

Legal Evidence in Neuroscience Reflected in Practice

Cristina Siserman-Gray
Faculty of Law, University of Vienna
Juridicum, Schottenbastei 10-16
1010, Vienna, Austria
+436802300653
cristinasiserman@gmail.com



ABSTRACT: *This paper presents the results of an empirical study conducted on a number of legal practitioners in Austria, Romania and Slovenia to measure the relevance of the neuroscientific evidence when determining the legal responsibility of a defendant during court proceedings. The legal practitioners were presented five case scenarios in which they were asked to analyze the admissibility of neuroscientific evidence. The results revealed certain important challenges when interpreting neuroscientific evidence for use in legal proceedings. This study summarizes those challenges and further concludes that the application of neuroscientific data is not a straightforward matter. As such, it also argues that neuroscientific experts must play a greater role in court proceedings in order to provide better guidance to judges and other legal practitioners.*

Keywords: Legal Practitioners, Neuroscience, Law, Courtroom, Criminal Responsibility etc

Received: 10 October 2018, Revised 3 December 2018, Accepted 12 December 2018

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1. Introduction

Neuroimaging scans have been used in a variety of cases in order to establish a defendant's mental state. In civil cases, neuroimaging has been requested in personal injury, disability belief and contract cases, while in criminal cases it has been mainly invoked in order to negate the *mens rea* of a crime and to avoid convictions. For instance, statistics show that in some countries such as the USA over 1500 judicial opinions issued during 2005-2012 discuss the use of neuroscience by criminal defendants [1]. However, despite the wide use of scans in courts, there is concern among scientists and legal practitioners regarding the practical consequences of neuroscientific developments. The aim of this empirical study seeks to understand how European legal practitioners relate to "neurolaw cases" and the degree to which they admit neuroscientific evidence in court in order to determine the moral and legal responsibility of an individual.

2. Previous Research

To our knowledge this is one of the first studies of its kind to assess the views of legal practitioners regarding neuroscientific evidence and the impact of those views on their decisions when assessing the responsibility of an individual. While a number of studies have concluded that neuroscientific evidence affects legal practitioners, few have attempted to qualify that effect. Therefore, in order to test the degree to which legal practitioners use neuroscientific evidence in the assessment of responsibility, we based our study on a hypothesis tested by Aspinwall et al. in 2012 who argued that there is a “correlation between the inclusion of the biological explanation of neurological disorder with significantly reduced sentence length and increased number of mitigating factors listed” [2]. Though this correlation has seen corroborated by the US president’s Council on Bioethics, which claimed that “judges and juries have recognized the persuasive allure of brain scans” [3] and Munro’s 2014 study, which concluded that the public is more likely to trust diagnosis when brain imaging evidence is presented [4], our study will step beyond these conclusions to understand *how* neuroscientific evidence affects legal practitioners in legal proceedings.

3. Design of the Experiment

3.1 Participants

The participants selected for this study were legal practitioners (judges, lawyers and attorneys) or graduates of legal studies who were already working in the legal profession. The participants’ views were assessed via an online questionnaire that was completed by 91 participants ($N=91$).

The participants were categorized in three main groups, a group from Slovenia (=Slovenian group comprising 41 practitioners with an average of 28.2 years old); a second group from Romania (=Romanian group comprising 22 practitioners with an average age of 34.1 years old); and a third group (=Mixed group comprising 28 legal practitioners with an average age of 28.6 years old) representing legal practitioners residing in Austria, but coming from other countries in Europe and North America.

3.2 Instruments

The legal practitioners were asked to analyze five case scenarios that were designed in such a way as to determine a) the types of neuroscientific evidence that would be acceptable in courts and b) how the legal practitioners’ assessment of the individual’s responsibility (i.e. guiltiness, type and length of punishment) would be influenced by this type of evidence. The case scenarios were also designed to assess how legal practitioners view “new science”, such as advancements in neuroscience.

Before briefly introducing each case scenario and the results, a few remarks are required to fully understand why each case was formulated as it was. Sloboghin identified five categories of neuroscientific evidence based on the cases presented in American courts [5], which we adopted as the basis for our scenarios. The 5 types of evidence are: (a) evidence of abnormality; (b) cause-of-an-effect evidence; (c) effect-of-cause evidence; (d) individualized neuro-psychological findings compared against known performance baselines; (e) individualized neuroscience findings compared against known legal baselines.

4. Results and Discussion

In the following we will discuss the questionnaire results of each scenario, as well as the main problems that were raised by the respondents. Each case scenario presents an offence and the type of neuroscientific evidence that the defendant invoked in order to either excuse his/her behavior or diminish his/her legal responsibility. The legal practitioners were asked to perform three tasks in order to determine: (i) whether the individual in the scenario should be held responsible for the act; (ii) the kind of punishment or treatment that should be applied to an individual; and (iii) the length of punishment (if any). We will additionally highlight some of the challenges identified by the legal practitioners when analyzing the type of neuroscientific evidence presented in each case scenarios.

4.1 Difficulties Demonstrating Causality

As reported by legal practitioners, demonstrating causality is among the most important problems that arise in practice when using neuroscientific evidence. The problem of causality was specifically included in one of this first case scenarios, in which the legal practitioners were presented with a “cause-of-an-effect” evidence, and asked to determine whether the evidence showing a link between the damage to the frontal lobe and abnormal sexual behavior is acceptable. They were presented the following scenario:

“Mr. Jones, aged 35, was arrested for having raped three young women. In the pre-trial investigation, a scan of Mr. Jones’ brain using PET (positron emission tomography) revealed serious damage to his frontal lobe, apparently as a result of a stroke. The medical expert showed that during the stroke, the frontal lobe (which is involved in judgment, impulse control and sexual behavior) has been irreversibly damaged and this explains Mr. Jones’ abnormal sexual behavior”.

In principle, a “cause-of-an-effect” evidence could be highly exculpatory in order to decide on a volitional impairment. However, the results indicated that our participants did not generally agree in this case. In fact, some Slovenian legal practitioners reported that this type of evidence is not very useful for them as a basis to decide the legal responsibility of an individual. Though this argument was expressed by only some Slovenian respondents, it could generally explain the answers of the Slovenian Group, which agreed by a large majority (80.2%) that the accused in this case should be held responsible for rape. The same view was expressed in a proportion of 64.3% by the Mixed Group.

Interestingly, the Romanian judges were of a different opinion, with only 41% of them agreeing that the accused should be held responsible. The Romanian legal practitioners believed that the evidence was acceptable to diminish the responsibility of the defendant, but not sufficient to remove it completely. The Romanian legal practitioners did not challenge the evidence *per se* in as much detail as the Slovenians did, but the Romanian legal practitioners that did agree that the accused should be held responsible also reported that they were not convinced beyond any reasonable doubt about the causal link between the stroke and the abnormal sexual behavior.

Additionally, some Slovenian legal practitioners noted disparities in the way scientific conclusions could be interpreted. In their view, the conclusion presented in this case, which argues for a causal link between a stroke and abnormal behavior, could also be interpreted as accepting that a high proportion of people that commit rape had a frontal lobe stroke at some point, which, of course, is not necessarily true. In their view, the evidence submitted does not indicate the probability with which people with strokes would also commit rape, which is the central question that a judge would want to have answered and which was not done in a satisfactory manner here.

Consequently, legal practitioners noted that neuroscientific studies presented in courts can rarely be presumed to be fully conclusive, despite the fact that some researchers often invoke assumptions of cause and effect. In their view, the notion of “cause” presents differences in meaning between the social sciences and the criminal law. It might be that because of this reason the two fields frequently clash. According to many legal practitioners, among which Denno, as well, scientists do not often use terms such as “cause-and-effect”, but instead use concepts such as “laws of change”, “paradigms”, “models and theories”, “hypothesis testing” and “falsification” [6]. According to them, these various “jargons” make their work more complicated.

4.2 The effect of Methodological Weaknesses

There is an awareness among legal practitioners that many scientific studies have methodological weaknesses, which have an unknown degree of impact on the overall results. Because of these methodological weaknesses, many Courts have showed certain resistance in considering certain statistical data in their decision-making. Therefore, when deciding to accept probabilistic results as evidence, legal practitioners generally discard causal links that are assessed as not being fully convincing, regardless of the type of evidence, neuroscientific or otherwise.

This was the solution reached by a majority of legal practitioners when presented the following scenario which contained a type of evidence that can be categorized as an individualized neuro-psychological finding:

Mr. Johnson, aged 27, was brought in front of the court for having sold methamphetamines. The defense lawyers informed the judges that the defendant found out 8 years before that he had an unusually large pituitary tumor, which caused irreversible brain tumors. The medical expert showed that pituitary tumors may affect thyroid production, causing mood disorder and damage to the frontal, temporal and thalamic regions, which may cause problems in decision-making, mental flexibility and overall intellectual capacity. The medical expert supported the defense who claimed that because of the tumor, the defendant was more susceptible to be influenced and manipulated by the drugs dealers and that is why he accepted to sell the drugs”.

In general, individualized neuro-psychological findings compared against known performance baselines (such as those in this scenario) are accepted in courts because they provide insight into the particular defendant’s biological functioning. Despite this

fact, a great majority of respondents across all three groups (average of 87.9%) rejected the evidence presented and agreed that the accused should be held responsible for selling drugs. An argument invoked by the legal practitioners for this conclusion was that it is generally very difficult for scientists to come up with convincing and compelling data relevant for all necessary demographic groups in order to make a useful comparison with the defendant. That is because findings from neurological testing can vary significantly based on a series of variables, including gender, age, and education, among others. In the view of the legal practitioners, interpreting specific results can be very difficult without this baseline information.

Another concern noted by legal practitioners was that even if these baseline measurements would be obtained, a correct determination about relative impulsivity of the defendant at one point in time does not prove anything about the impulsivity of the defendant at the time the crime occurred (in our case when the accused decided to sell the drugs). Consequently, our respondents confirmed conclusions reached in other studies, such as that of Sloboghin who noted “that science cannot currently answer the normative question of how far below the average a defendant would have to register on a particular performance task to be considered legally impaired” [5].

4.3 Limits Regarding Potential Simultaneous Effects and Interrelationships

Another challenge of neuroscientific evidence noted by legal practitioners was that they were seldom presented studies that examined all the possible variables. By ignoring potential simultaneous effects and interrelationships that may exist among the numerous other biological, social, and economic factors, they concluded that very few of these studies were complete, leaving room for interpretation. Therefore, a majority of judges in our study continue to believe that most biological and environmental studies of crime remain isolated in their particular disciplines, which often makes them unacceptable as evidence in the court.

This was one of the main conclusions reached based on the results obtain for the following case scenario:

“Mr. Green, aged 47 is brought in front of the criminal court for assault and injuries on a pedestrian. He assaulted the pedestrian on the reason that he almost generated an accident while walking on the lane destined only for bikers. Mr. Green’s lawyer pleaded that the defendant is a peaceful person never having been involved in fights and that his violent behavior was the result of the defendant’s level of testosterone which changed its normal level because of the ingestion of some steroids that Mr. Green took during sport training. The medical expert showed that the saliva samples collected from the defendant exhibited abnormal level of testosterone and this generated his aggressive behavior. He also added that there is no unanimity within the scientific community regarding the positive correlation between testosterone level and aggression in general, but that in his opinion, in this particular case, the correlation is evident”.

This case scenario contains “effect-of-a-cause” evidence, which basically compares the prevalence of criminal behavior among individuals presenting a neurological impairment to those that do not have such an impairment. More precisely, the evidence refers to research that indicates a higher prevalence rate of violence among people with high level of testosterone. When asked to evaluate whether the defendant should be held responsible for assault and injuries on a pedestrian, the great majority (94.5%) of respondents from all three groups agreed that he should be held responsible. Compared to the previous two case scenarios, this one contained less divergent views.

As mentioned by the respondents in the comments sections, and confirmed by other studies, evidence of clear association between androgen levels and aggression in human males is currently inconclusive. Legal practitioners took note of studies that noted that behavioral “traits of dominance and aggression in the human male have been associated with higher levels of testosterone” [6]. However, they were also aware that, as Archer concluded, “direct associations between androgen levels, primarily testosterone, and criminality show somewhat conflicting results, possibly because of the different types of hormone measures used” [7]. As such, it seems that legal practitioners view research on some of these factors as statistically weak and believe that more carefully performed studies are needed before they can use this type of evidence in the courtroom.

Nonetheless, the legal practitioners also argued this type of data must be put in context. In their view, without knowing the general base rate for violence in people with normal levels of testosterone, crime prevalence in groups of people with high levels of testosterone is not of much help to legal practitioners.

4.4 Too much focus on incrimination rather than exoneration

Connected to the conclusion above, an interesting view of many legal practitioners was the acknowledgement that current

neuroscience evidence is mostly focused on culpability issues (whether an individual is morally and legally responsible for their acts) rather than providing a basis for exoneration. Because of that, in deciding on the relevance of such evidence, legal practitioners and experts are aware that they have to pay attention both to the precise nature of the evidence in question and the specific legal doctrine to be addressed. Though some may argue that neuroscience evidence alone could be sufficient to remove the responsibility of an individual, in reality, in most cases, it is not. This was what the legal practitioners decided in the case of the following case scenario:

“Ms. Black, aged 47, accountant, was filed for conducting fraudulent insurance practices for a period of 8 years. She was diagnosed 10 years before with anoxic encephalopathy caused by a myocardial infarction. A SPECT (single-photon emission computed tomography) was performed, which indicated a reduction in blood flow in the temporal and frontal lobes (which are associated with executive functioning and memory). The medical expert showed that her fraudulent behavior could be explained by her impairment”.

For this scenario, the majority of the legal practitioners considered that the SPECT evidence that was included to demonstrate a reduction in blood flow in the temporal and frontal lobe should not be received as an exculpatory evidence. Their main argument was that neuro-abnormalities have minimal relevance for cause in this case, particularly when having to explain a causal link over an extended period of time (a stroke that occurred 10 years before the trial). The causal link between the stroke and the multiple fraudulent acts was impossible to establish. Therefore, the majority discarded this evidence, with 95.2% of the Slovenian, 81.9% of the Romanian respondents and 85.7% agreeing that the defendant should be held responsible for fraudulent practices.

As noted by the legal practitioners, a reason why they believed prison punishment was appropriate was due of the concern that, in this case, improperly used neuroscience evidence could be used to mitigate punishment and thereby present a greater risk of re-offense. It seems thus that judges, when confronted with the public pressure to ensure to that there is no risk of re-offense (like in the scenario presented above), may be more inclined to admit the neuroscientific evidence in order to evaluate one’s risk of re-offending. The “double-edge sword” nature of neuroscience evidence is important and was not noted by the respondents prior to this case scenario. Therefore, based on these results, it is important to be aware of the possibility that neuroscientific evidence could be misused in the future to evaluate or predict an individual’s potential level of dangerousness.

4.5 Cultural Differences in Weighing the Strength of the Evidence

Finally, it is important to note that we believe that some of discrepancies included in our results are attributable to cultural differences. In fact, these cultural differences seemed particularly important in relation to the severity of punishment. This is seen most clearly in the following scenario:

“Mr. Smith, aged 37, is a teacher and he is being tried for having made sexual advances on his young stepdaughter. He was found to have a tumor in the right frontal lobe of his brain. His medical results showed that when the tumor was removed, his pedophilic behavior stopped. When the tumor recurred, the behavior also resumed”.

When asked whether the defendant should be held responsible for the sexual advances committed on his stepdaughter, a majority of the Slovenian and the Mixed groups, with 83% and 60.7%, respectively, agreed that the accused should be held responsible for sexual advances. However, the majority of Romanians (59%) disagreed, believing that in this case, the individual should not be held responsible for sexual advances.

We believe that the difference in the way this defendant was evaluated by the three groups has to do with the type of neuroscientific evidence presented to the participants in the study. In this case, the legal practitioners were asked to evaluate evidence of a brain abnormality. The Slovenian and Mixed Group argued that since hypothetical cases like these are very rare in practice, very few defendants can present such a straightforward connection between neurology and behavior. As such, the majority of the respondents from those two groups believed that the behavior of the defendant could not be excused because this neurological abnormality provides an insufficient basis for making the necessary link to the unlawful behavior.

That was not the case for the Romanian Group, who in a proportion of 59.1% believed that the accused should not be held responsible for sexual advances. In this situation, Romanian legal practitioners admitted the neuroscientific evidence on the presumption that the medical conclusions were correct. Compared to the Slovenian and Mixed Groups, the Romanian Group did

not challenge the accuracy of the medical results and/ or of the neuroscientific evidence that was brought to be examined in the case. The reason for this discrepancy is unknown and could warrant further study.

5. Conclusion and Further Directions

The results of this experiment are addressed to both scientists and legal practitioners, who, we hope, will be able to draw some practical applications for their work. Our first recommendation for the scientists is to make sure that information they release publicly is valid and clearly states the scientific limitations. Experts in the field of neuroscience should keep in mind that as much as legal practitioners would sometimes want to accept a certain type of neuroscientific evidence, specific constraints of the legal doctrine in which they work prevent them. A second message is addressed to legal practitioners, who should begin considering the best ways to integrate new scientific discoveries. Neuroscientific evidence can provide a more nuanced understanding of neurological impairments in a way designed to humanize the legal system rather than creating motives for discriminating against individuals. This more nuanced understanding can additionally provide a more graded approach for assigning responsibility, by minimizing arbitrary incrimination or full exonerations based only on the premise that “my brain made me do it”.

We are also hopeful that the conclusions obtained in this study are sufficient to provide at least a more accurate picture of how various legal practitioners witness, from their positions, the new developments in neuroscience. However, based on the results obtained in this study it is difficult to predict whether neuroscientific evidence will play a more important role in courtrooms in Europe in the future. There are many optimistic voices that see a future for neuroscientific tools, as they may provide a more objective assessment of an individual’s responsibility, particularly when compared to legal rules, which are generally insufficient and represent only a translation of the social beliefs in legal terms. Of course, some concerned voices support the view that neuroscientific techniques are still not ready to provide sufficient accuracy, and hence they are not fully reliable in the court. In our view, caution is certainly warranted in regard to neuroscientific evidence. However, with further education and better understanding of neuroscientific evidence by judges and other legal practitioners, we are certain that it holds great potential for the future.

Acknowledgments

Our thanks to University of Ljubljana where an important part of the study was performed, particularly to Prof. Dr. Olga Markic and Assist. Dr. Toma Strle who coordinated this project.

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