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Integrating Neuroscience in Criminal Law: The Dutch Situation as an Example

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ABSTRACT

Empirical findings demonstrate that neuroscientific expertise is increasingly prevalent in courtrooms. This suggests that both "territorial conflicts" between law and neuroscience—-for example about how to conceptualize concepts like culpability—and questions regarding the integration of neuroscience and law, which both have long been present in theoretical discussions, are now finding their way to legal practice. As jurisdictions around the globe differ on multiple dimensions (e.g., on how concepts like culpability are conceptualized, embedded in legal doctrine, and how integration of neuroscience takes place within (procedural) legal frameworks) analyses on a national level are needed next to universal endeavors. In this article, the Dutch situation will be addressed. First, we will assess whether the theoretical notions underlying Dutch criminal law are compatible with the theoretical discussion between neuroscience and legal doctrine. Second, we turn to empirical evidence as to the way neuroscientific information is brought into Dutch legal practice. Finally, we will examine how (well) the current practice of forensic assessment is able to accommodate neuroscientific information. Herewith, we aim to illustrate that the manner of integration is indeed dependent on jurisdiction specific features and that the international debate would benefit from more national perspectives.

KEYWORDS

Criminal law; neuroscience; criminal responsibility; forensic assessment

Introduction: Neuroscience and Dutch criminal justice

In many jurisdictions, including the Netherlands (De Kogel & Westgeest, 2015), the frequency with which neuroscientific information is brought up in criminal courts is increasing. While neuropsychological test results have long been part of forensic behavioral expertise, it now progressively also involves brain-scans, neurological, -toxicological, -genetic, or other, also less individualized, neuroscientific expertise. The apparent increase in practical legal relevance suggests that the discussions which have long been present in scientific literature, are finding their way to legal practice. Some of these have a potentially disjointing import, as some neuroscientists have been attacking the criminal justice dogma, claiming that it is based on an outdated image of human functioning and now falsified notions such as responsibility and guilt. However, the arisen area of scientific inquiry into the meaning and implications of neuroscience for the law and related practices—"neurolaw" (Meynen, 2016)—aims for a larger part on integration of the disciplines through revision of law, legal, and assessment practice or interventions from a neuroscientific perspective.

One of the mentioned obstacles for integration of the disciplines is the lack of a "lingua franca" or a coherent framework for linking legal standards referencing mental function to specific, quantifiable cognitive processes (Buckholtz & Faigman, 2014). Moreover, while neurosciences may speak a universal language, (criminal) law does not. Jurisdictions around the globe differ in the way they conceptualize relevant aspects of substantive law, as for example culpability—probably the most prominent concept that neuroscientists seem to claim as expertise—as well as in matters of procedural law: meaning provisions concerning acquiring, admitting and evaluating neuroscientific expertise. Therefore, inquiries on jurisdiction

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specific discussions on the integration of criminal law and neuroscience are needed next to more universal endeavors.

In this aritcle, we will start this endeavor by adressing the Dutch situation. The choice for the Dutch situation is not merely one of acquaintance. Especially the Dutch "degrees" of diminished responsibility have been mentioned in international literature as possibly compatible with one of the promises of the advancements of neuroscience for criminal law: conceptualizing the responsibility doctrine more broadly than it is today, includes defining responsibility more as a dimensional than a categorical construct (Glenn & Raine, 2014). The chosen approach therefore also allows for testing whether the Dutch situation is possibly not only an example in the descriptive sense, but also in an appraising one. In recognizing that the outcomes of a universal debate differ depending on jurisdictional specificities lies the added value of the narrow approach for an international audience. Therefore, as the focus explains why most references are made to the Dutch scholarly discussion, at critical issues references are made to the underlying international debate. Similarly, on a few key characteristics, the international reader will be aided in legal comparison through contrasting the Dutch civil law framework with those in common law jurisdictions.

In what follows, we will first assess whether the dogmatic foundations of Dutch criminal law are affected by the mentioned theoretical discussion between neuroscience and legal doctrine. Second, we will turn to empirical evidence as to the way neuroscientific information is brought into Dutch legal practice. And third, we will examine how (well) the current practice of forensic assessment is able to accommodate neuroscientific information.

Theoretical discussions about neuroscience versus criminal justice

It is now generally accepted that the human brain works according to applicable laws of nature, in the sense that we assume that—in theory—a physical process exists for every instance of knowing, wanting or feeling. Recent discoveries have convinced some scientists that "free will" is an illusion. It should be pointed out at the outset of this article that here already appears to be an essential difference between the neurosciences and the criminal justice method, since the smallest level of analysis in criminal justice is the person with legal rights and obligations, not their organs or neurons. Reference is made in this context to a pitfall that neuroscientists fall into: the Mereological fallacy. This fallacy arises when a part (for example, the brain) is considered responsible for something that can only be considered responsible when it is whole (for example, person with legal rights) (Pardo & Patterson, 2010). Nevertheless, in the past few years it has become apparent that casting doubt on "free will" must be discussed by and within criminal law studies. Since in most jurisdictions criminal liability is founded on both harm (actus reus) and fault (mens rea), the latter includes establishing the extent to which culpability can be attributed to a person and at a first glance it seems difficult to perform this task when a "free will" is absent.

It is standard in the debate about the relationship of modern neuroscience findings on free will to distinguish three positions: hard determinism, libertarianism (also called "indeterminism") and compatibilism (e.g., Roskies, 2006; Meynen, 2014). Hard determinists believe that free will is not compatible with neuroscientific insights and prefer neuroscience to free will. In their view, as the Dutch neuroscientist Victor Lamme (2008) expressed it, it can be concluded that free will "does not exist." The libertarians likewise do not believe in the possibility of aligning neuroscientific findings with the existence of free will, but they choose free will as the only valid explanation of human behavior. Compatibilism strives for a compromise: accepting the natural science mechanics of the brain but believing that this is compatible with the existence of free will or at least ascribing responsibility. This last position, which currently seems to have the most adherents, has elaborated several different versions of what such a compromise would look like exactly (e.g., Roskies, 2006; Meynen 2014).

At first glance, one could wonder if there is anything new under the sun. For example, during the turn of the 20th century, especially in continental Europe, the Modern Direction within criminal law already presented on scientific, in contrast to earlier philosophical or religious, viewpoints that man was more or less forced to be determined (Roef, 2013). However, while in that debate the emphasis lay primarily on *verifying* the alternative explanations, e.g., biological or social, for our deeds, nowadays—supported by the alleged "hardness" of the new science—it is attempted to *falsify* free choice by claiming that our consciousness does not control our behavior. This last element contains the renewed arguments of the neurosciences.

Intuitively, it seems obvious to assume that people are capable of influencing their actions through their consciousness; we do experience that our consciousness precedes our actions. However, on the basis of several experiments and case reports, this order has been reversed by some neuroscientists. Decisions to carry out a certain action are apparently evident in our brain before we are conscious of them, as Libet first demonstrated through a readiness potential with an EEG in a decision task experiment (Libet, Gleason, Wright, & Peral, 1983; Libet, 1985). The conclusion is that decisions are taken by neurological processes that are independent of consciousness. The function of our consciousness in this view is nothing more than a 'chatter box' that subsequently invents rationalizations for our behavior (Lamme, 2008). Consciousness is "impotent in a causal sense" according to neuroscientists who adhere to this theory (De Jong, 2013). These findings are crucial because modern ideas about free will align with our ability to act in accordance with our deeper consciousness. It is self-evident that such a proposition is problematic for criminal law matters because it is vital for the attribution of criminal culpability to assume that people can be held responsible for their behavior, or at least can decide not to act on undesirable behavior (Hart, 2007). Much has been written in the literature about how to respond to this "attack (cf. Gordon & Fondacaro, 2018).

Three directions can roughly be distinguished. First, disputing aforementioned neuroscientific findings with its own weapons, by challenging the validity of the research methods employed or the conclusions drawn. A second direction relieves the tension by defining the neuroscientific discourse and the criminal justice method as incompatible paradigms, which are not dependent on each other for their right to exist. A final direction of thought accepts that these neuroscientific findings have achieved the definitive triumph for hard determinism and concludes that the newly accepted reality requires a reform of criminal justice systems at a fundamental level. These three positions are described in more detail below.

Substantial criticism is aimed partly at the research methods used: the experiments the neuroscientists present as evidence of the concept that our consciousness does not guide our behavior are so far removed from the normal reality that it is not possible to extrapolate the conclusion that it is *always* so (Van Marle, Koenraadt, & Weijers, 2009). Sie and Wouters, (2010) make an analogy with experiments in which subjects experience a deliberately staged optical illusion. In their opinion, this shows that the way in which we process visual information can be misled by a clever experiment, but does not confirm that our system for visual information processing does not work in general. A second criticism digs deeper and proposes that the moral responsibility of people who have committed a crime should not be based on their thoughts shortly before the offense. The reasoning is that *if* people act on automatic pilot, as some neuroscientists conclude from their research, and our explanations for our behavior are no more than post hoc rationalizations, this does not necessarily mean that people cannot be held morally responsible for their actions. Sie and Wouters (2010) build on the above-mentioned metaphor when they write that such a finding still does not negate the argument that people with their free will are capable of programing their automatic pilot. Finally, it has been added that the conclusions drawn by some neuroscientists about free will are too rigid. A holistic view, in which the brain is not understood as a collection of parts, each with its own isolated function, but as a system with the whole being more than the sum of the parts due to the continuous interactions between them, seems to have recently triumphed in the field of neuroscience. This "connectionist" approach offers an explanation for the observed "plasticity" of the brain—the continuous changing of its functional anatomy—and offsets the idea that certain traits are permanently preprogramed in our brain (with regards to psychopathic behavior; see the reviews of Koenigs, Baskin-Sommers, Zeier, & Newman, 2011; and Brazil, van Dongen, Maes, Mars, & Baskin-Sommers, 2016). Psychological processes could then precede in a causal way the neurological processes (that lead to action), as even environmental factors can influence the formation of new connections in the nervous system (Kandel, 2008). It can be deduced from other important objections that the conclusion of the total absence of freedom of choice cannot be based on the findings of Libet and successors. First of all, because they show that while we do not initiate an action consciously, we *can* stop it. Libet spoke of a "free won't" instead of a "free will," which does allow some freedom of choice (Libet, 1993). Second, according to some people, it is an example of the previously mentioned "mereological fallacy," identifying the brain function of consciousness with the person as the source of freedom of choice.

Next to trying to falsify the neuroscientific claim of the nonexistence of free choice, another way to parry the neuroscientific insights from the criminal law is to label them as incompatible paradigms and claiming

law to be immune to attacks based on neuroscientific findings. Dutch Supreme Court justice Buruma (2008, 2011, 2013) seems to define the legal paradigm as he talks about the "social functionality" of criminal law, meaning that it is mainly essential to keep society in order. Similarly, Roef (2013) states that the alleged free will in criminal law must not be considered an empirically verifiable natural phenomenon but a social construction that—in brief—enables an orderly social cohabitation. Neuroscience and criminal law are thus considered two different paradigms with no possibility of sensible communication between them. From a legal philosophical perspective, the Kantian distinction between theoretical and intersubjective reason is helpful in such an argumentation; it is claimed that the neuroscientists *frame* the debate incorrectly in terms of theoretical reason—or pretend that determining "free will" is an objective empirical mater. The concept belongs in this Kantian view to the domain of practical reason and must therefore be considered a concept with an *intersubjective* meaning (Mackor, 2010). We practice free will in our daily lives and as such it is inconceivable that it is not there. "Reactive attitudes"—such as feelings of gratitude and outrage—are essential in interpersonal relationships according to Strawson (2008), as he postulates that human contact can simply not do without the possibility of holding each other responsible for one's deeds. He asserts that the suggestion of a completely anomic society in which such notions would no longer play a role is absurd. Expanding on this, the legitimation of everyone's *criminal law* responsibility could be accepted by considering the criminal justice system as the *institutionalized conclusion* of this necessary social order. Concluding that there are two irreconcilable paradigms, does not have to be the end of this line of thought; indeed, on the basis of these arguments it can also be concluded that neuroscientists are wrong when they choose a reductionist, objectifying view which ignores the essentially intersubjective which permeates human interactions.

Finally, it is of course also possible not to dispute the claims of the deterministic neuroscientists but to accept them and use them as the starting point for a new type of criminal justice system. This is what some neuroscientists propose themselves, despite the criticism of entering a field they are not experts in. Well-known advocates of this option are the American psychologists Greene and Cohen (2004), who argue in an article with the revealing title, *For the law, neuroscience changes nothing and everything,* for redesigning the fundamental principles of the criminal justice system. In this view, a retributive basis of criminal law is dismissed because it is accepted that notions such as culpability and intent have been revealed to be non-existent illusions. This does not mean that the entire structure of criminal law must be demolished; Greene and Cohen are looking for a new, utilitarian foundation. This will lead to a new type of future-oriented criminal law based on the laws of determinism. If we understand Greene and Cohen correctly, this means that a distinction ought to be made between people who are and people who are not sensitive to the deterrent effect of a threat of punishment. For people who are sensitive, but nevertheless committed a crime, the "punishment" could be maintained. People who are not sensitive to a criminal justice deterrent, and Greene and Cohen include at least those of unsound mind and juveniles here, would not be considered for punishment.

Despite the outward appearance of a novelty, the last presented view is almost identical to that of the mentioned Modern Direction in criminal law theory of about a century ago. Dutch criminal law has been greatly influenced by this deterministic movement, as was the case in other mainly continental European jurisdictions. In that time, separate tracks within criminal justice have arisen for specific groups—in short: offenders that, because of, e.g., a mental disorder, underdevelopment, or addiction are considered to be at a high risk of reoffending—with distinct sanctions ("measures") that are not retrospective (retributive) in nature but prospective (preventative). The Dutch entrustment order (tbs), entailing detention and treatment in a high security forensic mental hospital, and the associated regulation can be considered classic examples of the compromise between the retributivist oriented Classical Direction, and the—by deterministic revelations sparked—Modern Direction (Van der Landen, 1992; Van der Wolf, 2012). The most important advocate of the Modern Direction in the Netherlands was the criminal law scholar G. A. van Hamel (1906), who proposed distinguishing groups of "subject to punishment," "open to improvement," and "incorrigible." The sanction for the last-mentioned group was rendering them harmless, which produced massive criticism at the time because it led for example to arguments for the mandatory castration of sexual offenders (Van der Meer, 2008) and reintroduction of the death penalty (De Roos, 1900) apart from elimination through lengthy detention. The possibility of exceeding ethical boundaries by exceeding the limits of proportionality, which is indicated in classical thought by the extent of culpability, is the

familiar dogmatic criticism of such sanctions on the basis of risk. The tbs-order has been dealing with this for a century already.

However, already in the discussions leading up to enactment of the order in 1928, the criticism was expressed that no reliable distinction in a diagnostic sense of the specified groups could be made (van Hamel, 1912). And a final criticism on not sanctioning guilt but risk is that a denial of responsibility sends a rather unsettling message to society—separate from the issue of whether society would accept it from the viewpoint of granting justice to the victims. Erasmus for example felt, as early as his salvation theological discussion with Luther about predestination that the denial of free will by his opponent would lead to people no longer exerting themselves to do "good deeds" (Van der Wolf, 2006). Social scientific research seems to confirm this. In an experiment in which people first read about the nonexistence of free will, it seemed that they cheated by copying, took more money as a reward, were more aggressive and less inclined to help others than the group that had not read the text (Vohs & Schooler, 2008).

As such the Dutch came up with a compromise on the theoretical level to ensure on the practical level that society could be granted maximum safety from dangerous individuals through the tbs-order. The concept of diminished responsibility plays a pivotal role in this compromise. Classical theorists only accepted the distinction between penalties and safety-measures for groups which could not be held fully responsible. Their mental disorder (or underdevelopment for minors) only partly determines the commission of the offense. For that psychopathological part which makes them dangerous they may receive a preventative order, but for the part that they are still responsible they should receive a penalty in addition. The order of execution is such that possibly after a (prison) sentence, detention in a tbs-clinic will follow. Indeed, this has turned out to be a dogmatic demand with severe practical consequences, among which the deterioration of the disorder during a lengthy prison sentence rendering the subsequent treatment an even more daunting task. For the classical theorists the downside was that the modernists demanded that the term "diminished responsibility" would not be mentioned in the legislation. So now for imposition of a tbs-order only the presence of a disorder at the time of the crime—-not necessarily a causal connection—is required. Because of this, it has been argued that Dutch criminal justice could dismiss diminished responsibility (Bijlsma & Meynen, 2017), but that would not do any justice to the central role of the doctrine in the coming about of the tbs-order. Nor to the fact that Dutch criminal law has a long history, dating back to at least 1804, of recognizing criminal responsibility as a dimensional concept.

Not only the nuanced responsibility doctrine separates the Dutch framework for culpability from that used in Anglo-American common law jurisdictions. In the Netherlands "mens rea" is acknowledged to have both a descriptive meaning—the fault element of an offense, for example intent—and a normative meaning—blameworthiness. In this system "insanity"—or the lack of criminal responsibility due to a mental disorder—is seen as an excuse negating the blameworthiness of the offense. Through this system it can easily be explained that insanity does not generally lead to a complete lack of mens rea, as for example the element of "intent" can usually still be fulfilled: mentally disordered can act intentional yet not be blameworthy (Keiler & Roef, 2015). The fact that it is more of a normative concept than a description of impaired cognition or capability allows judges for more leeway to incorporate all sorts of relevant arguments into the act of establishing the degree of responsibility—including for example the consequences for sanctioning. Theoretically, both the normative and the dimensional character of the criminal responsibility doctrine seem to render it open towards integrating neuroscientific information.

The use of neuroscientific information in criminal courts

In the following, we shall focus on the Dutch criminal law practice to examine whether an empirical view on legal practice actually indicates that the criminal responsibility doctrine is especially sensitive toward neuroscientific information. While in the theoretical discussion primarily *general* starting points were cast into doubt, neuroscientific information in concrete criminal cases is involved in determining *specific deviations of normal brain functioning*: by using scans and other forms of brain examination, an attempt is made to define the extent to which someone deviates from the standard "normal." Allied to the transition from the general to the specific, is that in legal practice neuroscientific findings no longer seem potentially *undermining,* but instead providing a *supportive* function in answering legal issues in concrete cases.

As the Dutch criminal responsibility concept is based on the relationship between the offense and a mental disorder, diminished responsibility may be

based on the presence of a mental, psychotic, or even personality disorder at the time of the crime. In common law jurisdictions a personality disorder is generally not associated with the insanity defense (e.g., Palermo, 2010). Diminished responsibility usually acts by mitigating the punishment and also makes it possible to impose additional sanctions on the suspect, such as the mentioned tbs-order, often to be executed after the termination of a detention period. A decision of non-responsibility excludes punishment, but renders the tbs-order applicable in cases of high risk for recidivism and a conviction for a serious crime. Judges are advised by behavioral scientists when it seems likely that there is a case for diminished criminal responsibility, but this does not affect the fact that it is not a purely behavioral science judgment but in essence a normative judgment. This can be illustrated by the situation in which someone under the influence of alcohol commits a crime; behavioral scientists will probably agree that the person did not know what he was doing, but the judge is unlikely to be persuaded to have compassion with him. The issue of criminal responsibility will not soon play a role in such a context as a conscious decision of taking the alcohol precedes the consequences of the intoxication and therefore someone will be deemed to have "culpa in causa" or prior fault.

The Dutch criminal law proceedings also work with a mandatory (dichotomic: yes/no) decision tree, and the issue of responsibility in the order of this scheme is one of the last questions to be considered by the judge. First s/he has to declare the offense proven, including the subjective components from the description of the offense (the descriptive part of mens rea). In practice, this mostly concerns "intent," in a few cases a lighter form of culpability ("culpa"), and in a very limited number of cases the factor for increasing the penalty, "premeditation," may be required. Because of this order, if the subjective components required for the offense cannot be proven out of the facts and circumstances, the issue of criminal responsibility will never be addressed.

Although the aforementioned subjective components may seem at first glance useful for formulating the behavioral problem, they are traditionally only used incidentally to formulate the problem with the aid of behavioral arguments. The current dogmatic consensus prescribes—partly as a result of the interpretation by the Dutch Supreme Court—that for assessing these subjective components, judges should abstract to a large extent from the individual characteristics of the culprit and judge on the basis of generalized, phenomenological conceptions of intent, guilt, or premeditation. Because the modern neuroscientific insights provide new ammunition, however, it is in theory conceivable that their introduction would lead to a change in the way these legal questions are answered. In earlier Dutch literature, it was suggested that neuroscientific information could hinder the proving of intent or premeditation, which would mean a break with the past (Haseleger, Leoné, & Van Toor, 2013). That would mean that neuroscientific information would than already be used for proving the offense, instead of determining the criminal responsibility.

To test these hypotheses we turn to the empirical evidence from a database of the Scientific Research and Documentation Centre (WODC) of the Ministry of Justice and Security of cases in which neurobiological or genetic information was introduced (De Kogel & Westgeest, 2015). The number of times that neuroscientific information was discussed considering the proof (of) absence intent (N = 20) or culpa (N = 14) was low. Premeditation was discussed just twice. Altogether, the influence of neuroscientific information on the answering of these legal questions seems not revolutionary in practice.

Expanding on this WODC study, we have reviewed the rare judgments in which there *was* a discussion about intent or culpa which was examined further on the basis of neuroscientific information. The input here seems to remain focused on a deviation from the normal condition (sleepwalking, blood circulatory disturbance)—just like with the question of criminal responsibility—and therefore definitely not on the denial of intent or culpa in an apparently "normal" psychological configuration. With "normal" suspects, the criminal practice is satisfied in general with the *experience* of terms such as wanting and knowing to ascertain the subjective components, a phenomenological view that by definition is not interested in neuronaturalism. The Supreme Court has set a separate standard for intent in the case of a severe mental disorder; only a defendant who has lost all insight in the scope of his actions and its consequences would act unintentional. This criterion is rarely met and only in cases of dissociative disorders. Psychotic offenders for example are therefore generally seen as acting intentional. Culpa is more normative in character; there was no knowledge but ought to have been—rendering this doctrine practically immune to a certain extent against modern neuroscientific insights, which always aim at the relevance of consciousness shortly before the offense. The almost total lack of attention paid to

premeditation in legal practice can be surprising at first glance as the modern neuroscientific insights especially focus on discussing the relevance of consciousness shortly before the crime is committed. However, this leads in fact to the doctrine itself being put to discussion, with it appearing obvious to conduct this discussion in a general sense rather than in a concrete case, considering the very small number of crimes for which premeditation is a component.

Neither the WODC study nor our subsequent review of the relevant judgements leads to the impression that a watershed has been reached with the introduction of neuroscientific information in criminal courts. Indeed, such information is by far most often used in determining the criminal responsibility and therefore the individual defendant's culpability (N = 72), based on the question of whether there was "a lack of development or pathological disorder of the mental faculties" (the legal criterion for disorder) which caused the offense (in part). These findings are somewhat in line with American findings on case law with regards to neuroimaging evidence. Courts were not willing to allow it (unlike civil law jurisdictions like the Netherlands, most common law jurisdictions assessment of expert evidence do not gravitate towards an *ex post* appraisal, including provisions for motivating the use of this evidence, but instead provide *ex ante* admissibility provisions), to negate for example 'intent' at the guilt phase, but were—if the evidence was allowed and found relevant—sometimes willing to mitigate the sentence, for example from a death sentence to a prison sentence (Edersheim, Brendel, & Price, 2012). Contrast with the Dutch findings is that in the Netherlands other than in most jurisdictions, mitigation of the sentence is explicitly linked to the criminal responsibility doctrine, also allowing neuroscientific information to affect a decision of the absence of guilt in the sense of blameworthiness. Second, a Dutch finding of diminished responsibility does not only lead to mitigation of the sentence, but also to the possibility of imposing a preventative treatment order, like the tbs.

Looking at the whole, it seems that despite the fact that the quantity of neuroscientific information in court cases has increased, little has actually changed. The fundamental issues about assigning intent and guilt which have led to interesting discussions at the theoretical level are ignored in the Dutch legal practice of the law for now. Even if the growing insight into the working of our brain eventually leads to more detailed advice about the extent of guilt or accountability of defendants, this can be incorporated without difficulty in the current system. The main difference from the past may be that among the experts called upon, there will more often be a neuroscientist instead of a psychologist or psychiatrist. The input of neuroscientific information will come with new challenges for both neuroscientists and legal scholars. We shall return to this point in the next section.

Interpretation of neuroscientific information in forensic assessment

Neuroscientific knowledge was quickly acknowledged to be very reliable. It was soon assumed that the "robust" knowledge had a similar strength to DNA or fingerprints (Jelicic & Merckelbach, 2007). The Royal Netherlands Academy of Arts and Sciences (2011) stated in the *Wetenschapsagenda KNAW 2011* that the neurosciences produced "hard" knowledge. Various authors warned, however, that the hardness of neuroscience was often overestimated (Jelicic & Merckelbach, 2007; Van Marle, 2009; Rassin, 2012). That is why we are discussing in this last section how the interpretation of neuroscientific information is and should be incorporated in the forensic assessment of criminal responsibility in the Netherlands.

A part of the neuroscientific body of research aims at establishing the correlations between certain aberrations in the anatomy of the brain and delinquent behavior. The fact that neuroscientists claim to be able to identify pedophilia with 95% certainty in the brain (Ponseti, Granert, & Jansen, 2012) does not have criminal relevance now as such feelings and thoughts can lead to criminal acts but most of the time they do not. This applies likewise to the link between small amygdalae and psychopathic behavior (Haseleger et al., 2013), now that references are increasingly being made to psychopathic characteristics being useful, or at least accepted, in the top echelon of business ("snakes in suits" according to Hare & Babiak, 2006), but still callous and unemotional. An important subsequent qualification of such findings at group level is that they do not justify making statements about individuals. This is called the group-to-individual (G2i) problem, which is of course related to the differences in paradigm between neuroscience and law as described in section 2. In other words, we cannot say that a person with a small amygdala is a psychopath (Schleim & Rosier, 2009). In addition, such findings are often not unequivocal. For example, a small frontal cortex is related to violent behavior, whereas a *large* frontal cortex is associated with white-collar criminality (Glenn & Raine, 2014). This shows

that it is not possible to make predictions for a person about the relevance in criminal law of the anatomy of his brain without the input of other knowledge. If we know that someone has a predisposition to violent behavior or is known to have committed white-collar crimes in the past, we can try to make a sensible link to the state of his frontal cortex, and from there possibly enhance assessments about future risk and/or sensible remedies. Neuroscientific information considered in isolation is therefore not that informative; it gains meaning when embedded in more comprehensive knowledge about a person's personality or psychopathology.

Other neuroscientific research focusses on brain functions. The best-known instrument is the fMRI (functional Magnetic Resonance Imaging) scan. The use of such scans is associated with the necessary uncertainty, however. The important point to know is that fMRI scans measure brain activity by the perfusion of brain regions. It is *assumed* that increased perfusion implies a higher activity of that part of the brain. It is also possible, however, that increased perfusion is a symptom of less efficient oxygen consumption of the region in question, or that the activity consists of inhibiting another region of the brain (Schleim & Rosier, 2009; Haseleger et al., 2013). Another problem with fMRI scans is that it is difficult to estimate what the magnitude of the effect of a certain finding is. In other words, if it can be assumed that a certain brain function correlates with a concept such as "aggression," and that it seems reasonable that there is a causal link, *then to what extent* was that particular brain activity responsible for the increase in aggression? It is also always important when interpreting a fMRI scan of an individual to know who made up the control group. To be able to decide if a person is deviating, we first need to establish what is normal. There is a great variety in brains, and too little research has been done into the question of how to create a sensible control group to compare with individuals. This limits the diagnostic applications (De Kogel & Westgeest, 2015). Finally, we have to take into account the influence of medication. Many people who undergo scanning take certain psychopharmaceuticals which influence what is visible on the scans made (Schleim & Rosier, 2009). Jelicic and Merckelbach point out in this context to the second forensic relevance of medication: scans could be easily manipulated by people involved in criminal justice by taking psychotropic substances (2007).

In addition, the concepts being examined in neuroscience could be criticized. The neuroscientific method attempts to establish correlations between concepts that are psychological in nature, such as "aggression" or "control," and cognitive functions, such as "attention control" or "impulse control," and finally brain regions and circuits (Haseleger et al., 2013). The existence of these concepts rests on assumptions, however. If a particular brain activity can be correlated with a certain concept, this does not say much about the meaning that must be ascribed to this activity. This activity may be responsible for a range of other processes, or perhaps the concept that is hypothesized to be a dependent variable is incorrect. Finally, it can be pointed out that psychological research has shown that experts who have to interpret brain scans often make false-positive conclusions (Jelicic & Merckelbach, 2007). In other words, if the experts participating in an experiment hear that the scan they are to be given is from a "sick" individual, they tend to see deviations more often than when they see the same scans without being told that something is wrong with the scanned subject. This is a real danger in forensic settings, when someone has committed an offense that needs an explanation. This discussion matches the finding that American courts exclude neuroimaging evidence because they fail to meet general admissibility standards, there is an insufficient causal link between the brain abnormality presented and its ability to negate the specific legal concept, the scan is temporally irrelevant, as it was administered at a date far removed from the offense; and the modality proposed is not clinically reliable in diagnosing the condition at issue (Edersheim et al., 2012).

In brief, given the above-mentioned restrictions, it can be concluded that the clinical applications of neuroscientific research is still limited, even after 30 years of comprehensive studies. For the explanatory diagnostics in forensic psychiatry, there is the additional problem that it is not clear how a possible dysfunction is expressed in a particular action (choice to act), such as a crime (Van Marle, 2009).

Admitted, the traditional method of behavioral explanatory diagnostics is liable to its fair share of criticism, as frequently expressed by legal psychologists. In a general sense, the step from research data to an explanatory and individualized story still lacks scientific support. However, that is specifically the step that traditionally brought behavioral science and criminal justice together, as both disciplines are asked to form judgements in individual cases. Brain scans and instruments score better with important scientific aspects such as reproducibility, but they lack the relevant translation to the court. That applies for now to all criminal justice-relevant concepts, the absence of

intention or accountability which cannot be validated, the assessment of danger, sensitivity to punishment or treatment, etc. Risk assessment research has shown in the meantime that the combination of a scientifically supported instrument with a clinical interpretation based on knowledge about and experience with the involved person led to the best "predictions" (De Vogel, 2005). The embracing of "soft science" for more relevant and harder results seems to be a direction that sets an example for forensic science. Therefore, as neuroscientific information is most often incorporated in the assessment of criminal responsibility, it seems to be state of the art that the behavioral experts which are used to do these assessments—in conjunction with the neuroscientist—integrate (the relevance of) the neuroscientific findings in their interpretation and advice to the court.

Conclusion

In this article, by using the Dutch situation as an example, we illustrate how the integration of criminal law and neuroscience take different shapes and forms within different legal frameworks. We started with a discussion on the theoretical level, which is promoted by neuroscientists who claim that the belief in free will is an illusion and that this compels us to reform criminal law, as well as three reactions to this position that are predominant in the literature. We established that the Dutch criminal justice and sanctioning system already consist of a compromise between holding people partly responsible for their actions and preventatively sanctioning them for future actions to which they may be predisposed because of their mental condition. In addition to the nuanced dimensional approach to criminal responsibility also the normative approach which is taken toward that doctrine allows for the integration of all relevant information.

Second, we turned the focus on the Dutch legal practice. Here, neuroscientific input is increasingly playing a role in answering concrete legal questions. Although previous literature tentatively suggested otherwise, we do not see any indications that this leads more often to problems arising in proving "subjective" doctrines, such as intent, guilt or premeditation. Criminal responsibility remains the most suitable doctrine for the individual assessment of the suspect's determinism, whether founded in neurobiological terminology or not. Neurosciences are incorporated in establishing abnormalities that would diminish accountability instead of rendering anyone unaccountable. As it is now a question of abnormality or psychopathology, an advantage of the Dutch system may be that diminished responsibility does not only lead to mitigation of the sentence, but also opens up the possibility of placement in specialized treatment facilities.

Now that neuroscience in the Netherlands seems to have been given a comparable place to the traditional behavioral science contribution in court in assessing criminal responsibility, it can be expected that it will be similarly given a role in supportive decisions in criminal law, such as assessing danger or sensitivity to treatment, whether mandatory or not. Now, with the same arguments to criticize the traditional behavioral science input, neuroscience will also need to be prepared to have its value (validity) scrutinized in court. Where the traditional input of behavioral experts is considered soft science, the hardness of neuroscientific contributions also appears overestimated. In addition, there is a lack of clarity and utility for forming a judgement about the individual defendant. We feel that an integrative behavioral science approach interpreting neuroscientific information combined with soft science methods is the most appropriate course to take. Experience from risk assessment research suggests that this integrative approach serves not only the utility in court but also the validity. Moreover, it mitigates the hardness of the conclusions, paying more respect to the individual behind the offense.

In short, especially the typical Dutch criminal responsibility doctrine, allowing for diminished responsibility because of a mental disorder, seems to render a framework in which neuroscientific information may be easily integrated. An empirical look at Dutch case law seems to confirm that assumption. Moreover, the common practice of forensic assessment in the Netherlands also allows for an integrative approach. As criminal justice systems are shaped on the basis of long legal traditions and temporal developments, the eventuality of these feature give no cause to complacency. Also in the Netherlands, the described debate is not silenced by this situation and much is still to gain in the integration of neuroscience and law. However, we hope to have demonstrated that national perspectives may inform the international debate and that legal comparison may aid forwarding the discussions on integrating neuroscientific information in other criminal justice systems worldwide.

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