases that go through the legal system. Moreover, judicial opinions themselves do not contain all of the details about particular cases. This analysis sheds light on how legal decision-makers view and respond to neuroscience evidence in this limited context.

5.2. How Mitigating Circumstances and Neuroscience Information Affect Sentencing Related Judgments

Study 2 corroborated some of the themes found in Study 1. For example, using neuroscience (in the form of neuropsychological testing that references cognitive abilities or that puts cognitive abilities in context of the brain) seems to change judgments about moral responsibility, perceptions of control, and punishment. The results from Study 2 also show that neuroscience information—particularly information that contains a brain-based context—influences legally relevant judgments and perceptions across a wide variety of mitigating

circumstances. Specifically, brain-based information exerted mitigating influence on legally relevant judgments over and above neuropsychological information across circumstances that are ostensibly “not relevant” for sentencing considerations. However, both neuropsychology information and brain-based information exerted mitigating influence on legally relevant judgments across the mental/emotional condition and the physical health condition.

The results from Study 2 also showed that generally, laypeople agree with the sentencing guidelines’ depictions of these circumstances as ordinarily not being relevant for sentencing. SES and employment record were rated as being the least relevant for sentencing, but even mental/emotional condition was barely above the midpoint of the scale, suggesting that people believe this information should be used to reduce sentences only some of the time.

A limitation of the experimental studies in this dissertation is that participants were not trained legal decision makers. Decisions made in non-capital cases are generally made by judges. There could be discrepancies between how the participants in the studies responded and how trained legal actors would respond.

Moreover, while the experimental methods allow us to control for extraneous variables, they also limit the conclusions that can be drawn across real legal contexts and are not an ecologically valid representation of legal decision-making. The vignettes used in the studies were less than a page long, and did not contain any back-and-forth exchanges between defense and

prosecution, which would be the norm in an actual case. Furthermore, the use of an online platform to gauge legal judgments may also likely affecting results: decision-makers frequently use cues about the defendant, either consciously (as the judges did in Study 1 when assessing the defendant's behavior in court) or unconsciously (being influenced by race). Given the overrepresentation of minorities in the U.S. criminal justice system, future studies should address whether these results hold across minority groups, or whether racial cues overpower whatever effects the neuroscience information provides.

Finally, the experimental studies did not manipulate any sort of aggravating circumstance, even though the results from Study 1 indicated that judges frequently introduce aggravating evidence about a defendant's character to counter the neuroscience-based mitigation claim. Neuroscience likely has different or diminished effects in cases where aggravating circumstances are presented. Future studies should explore the limits of neuroscience-based mitigation across different aggravating characteristics.

5.3. The Association Between Mitigating Circumstances and Brain Related Processes

Study 3a demonstrated that people are more likely to associate certain mitigating circumstances, such as having depression or an autoimmune disorder that affects the nerves, with the brain and that the causal direction of influence is from brain to circumstance. The rest of the circumstances were less frequently associated with the brain. However, when asked about the causal direction of the

brain's influence, social history circumstances (such as being abused as a child or being a veteran) were more frequently viewed as having an influence on the brain than SES-related circumstances (such as type of job or level of income). These results suggested that the pattern of results observed in Study 2—that only brain-based information was more likely to lead to decreased perceptions of control, decreased moral responsibility, and decreased punishment across SES and employment circumstances—could be the result of a legal equivalent of the "seductive allure" effect for mitigation. As a result, brain-based explanations of behavior may lead to better outcomes for a defendant when it is used across circumstances that are not usually relevant to the brain or behavior.

5.4. Explaining The Seductive Allure of Neuroscience Information To Mitigate Sentences

Study 3b assessed whether the seductive allure pattern of results was driven by the belief that a defendant's traits or behaviors were based on innate, biological factors. The results demonstrated that brain-based information decreased perceptions of control via essentialist beliefs and that this effect was strongest across the SES-related circumstances, providing evidence that the "seductive allure" effect can occur in a legal context. However, perceptions of control were also influenced via attributions of moral responsibility. Neuroscience influences perceptions of control via both essentialist beliefs and moral responsibility judgments, but only across SES-related circumstances.

The results also demonstrated that although brain-based information led to the belief that a defendant's traits or behaviors were more likely caused by biological factors, this belief did not influence sentencing. Rather, lower punishment in the SES-related circumstances were associated with lower moral responsibility ratings. This suggests that brain-based information could be used to explain why a defendant did not knowingly or voluntarily commit a criminal act and may account for why the previous courtroom studies also found that neuroscience is used across claims of competency. It also suggests that punishment decisions are influenced by more than essentialist beliefs. Even when defendants' traits and behaviors are viewed as being biologically based, they are still morally responsible for their actions in the SES-related circumstances. Future studies should assess whether this effect is associated with the perception of the mental health issue itself. For example, studies have found that people perceive mental health on a variety of dimensions, and may believe that the person himself is morally accountable for his condition, or that the accountability lies more within the biological essence of the disorder (Haslam, 2005; Haslam, & Giosan, 2002). Even though brain-based information increased essentialist beliefs across non-relevant circumstances, this may not have been enough to change the perception of the causality of the defendant's mental health issues on his behavior.

Study 3b assessed the mechanisms that underlie the effects seen across circumstances that are generally not associated with brain or biological

mechanisms. The results suggested that these mechanisms are associated with traditional models of blame attributions: neuroscience influences perceptions of causal attributions, moral responsibility, and punishment. However, neuroscience information seemed to have these effects only across non-relevant circumstances, suggesting that the mechanism of action differs across circumstances that are associated with the brain. Follow-up studies should explore what mediates the effects observed in the health-related circumstances.

6. Conclusion

The use of neuroscience in the courtrooms is increasing across the U.S. and abroad. Many scholars have speculated about how neuroscience will influence legal decisions. Is neuroscience relevant only to capital cases, where the stakes are much higher than in non-capital cases? Does neuroscience change perceptions of responsibility and mitigate punishment? Is neuroscience used as an indicator of future dangerousness? The work in this dissertation has used a mixed-methods approach to address these and other questions.

While qualitative courtroom studies generally explore neuroscience in high-stakes cases, the work in this dissertation demonstrates that neuroscience is also being used in low-stakes, non-capital cases as well. Furthermore, Study 1 demonstrates how neuroscience is used in the context of existing statutory sentencing guidelines. A cursory look at the results suggests that neuroscience is not helpful in non-capital cases, given that defendants' claims are unsuccessful. However, looking at the judicial reasons behind sentencing decisions revealed that neuroscience is being referenced as a reason for a low-end guideline range sentence, suggesting that neuroscience can mitigate sentencing across non-capital cases.

Scholars have also been worried about the "dazzling" effect of neuroscience in the courtroom. While the results form Study 1 and Study 3a indicate that neuroscience is generally used to bolster claims about circumstances that are associated with the brain, such as mental health issues,

Study 2 and Study 3b indicated that neuroscience does have an effect on legally relevant judgments even when it is introduced in seemingly unrelated and irrelevant contexts, suggesting that neuroscience could be a powerful defense tool. However, the results from Study 1 indicated that neuroscience is being used responsibly—to help decision-makers reason about how relevant mental processes could have influenced a defendant's behavior. Interestingly, characteristics about the defendant were frequently used to counter neuroscience-based claims. Whether this is an appropriate way to weigh and balance mitigating circumstances is an issue for policy-makers to address.

Appendix A

The following data represent the number of listed mitigating and aggravating circumstances across the 50 U.S. states and Washington, D.C. Data were collected using Westlaw and by performing online searches to find state sentencing commissions and their respective guidelines.

A closer analysis using MAXQDA reveals how frequently words related to the brain were used in these statutes, including “brain,” “mind,” and “mental.” Most instances of these words were used to describe mitigating circumstances, including the word “mental” to describe if an offense was committed under the influence of an extreme mental or emotional disturbance, and “brain” to describe conditions of impaired brain function including fetal alcohol spectrum disorder and PTSD or combat related brain injuries.

state	mit/agg		state	mit/agg	
AL	17	25	NE	7	9
AK	21	35	NV	7	15
AZ	11	39	NH	9	3
AR	15	22	NJ	13	15
CA	26	46	NM	0	11
CO	12	24	NY	6	0
CT	2	8	NC	21	20
DE	0	22	ND	n/a	n/a
FL	8	16	OH	9	24
GA	0	11	OK	0	8
HI	n/a	n/a	OR	1	2
ID	0	11	PA	8	40
IL	15	46	RI	17	17
IN	13	11	SC	10	12
IA	n/a	n/a	SD	0	10
KS	12	16	TN	13	25
KY	8	8	TX	0	9
LA	8	22	UT	7	2
ME	n/a	n/a	VT	0	8
MD	18	20	VA	0	15
MA	7	10	WA	11	35
MI	n/a	n/a	WV	n/a	n/a
MN	0	14	WI	0	9
MS	7	10	WY	8	12
MO	7	17	DC	10	23
MT	2	4			

	mitigating	aggravating
brain	12	0
mind	1	5
mental	51	36

Several aggravating circumstances mentioned the word “mental.” These circumstances typically described the impact of a defendant on a vulnerable victim, one that could not exercise normal mental powers of resistance. Many of these circumstances also described defendants who are motivated by victim characteristics (e.g. race, sexual orientation, physical or mental disability), or if the defendant conducted the crime to inflict “mental” anguish. All five of the “mind” aggravating references were to talk about the crime involving “depravity of mind.”

Appendix B

GENERAL CODING RULES

Data will be coded using the software program NVivo or MAXQDA. “Coding” in NVivo/MAXQDA involves highlighting relevant text and assigning the text to appropriate *nodes*. *Nodes* are the themes to be coded.

NVivo and MAXQDA allow users to code qualitative information and also has the capacity to link existing data (e.g. an Excel spreadsheet with demographic information) with the qualitative information. The linked data will be referred to as a *classification sheet*.

Nodes can have hierarchical structures. For example, if you had a node labeled “Sex,” you could further classify information by “Male,” “Female,” and “Other.” The node “Sex” would be the *parent* node—the node at the top of the hierarchical structure—while “Male,” “Female,” and “Other” would be the *child* nodes—the subset of this parent node.

What to code: Code text in complete phrases, sentences, or paragraphs depending on how much context is needed for interpretation of particular node.

LEGEND

BOLD UPPERCASE descriptors represent parent nodes. Text should be coded in NVivo/MaxQDA to corresponding parent node *unless* there are child nodes, in which case text will be coded to child nodes.

UNDERLINED UPPERCASE descriptors represent child nodes. Text should be coded in NVivo to corresponding child node.

bold lowercase descriptors represent variables in the classification sheet. If variables are to be coded in the classification sheet, there will also be string values associated with the variable which should be coded in the classification sheet.

NODES AND VARIABLES TO BE CODED

DECISION MAKING AND REASONING [contains child nodes]

See coding specifications for child nodes below.

DEFENSE REASONING ABOUT MITIGATION

Brief Definition: The *reasoning, explanation,* or *decision* made by the defense (not a judge or previous court) about why the mitigating circumstances are important or relevant to the case.

Full Definition: The defense may explain why the mitigating evidence or circumstances are important or relevant for the defendant's case, how the mitigating circumstances affect the outcome of the trial, why they are introducing the mitigating evidence, etc. This code should be about the *reasoning* and *explanations* made by the defense about mitigating circumstances, although it can contain the reasons or explanations made by the defense as summarized by the court.

Examples

"Brown argues that the district court failed to adequately consider his mental deficiencies and diminished capacity in imposing a sentence under application of the 18 USC §3553(a) factors." (Brown v US)

"In ground five of the Motion to Vacate, Petitioner claims that his counsel was ineffective because she failed to offer mitigating psychological expert testimony of Dr. Bailey to the Court and thus her conduct constituted abandonment of his case." (Gladney v US)

"Shafeek raises one issue, which we restate as whether his sentence is inappropriate." (Shafeek v State)

COURT REASONING/DECISION MAKING ABOUT MITIGATION

Brief Definition: The *reasoning, explanations,* or *decisions* made by a judge or court (not defense) about mitigating circumstances.

Full Definition: A judge or court's *reasoning* or *explanation* about any of the *decisions* made about mitigating circumstances. For example, the Judge or Court may explain why mitigation evidence was/wasn't allowed to be introduced, why the mitigation strategy of the defense did/did not work in the petitioner's favor, etc.

Examples

“As for Blue's character, he notes that he was only twenty years old (nearly twenty-one) at the time of the crimes. That is not an especially youthful age for purposes of sentencing though, especially where, as here, a defendant is “more ‘hardened and purposeful’ than ‘clueless.’” (Blue v State)

“Petitioner has not shown that he suffered from any brain damage or mental illness that his trial counsel would have discovered if he investigated further. There is no psychiatric or medical evidence before the Court, and even Petitioner's own assertions are not under penalty of perjury. Petitioner argues that the evidence is not before the Court, because his counsel did not investigate it. In post-conviction proceedings asserting ineffective assistance claims, however, it is a petitioner's burden to show that the evidence that defense counsel failed to investigate actually existed.” (Gutierrez v Grounds)

PSYC OR NEUR TESTIMONY/EVIDENCE

Brief Definition:Text that refers to the psychological, neuroscientific, or neuropsychological evidence or testimony used about a defendant.
Full Definition: This is text that refers to the psychological, neuroscientific, or neuropsychological evidence or testimony used about a defendant. This can include brain scans, psychological testing, testimony about the defendant’s state of mind, etc. This should be testimony or diagnoses made by any scientific

experts or summarized by the court, regardless of whether the court accepted it or used it in their decision.

Examples

“Dr. Susan Messina testified that she evaluated defendant's sanity at the court's order. She reviewed prior FCS evaluations, extensive medical records, and police reports, and she interviewed defendant three times, in October and November 2011 and March 2012…” (People v Jackson)

“The psychologist who completed the psychosexual evaluation administered five tests and conducted a clinical interview. During the interview, appellant “denied ever having sexual contact with his step- daughter.” The psychologist noted that appellant's test results were inconsistent, ruled out a neurological reason for this, and suggested that appellant was being defensive or deceptive, or was in denial.” (State v Goerdt)

MITIGATING CIRCUMSTANCES [contains child nodes]

This node will document relevant mitigating circumstances that are used for mitigation and that are mentioned in the sentencing guidelines. Code only text that defines what the mitigating circumstance is (whole sentences not needed). Circumstances could be mentioned by either defense or court. Code to circumstances listed below.

DISADVANTAGED BACKGROUND

Text that refers to personal circumstances indicating a disadvantaged background, but not related to childhood disadvantage or trauma.

Examples

"…physical abuse by her husband…" (State v Haag)

"…homelessness…" (Murphy v US)

disadvantaged background

if yes = disadvantaged

if no = no

HISTORY OR CHARACTERISTICS

Text that could broadly be construed to fall under the "history or characteristics" mitigating factor. These are circumstances used in mitigation but not specified by this list, and can refer to positive or negative characteristics or behaviors.

Examples

"[The trial court also recognized that there was evidence of mitigating circumstances; specifically, that] Hall pled guilty, that he had been a positive influence on his children's lives…" (Hall v State)

"…defendant's prior military service…" (People v Scharf)

history or characteristics

if yes = history

if no = no

SUBSTANCE ABUSE/ADDICTION

Text that refers to a defendant's issues, problems, or struggles with substance abuse or addiction. This can include alcohol, drug, and gambling issues.

Examples

"…chronic substance abuse…" (People v Sykes)

"…struggles with drug addiction…" (US v Douglas)

substance abuse

if yes = substanceabuse

if no = no

PHYSICAL HEALTH

Text that refers to a physical health condition or other medical condition, separate from mental health problems or head trauma.

Examples

"…severe food poisoning from eating leftover pizza…" (State v Webb)

"…diabetes, high blood pressure, and sleep apnea…" (US v Dikiara)

physical health

if yes = physical

if no = no

MENTAL HEALTH

Text that refers to mental health diagnoses or issues, separate from head trauma or concerns about cognitive deficiencies due to mental retardation or low IQ.

Examples

"…mental illness…" (Serpa v Ryan)

"…borderline personality disorder, severe anxiety, and severe depression…" (Helsley v State)

mentalhealth

if yes = mentalhealth

if no = no

HEAD TRAUMA

Text that refers to head trauma, brain injury, or brain defects.

"…catastrophic head injury…" (State v Stanhope)

"…brain tumors…" (US v Fout)

headtrauma

if yes = headtrauma

if no = no

MENTAL RETARDATION/LOW IQ

Text that refers to a defendant's mental retardation or low IQ.

Examples

"…mildly retarded…" (People v Sykes)

"…his IQ was extremely low…" (State v Taylor)

mentalretard

if yes = mentalretard

if no = no

CHILDHOOD TRAUMA

Text that refers to a disadvantaged upbringing, childhood abuse, or similar circumstances that occurred when the defendant was a child.

"…victimization as a child…" (Gladney v US)

"…troubled social history, neglect by her mother and sexual abuse by her brother…" (State v Avery)

childhoodtrauma

if yes = childhood

if no = no

guideline state

Is the state in which the case was adjudicated a state that has a sentencing commission or sentencing guidelines?

if yes = commission

if no = no

sentence length

How was the defendant sentenced? Write the number of months or years in the classification sheet.

guideline range

Is the sentence at the low, mid, or high end of the guideline range? Was the sentence an upward or downward departure from the guideline range? This information may not be available for some cases. If it is not available, code as "unknown."

mitigating circumstance count

How many mitigating circumstances were mentioned for mitigation? Count the total number from childhoodtrauma, mentalretard, headtrauma, mentalhealth, physicalhealth, history, substanceabuse, and disadvantaged variables. Write this number as the total count.

type of sentencing issue

Did the defendant introduce mitigation at sentencing as part of a claim, was mitigation during sentencing discussed in the opinion generally, or was the mitigation during sentencing part of a sentencing order/memorandum?

if sentencing claim: sentencing claim

if discussed generally: general

if part of sentencing order/memorandum: sentencing order

reference to mind/brain

Did the sentencing issue directly reference the mind/brain, was it an indirect reference to the mind/brain (meaning that the claim/order/etc itself did not mention mind/brain, but the meaning behind the claim/order/etc refers to the mind/brain), or was there no mention of the mind/brain at all?

if direct: direct

if indirect: indirect

if no mention: no mention

sentencing and mitigation

If the type of sentencing issue was a sentencing claim, what kind of claim was it? Examples include: IAC, sentence not appropriate, sentence excessive, etc.

court response

How would the court's response be characterized? Did it mention an mitigating circumstances? Did they refer to procedural errors?

Appendix C

Vignette Used for Study 2

On May 9, Robert Evert was sleeping in his home when a knock at the front door woke him up. Evert ignored the knock and went to the bathroom. While inside the bathroom, Evert heard a loud noise. Evert walked into his living room and saw a stranger, the defendant (identified as Eli Hall) standing inside. Evert told Hall to get out of his house. When Hall didn't leave, Evert punched him. Hall responded by hitting Evert in the head with a rock the size of a grapefruit. Evert eventually made his way to the back door outside his home.

Once outside, Evert flagged down a car and asked the occupants inside to call 911. The occupants saw that Evert was covered in blood. Evert told the car occupants that he did not know who the man was or what he wanted. They all saw Hall leave the house empty handed.

When the police arrived, they discovered a rock with blood on it in the dining area of Evert's house, and a shoe print on the front exterior door. The shoeprint impressions matched the tread patterns on the soles of the boots Hall was wearing when he was arrested. Hall later admitted to entering Evert's house and hitting him. Hall claimed that he just wanted to use a bathroom. Hall was charged with aggravated assault.

Appendix D

Mitigating circumstance conditions for Study 2

None present: control condition, psychological and neuroscience information is not associated with any context.

Employment record

The defense presented evidence that although Hall had a steady job for 5 years in the past installing lawn irrigation systems, Hall was laid off because the manager couldn't afford to pay him anymore. The defense argued that Hall's employment record should mitigate punishment and result in a lesser sentence.

SES

The defense presented evidence that Hall is from a low socioeconomic background and cited that in relation to others Hall makes less money, has less education, and has a low status job. The defense argued that Hall's socioeconomic status mitigate punishment and result in a lesser sentence.

Disadvantaged background

The defense presented evidence that Hall had a difficult youth and inadequate education and cited the lack of safety precautions regarding the use of pesticides on the family's farm and Hall's dysfunctional relationships from early childhood. The defense argued that Hall's disadvantaged background should mitigate punishment and result in a lesser sentence.

Childhood abuse

The defense presented evidence that Hall had a traumatic upbringing and cited that Hall suffered abuse in his childhood, including that Hall's father forbid Hall from taking showers and sexually abused him, and Hall's mother regularly forgot to feed him. The defense argued that Hall's childhood abuse should mitigate punishment and result in a lesser sentence.

Mental/Emotional condition

The defense presented evidence that Hall has major depression, and cited that Hall typically has a low mood, loss of interest in normally enjoyable activities, and often has thoughts and feelings of worthlessness and helplessness. The defense argued that Hall's mental and emotional condition should mitigate punishment and result in a lesser sentence.

Physical condition

The defense presented evidence that Hall has a rare autoimmune disorder, and cited that Hall's condition leads to extensive nerve damage that led to his hospitalization for eight months, where he had to relearn how to walk. The defense argued that Hall's mitigate punishment and result in a lesser sentence.

Substance abuse

The defense presented evidence that Hall has addiction problems, and cited that Hall is dependent on opioids, cocaine, and marijuana which results in adverse social and behavioral consequences. The defense argued that Hall's substance abuse issues should mitigate punishment and result in a lesser sentence.

Appendix E

Vignette Used for Study 3b

On April 16th, Clark Matthews was playing darts at a local bar. He was with two of his friends. A man who was sitting at a table nearby was yelling at them and trying to make them play poorly. Matthews told the man, later identified as Sean Jones, to stop yelling.

After Matthews and Jones exchanged a few words, Jones got up and pushed Matthews while he was waiting for his turn. Jones and Matthews got into a shoving match, and Jones hit Matthews in the face, which knocked him out for about five minutes. Matthews' friends called the police, who came and arrested Jones. When the police arrived, Matthews was experiencing confusion from being punched in the face. Jones admitted to starting the fight.

Jones was charged with aggravated assault.

Appendix F

Mitigating circumstance condition for Study 3b

SES: low status job

The defense presented evidence that Jones is from a low socioeconomic background and cited that in relation to others Jones has a low status job. The defense argued that Jones' low status job should mitigate punishment and result in a lesser sentence.

SES: less income

The defense presented evidence that Jones is from a low socioeconomic background and cited that in relation to others Jones makes less money. The defense argued that Jones' lower than average income should mitigate punishment and result in a lesser sentence.

Health: mental/emotional condition

The defense presented evidence that Hall has major depression, and cited that Hall typically has a low mood, loss of interest in normally enjoyable activities, and often has thoughts and feelings of worthlessness and helplessness. The defense argued that Hall's mental and emotional condition should mitigate punishment and result in a lesser sentence.

Health: physical condition

The defense presented evidence that Jones has an undersized brain, and cited that Jones' condition can lead to poor speech, motor function, or seizures.

The defense argued that Jones' physical condition should mitigate punishment and result in a lesser sentence.

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Biography

Beatrice Helene Capestany was born in Washington, D.C. on June 26, 1987. She attended Vassar College where she received her B.A. in Neuroscience & Behavior with a minor in Russian Studies in May 2009. While pursuing her Ph.D. at Duke, Beatrice earned her Master's degree in Psychology in 2015. Beatrice has long been interested in the intersection of neuroscience, psychology, and policy, conducting research in social neuroscience labs and interning in public policy positions before her tenure as a Ph.D. student.

While at Duke, Beatrice received multiple honors and awards including the Society for Personality and Social Psychology Travel Award, a Bass Instructorship Fellowship, several summer research fellowships, and twice received honorable mention for her research submitted to the National Science Foundation's Graduate Research Fellowship Program.

List of Publications:

Harris, L. T., Capestany, B. H., & Tan, J. (2016). How next generation neuroscience technologies can facilitate comparison across cultural contexts and species: Implications for global health. In: J. Chiao, S-C. Li, R. Seligman, & R. Turner (eds.). *The Oxford Handbook of Cultural Neuroscience*. Oxford University Press.

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