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Neuroscientific Evidence and Criminal Responsibility in the Netherlands

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Abstract
Insights from neuroscientific research are increasingly advancing our understanding of the neural correlates of human behaviour, cognition and emotion and can therefore be of significant practical use in a legal context. One of the most fundamental legal applications of neuroscience refers to the assessment of criminal responsibility. Recent empirical studies have established links between certain brain structures and antisocial or criminal behaviour. Three areas of brain abnormalities that are relevant for assessments of criminal responsibility can be differentiated: (1) impairments in the frontal lobes and associated problems with impulse control, aggressiveness and the processing of information that is evocative of moral emotions, (2) abnormalities in the limbic system and associated problems in affective processing, and (3) the potential side-effects of neurotechnologies and associated problems with impulse control, aggressiveness and disinhibited behaviour. This chapter addresses recent research findings in these three areas and how these could affect responsibility assessments. In addition, eight cases are discussed in which insights from neuroscientific research have been used by Dutch courts in responsibility assessments. By illustrating how neuroscientific evidence has already entered the courtroom in the Netherlands, the possible conditions and implications of such practice are addressed.

1. Introduction

Neuroscience is rapidly increasing our knowledge of the functioning of the brain. Recent studies have for instance shown that reduced prefrontal volume and abnormal activity in the prefrontal cortex – which is an area in the brain that is involved in various cognitive processes and executive functions including attention, working memory, planning and decision-making – are associated with antisocial behaviour (Barkatarki et al. 2006; Brower & Price 2001; Laakso et al. 2002; Raine et al. 1998; Raine et al. 1997; Sapolsky 2004; Volkow et al. 1995). Additionally, research has revealed that the frontal cortex plays an important role in moral reasoning and response inhibition (Greene et al. 2004; Horn et al. 2003; Liddle et al. 2001; Moll et al. 2002) and is associated with intentional behaviour (Haynes et al. 2007). For instance, Moll and his colleagues (2002) demonstrated that certain areas in the prefrontal cortex and superior temporal sulcus – which is an area in the brain that is involved in tasks such as the interpretation of other people's actions and intentions, the comprehension of speech and the perception of biological motion – are engaged when individuals view scenes that are evocative of moral emotions, which suggests that these brain regions are involved in moral processing. Damage to these areas may therefore compromise an individual's ability to

know right from wrong or to act upon knowledge of the morality of behaviour. Neuroscience research has furthermore indicated that certain brain areas that are associated with high-level executive functions including areas in the frontal cortex are more active during deception, which has been argued to be due to the increased cognitive effort involved in lying (Langleben et al. 2002; Spence et al. 2004).

These and other insights from neuroscientific studies can be of relevance to the law. As outlined by Goodenough and Tucker (2010), the interactions between neuroscience and the law can be grouped into the following three categories: (1) *the law of neuroscience*, (2) *neuroscience of the law* and (3) *neuroscience in law*. The first category refers to the regulation of neuroscientific research and applications and focuses on issues such as informed consent, privacy and dealing with incidental findings in experimental research involving human participants. Additionally, advances in neuroscience are believed to have implications for intellectual property issues such as the patenting of mental processes (Goodenough & Tucker 2010; Greely 2004; Tovino 2007). The second category of neurolaw refers to the neuroscience of normative judgment and decision-making. Research on neuroscience of the law has studied the neural correlates of normative and legal judgment (Casebeer & Churchland 2003; Goodenough & Prehn 2004; Schleim et al. 2010) and decisions about punishment (Buckholtz et al. 2008; Knoch et al. 2010; Seymour et al 2007). Research in this area has for instance demonstrated that legal judgments involve other brain areas as compared to moral judgments, namely areas associated with reflecting explicit rules (Schleim et al. 2010). The third category of neurolaw refers to the study of cognition and behaviour relevant to the law, for instance truth-telling and memory, impulsive behaviour (Barkataki et al. 2008; Raine et al. 1998), moral reasoning (Greene et al. 2004; Moll et al. 2002), psychopathy (Kiehl et al. 2001), and drug addiction (Hyman et al. 2006). These findings can be of great practical use in the legal context, for instance to detect deception (Kozel et al. 2005; Langleben et al. 2002; Spence et al. 2001: Wolpe et al. 2005), to develop treatment options for criminal behaviour (Greely 2008), to enhance eyewitness memory (Klaming & Vedder 2009; Vedder & Klaming 2010) and to detect physical and emotional pain and suffering (Grey 2007; Jones et al. 2009; Kolber 2007; Ochsner et al. 2006; Peyron et al. 2000; Tovino 2007). One of the most fundamental legal applications of neuroscience within this third category refers to the possibility of determining criminal or civil responsibility[1], i.e. the degree to which a person can be held legally accountable for her actions. Since up to now the use of neuroscience in a legal context is confined to assessments of responsibility, we have chosen this as the topic of focus in this chapter to illustrate the potential implications of neuroscience for the law.

There are two ways in which neuroscience can impact on criminal responsibility. The first is on the theoretical and most general level: do or should the insights appearing from neuroscientific research alter our conception of criminal responsibility? As research seems to suggest that decisions are taken in the brain before the subject is conscious of them, can we then still hold the subject accountable for her actions, in the most general and fundamental sense? A significant body of research is discussing notions of responsibility and accountability, free will, and consciousness in light of neuroscientific research (e.g. Aharoni et al. 2008; Greene & Cohen 2004; Morse 2004, 2007; Roskies 2006; Sapolsky 2004; Vincent 2010a). While some researchers believe that advances in neuroscience will show that neuroscience challenges our ideas of free will and will therefore have to lead to changes in the law (Greene & Cohen 2004; Sapolsky 2004), others have argued that existing legal principles and practice can accommodate whatever new information neuroscience will provide, mainly because there is no brain correlate of responsibility (Gazzaniga 2006; Morse 2004, 2007). Instead of being a property of an individual, responsibility is a normative concept (Gazzaniga 2006). Still others have argued that neither neuroscience nor criminal responsibility are

[1] The terms *responsibility*, *accountability* and *liability* will be used interchangeably in this chapter.

unified concepts, which complicates answering the question whether neuroscience is relevant to the law (Vincent 2010).

The second way in which neuroscience impacts on criminal responsibility is on a more applied and specific level: if neuroscientific research shows abnormalities in brain functioning of a specific subject, for example in areas associated with morality or impulse control, the question arises whether the subject can be held accountable for specific acts she committed. Research on the underlying neural mechanisms of moral judgment and intentional behaviour is still in its infancy, and the responsible use of neuroscientific evidence to answer questions of liability therefore seems questionable at this point in time. Nevertheless, the fact that recent empirical studies have established links between brain structures and antisocial or criminal behaviour warrants the assumption that neuroscience could play a more important role in assessments of criminal responsibility in the future. In fact, neuroscientific evidence has already been used in order to argue for diminished responsibility in various cases both in the Netherlands and internationally. Additionally, new technologies such as Deep Brain Stimulation that are intended to treat neurological and psychiatric disorders raise new concerns for questions of criminal responsibility.

Contrary to the general and fundamental discussion of criminal responsibility, the use of neuroscientific evidence of brain abnormalities in concrete criminal cases has been less a topic of research so far, even though it is more immediately relevant to actual practice of criminal law. For these reasons, we focus our discussion in this chapter on the second type of question: how does neuroscientific evidence impact the attribution of criminal responsibility in concrete cases? Since this question depends to a significant extent on the theory and practice of the specific legal system at issue, we base our discussion on Dutch law.

Neuroscientific research of brain abnormalities that are relevant for assessments of criminal responsibility can be broadly separated into three main areas. The first line of research focuses on impairments in the frontal parts of the brain and associated problems with impulse control and aggressiveness as well as with the processing of information that is evocative of moral emotions. The most frequently cited case of an individual with frontal lobe damage is that of Phineas Gage who, after having suffered severe damage to his left ventromedial frontal cortex caused by an accident, changed as a person. While his intelligence remained unaffected and he was not impaired in movement, speech and memory, he had lost any social inhibitions, became capricious and indulged in profanity which often offended those around him (Damasio et al. 1994). This case demonstrates the importance of the frontal parts of the brain in self-control and the ability to act appropriately in social situations. The second line of research studies limbic abnormalities and affective processing. The limbic system is a network of brain regions that includes the hippocampus, hypothalamus and amygdala and is involved in various functions such as memory and regulating emotion. In the case of Brian Dugan, who was found guilty for murdering a 10-year-old girl, evidence pertaining to his malfunctioning limbic system was presented as a mitigating factor in the sentencing phase of the trial. The expert witness assigned by Dugan's defence lawyers argued that Dugan, like other psychopaths, had reduced levels of activity in his limbic system (Hughes 2010). Neuroscientific research has indicated that psychopaths show less activity in limbic structures when they are presented with affective materials (Kiehl 2006; Kiehl et al. 2001). Apparently, anomalies in affective processing such as a lack of empathy which are often found in criminal psychopaths may be linked to inadequate activation of the limbic system.

In addition to the link between antisocial behaviour and frontal lobe impairments as well as reduced activation of limbic structures, we believe that there is a third link between activities in certain brain structures and criminal behaviour that is relevant in discussions about neuroscience and responsibility. The application of neurotechnologies including psychopharmaca and Deep Brain Stimulation (DBS) can have unwanted side-effects. These

technologies may in rare cases induce changes in a patient's personality which may conceivably result in criminal behaviour (Breggin 2003/2004; Healy et al. 2007; Klaming & Haselager 2010; Okado & Okajima 2001). It is for instance known that certain antidepressants can have effects such as mania, agitation and akathisia, which is an inner agitation that typically manifests itself in the inability to stop moving and that has been associated with increased aggressiveness (Breggin 2003/2004; Healy et al. 2007; Okado & Okajima 2001). These behavioural reactions can result in violence and other forms of abnormal behaviour, including abnormal sexual behaviour in some patients, especially in the initial period of taking the medication. In addition to psychopharmaca, DBS can have unwanted side-effects that may in rare cases lead to criminal behaviour. DBS is a is a well-accepted treatment for movement disorders, including Parkinson's disease (PD), Dystonia and Essential Tremor, if symptoms are medically intractable and/or medical treatment has serious side-effects (Houeto et al. 2002; Limousin et al. 1998; Weaver et al. 2009). It is also currently explored as a treatment option for a variety of neurological and psychiatric disorders (Gabriël et al. 2003; Mayberg et al. 2005; Sturm et al. 2003). Although to our knowledge no case in which a DBS patient became criminal as a result of the treatment has yet been described, side-effects have been reported in the literature, such as increased impulsivity and aggressiveness (Hälbig et al. 2009; Houeto et al. 2002; Sensi et al. 2004; Frank et al. 2007) or inappropriate sexual behaviour (Houeto et al. 2002; Leentjens et al. 2004), both of which could result in wrongful or even criminal behaviour. We therefore believe that certain treatments that affect brain functions can cause changes in an individual's behaviour patterns in such a way that he acts in morally or legally questionable ways. Consequently, the use of neurotechnologies such as certain psychopharmaca and DBS and their impact on an individual's brain pose important questions for criminal responsibility.

In light of these three distinct areas of neuroscientific research, we will describe how recent research findings in these areas are being or could be used to determine a suspect's responsibility. We start this discussion with further examining the potential impact of neuroscientific research into brain abnormalities in relation to criminal responsibility in general (section 2). We will then discuss the same issue, applied to the Dutch legal system and practice. We will briefly explain the concept of criminal responsibility in Dutch criminal trial and forensic practice, and, based on the consecutive stages in which cognitive and other brain functions could be used in the court's decision-making on attributing criminal liability, we will discuss whether and how relevant findings of neuroscientific research on frontal lobe impairments, reduced activation in the limbic system and the potential impact of neurotechnological interventions are or could be used by the Dutch courts. We will illustrate the discussion with case descriptions (section 3). We will conclude by discussing the actual and potential relevance of neuroscientific findings for the assessment of responsibility in Dutch criminal law and possible conditions and implications of such practice (section 4).

2. Neuroscience and Criminal Responsibility

Since insights from neuroscience are greatly advancing our understandings of human behaviour and cognition, it seems only logical that neuroscience can contribute to our understanding of what it means to act intentionally and knowingly. As described above, neuroscientific research on responsibility has focused on the link between frontal lobe dysfunction and criminal behaviour on the one hand and limbic system dysfunction and criminal behaviour on the other hand. Damage to either of these brain regions could be seen as indicative of poorly developed or pathologically disturbed mental capacities and hence of diminished responsibility or complete absence of responsibility. In addition to these two types of dysfunction and their implications for criminal responsibility, we will discuss the role of

potential side-effects of neurotechnological interventions and their implications for criminal responsibility.

2.1 Frontal lobe dysfunction and criminal behaviour

The frontal lobes, which are located in the front part of the brain and which are involved in various cognitive processes and executive functions including attention, working memory, planning and decision-making, seem to play an important role in moral judgment and intentional behaviour and therefore might be relevant to responsibility assessments. A link between frontal lobe dysfunction and violent behaviour has been reported in the literature (Brower & Price 2001; Raine et al. 1997; Raine et al. 1998; Sapolsky 2004, Volkow et al. 1995). For instance, research has found that murderers have reduced glucose metabolism in the prefrontal cortex (Raine et al. 1997). This finding suggests prefrontal deficits in antisocial individuals which may predispose them to higher impulsivity and lower self-control. In line with this finding, another study has shown that affective murderers in contrast to predatory murderers and a non-criminal control group had decreased activity in their prefrontal cortex, which suggests that affective murderers are less able to control their aggressive impulses due to insufficient prefrontal regulation (Raine et al. 1998). Hence, dysfunctions in certain areas in the frontal cortex can interfere with an individual's ability to control his impulses and foresee the consequences of his behaviour.

Additionally, studies have revealed that the orbitofrontal regions, including the orbitofrontal cortex and the ventromedial prefrontal cortex, are activated during moral reasoning. For example, when individuals were confronted with pictures that were morally charged, for instance pictures that depicted a physical assault or a war scene, they showed increased activation in the orbitofrontal cortex and superior temporal sulcus (Moll et al. 2002). The involvement of orbitofrontal regions in moral processing and decision-making was replicated in several studies (Casebeer & Churchland 2003; Greene et al. 2004), indicating that these brain regions play an important role in moral processing. Damage to these areas may therefore compromise an individual's ability to know right from wrong.

Based on the findings of empirical research, frontal lobe dysfunction can implicate several deficits in planning and foresight, in moral and social judgment and in the regulation of behaviour; it therefore seems to play a substantial role in explaining some types of criminal behaviour. Damage to the frontal lobes can for instance be caused by mild or traumatic brain injuries (for instance due to a motor-vehicle accident, a sport accident or a fall) or by a brain tumour. An interesting case in this regard is that of a 40-year-old man with so-called *acquired paedophilia*. The man experienced sudden and uncontrollable paedophilia for which he was ultimately ordered by a judge either to undergo inpatient rehabilitation in a program for sexual addiction or to go to jail. Although he knew that his behaviour was morally wrong and he furthermore had a strong desire to complete the treatment program and to avoid prison, the man was unable to control his sexual urges and was eventually expelled from the rehabilitation centre. Right before his prison sentence, he received a neurological examination because of sudden severe headaches. During this examination, an egg-sized tumour was found in the orbitofrontal cortex. After the tumour had been removed, the inappropriate urges disappeared and the man successfully completed the rehabilitation program. When about a year later the man started secretly collecting pornography again, re-growth of the tumour was detected. Again, after removing the tumour, the urges disappeared (Burns & Swerdlow 2003). This case demonstrates that damage to the frontal lobes, in this case caused by a tumour, can significantly change an individual's behaviour.

Based on this case and the findings of several studies, it seems that frontal lobe damage can cause a number of deficits that might excuse criminal behaviour or lead to treatment rather than imprisonment of perpetrators. However, it is also important to note that most people with

some kind of damage to their frontal lobes never show any antisocial or criminal tendencies (Brower & Price 2001). For instance, the literature describes the case of a woman who was found to lack more than 75% of her cerebral cortex and nevertheless did not have any problems controlling her behaviour (Glannon 2005). In addition to this case, the decision of the United States Supreme Court in the case *Roper v. Simmons* is relevant for the argument that brain abnormalities imply that an individual cannot be held responsible for his actions. In 2004, the Supreme Court reviewed the case of Christopher Simmons, who at the age of 17 had robbed and murdered a woman (*Roper v. Simmons*). Simmons was initially convicted of first-degree murder and sentenced to death. However, the Supreme Court later ruled that it is unconstitutional to impose the death penalty on individuals under the age of 18 based on the argument that the frontal cortex is not yet fully developed in adolescents and they are therefore incapable of acting rationally and controlling their impulses (Beckman 2004). However, as outlined by Glannon (2005) and others, there are problems with this argument. An abnormality in the frontal cortex does not necessarily imply a lack of impulse control. After all, if Simmons had an immature brain at the age of 17 due to the normal development of the brain, all adolescents have immature frontal lobes and yet only an extremely small number of adolescents ever display any antisocial or criminal behaviour. Hence, abnormalities in the frontal cortex do not automatically imply a lack of impulse control.

2.2 Limbic system dysfunction and criminal behaviour

While the frontal lobes seem to be particularly relevant to responsibility assessments, dysfunction in other brain areas may of course also be associated with violent or criminal behaviour. Studies have for instance shown that reduced activity in the thalamus (Barkataki et al. 2008) and a dysfunctional amygdala-hippocampal complex (Kiehl et al. 2001) are linked to antisocial behaviour. Research on psychopathy has shown that psychopathic individuals have decreased activation in the limbic system, a structure in the middle of the brain including the hippocampus, hypothalamus and amygdala, when they view negative affective pictures (Kiehl et al. 2001). The limbic system is involved in various functions, most notably memory and the regulation of emotion. In contrast to normal individuals, psychopaths fail to differentiate between negative and neutral material. They lack empathy, are unable to experience guilt or remorse, are highly manipulative and are typically unconcerned about the consequences of their actions. The finding that psychopaths have decreased limbic activation has been taken as an indication for a biological basis for the affective abnormalities observed in psychopaths. In addition to decreased activation in the limbic system when being confronted with information that is morally charged, psychopaths were found to have increased activity in prefrontal regions (Kiehl et al. 2001; Müller et al. 2003). This finding has been interpreted as supporting the notion that psychopathic individuals use cognitive strategies to process affective information instead (Kiehl et al. 2001). This finding is supported by a study exploring the neural correlates of conscious self-regulation of emotion in healthy individuals (Beauregard et al 2001). The participants in this study watched erotic film excerpts and were either instructed to respond normally or to suppress their emotional responses. In the first group of participants, limbic and para-limbic structures were activated, while in the latter group, prefrontal regions were activated instead, leading the researchers to conclude that humans have the capacity to self-regulate their emotional responses. Additionally, they concluded that "a defect of this neural circuitry [...] may have disastrous psychological and social consequences" (Beauregard et al. 2001 p. 5).

Based on the findings of research on the neural correlates of psychopathy, some researchers believe that psychopathy is as much an illness as for instance schizophrenia. However, there is a debate about whether the fact that psychopathy has a biological basis is an argument to excuse or condemn criminal behaviour (Maibom 2008; Miller 2008; Reimer 2008; Vincent

2010). A diagnosis of psychopathy is therefore currently in some cases (mainly and probably exclusively in the United States) used to argue for mitigation of the sentence rather than for diminished responsibility. The above described case of Brian Dugan is the most well-known case in this regard.

2.3 Neurotechnologies and criminal behaviour

Most medical treatments or interventions can have unwanted side-effects, some of which may even lead to morally or legally questionable behaviour. For instance, it is well known that antidepressants can have effects such as mania, agitation and akathisia, which is an inner agitation that typically manifests itself in the inability to stop moving and that has been associated with increased aggressiveness (Breggin 2003/2004; Healy et al. 2007; Okado & Okajima 2001). These behavioural reactions can result in violence and other forms of abnormal behaviour, including abnormal sexual behaviour in some patients, especially in the initial period of taking the medication. In the literature, several cases in which individuals without any prior history of aggressive or violent behaviour suddenly behaved violently after taking antidepressants are reported (Breggin 2003/2004; Healy et al. 2007; Okado & Okajima 2001). Additionally, several legal cases linking violent behaviour to the use of antidepressants have been reported (Breggin 2003/2004; Healy et al. 2007; Merckelbach et al. 2009). For instance, Merckelbach and his colleagues (2009) describe the case of a 56-year-old man who had murdered his girlfriend. When confronted with what he had done, the suspect stated that he had problems remembering what exactly had happened, but that he believed that he had probably murdered her. According to the authors, it is possible that the violent behaviour of the suspect was caused by the antidepressant that he had started taking only a few days before the murder. The suspect committed suicide before the court could make a decision in this case (Merckelbach et al. 2009).

In addition to psychopharmaca, invasive neurotechnologies such as deep brain stimulation (DBS) can have unwanted side-effects that may in rare cases lead to criminal behaviour. DBS is a well-accepted treatment for movement disorders, including Parkinson's disease, Dystonia and Essential Tremor if symptoms are medically intractable and/or medical treatment has serious side-effects (Houeto et al. 2002; Limousin et al. 1998; Weaver et al. 2009); it is currently also explored as a treatment option for a variety of neurological and psychiatric disorders (Gabriël et al. 2003; Mayberg et al. 2005; Sturm et al. 2003). Although to our knowledge no case in which a DBS patient became criminal as a result of the treatment has yet been described, side-effects have been reported in the literature, such as increased impulsivity and aggressiveness (Hälbig et al. 2009; Houeto et al. 2002; Sensi et al. 2004; Frank et al. 2007) or inappropriate sexual behaviour (Houeto et al. 2002; Leentjens et al. 2004), both of which could result in wrongful or even criminal behaviour. For instance, Sensi and his colleagues (2004) describe the case of a 64-year-old patient who received DBS to treat the symptoms of Parkinson's Disease and who a few days after the implantation of the electrodes displayed spontaneous, unprovoked aggressive outbursts. In the days following the operation, he physically attacked other patients, medical staff and members of his family. "When asked about his excessive and unusual conduct the patient denied being aggressive; he was not able to control himself if asked" (Sensi et al. 2004, p. 248). Another case that is discussed in the literature concerns a 62-year-old Dutch man suffering from a severe case of Parkinson's Disease. He showed remarkable improvement of his physical condition during DBS treatment, but at the same time manic and megalomanic symptoms as well as boundary-crossing sexual behaviour were observed (Leentjens et al. 2004). On the basis of these and other cases discussed in the literature, it seems that interventions that aim at changing specific brain activity can have unwanted side-effects, some of which may lead to morally or legally

questionable behaviour and therefore raise the question whether an indivual who acted under the influence of such an intervention can or should be held (completely) responsible for his actions.

3. Neuroscience and Criminal Responsibility in Dutch Law

3.1 Criminal responsibility in Dutch law

A prerequisite for culpability in most jurisdictions is that the accused must have acted intentionally or knowingly. However, even if someone acted intentionally or knowingly, there may be circumstances that prevent attribution of criminal liability, for example if circumstances point to a case of *force majeure*, self-defence, or that someone acted in the exercise of government authority. For the purpose of this chapter, the exception of an unsound mind is relevant. In Dutch law, an individual cannot be held responsible if his mental capacities were seriously deficient at the time he committed a crime: "Not punishable is he who commits an act which cannot be attributed to him because of poorly developed or pathologically disturbed mental capacities" (Article 39 of the Dutch Criminal Code (DCC)). This provision determines that an individual cannot be held accountable in criminal law for his actions if he lacks particular mental capacities that enable him to act (sufficiently) intentionally and knowingly. The emphasis is on whether the act can (in a more objective sense) be attributed to the defendant (*toerekenbaarheid*) rather than on whether (in a purely subjective perspective) the defendant was able to determine his will during the act – the train driver who fell asleep could not subjectively do much about his negligence, but the fact can be attributed to him nonetheless (De Hullu 2003, p. 343). An important change in this provision was the replacement in 1928 of 'powers of reason' (*verstandelijke vermogens*) by the broader 'mental capacities' (literally: 'mind capacities': *geestvermogens*), so that not only cognitive but also emotional deficiencies could be included in the scope of the exception (De Hullu 2003, p. 345).

The defect or disorder of the mental capacities must have existed at the time of the crime and must have contributed to the perpetration of the crime, i.e. there must be a relation between the crime and the defect or disorder of the suspect's relevant mental capacities (Mooij 2005).

The background of excluding culpability, also in relation to mental capacity, was briefly explained in the Explanatory Memorandum when a new Criminal Code was introduced in 1886: 'No criminal responsibility without accountability of the act to the perpetrator, and no accountability in case either the freedom of acting – choosing between doing or not doing what the law prohibits or requires – is excluded or the perpetrator is in such a state that he cannot realise the unlawfulness of his act and cannot calculate its consequences' (quoted in De Hullu 2003, p. 284, our translation). This shows that two capacities are considered key to criminal responsibility: the freedom of choosing to act or not to act (which may be related to impulse control) and the capacity to distinguish right from wrong.

In the Netherlands, an assessment of the suspect's accountability can be ordered by the court if it believes that the suspect may be suffering from a defect or disorder of his mental capacities. Typically, the court orders a mono-disciplinary assessment, which involves a psychiatrist or a psychologist, or a bi-disciplinary assessment, which involves both a psychiatrist and a psychologist. In such cases, the expert typically only has one or two interviews with the suspect. In severe cases, i.e. if the crime and the assumed psychopathology are severe, the court can order a more intensive multidisciplinary

assessment, which means that the suspect is assessed during a seven-week observation period in a forensic institution (Barendregt et al. 2008).
A 5-point scale (complete responsibility – slightly diminished responsibility – diminished responsibility – severely diminished responsibility – complete absence of responsibility) is used in forensic practice in the Netherlands in order to determine the degree of responsibility. Responsibility is typically measured by a number of clinical variables, which are determined by means of an anamnesis and standardized behavioural and/or (neuro)psychological tests, as well as by demographic and crime-related variables (Barendregt et al. 2008). Complete absence of responsibility is a reason for discharge, i.e. the suspect committed the crime but is not liable to punishment or the criminal act cannot be attributed to the suspect, while diminished responsibility is typically a reason for mitigated sentencing and typically leads to an order of detention during Her Majesty's pleasure (*terbeschikkingstelling*, TBS).

3.2 Neuroscientific evidence in the courtroom

Although the number of cases is unknown, neuroscientific evidence aimed at the assessment of responsibility has already entered the courtroom in the Netherlands[2]. In some cases, the expert witness – a behavioural neurologist – did not find any brain damage or not sufficient connections between the brain damage and the behaviour that constituted the criminal act, and hence the suspect was considered fully responsible (cases LJN BA9671, BO0306, and BK3854). In other cases, however, brain damage and a link between the damage and the behaviour was found that did influence the decision about the degree of responsibility.
We briefly describe eight court cases to illustrate the use of neuroscientific evidence in Dutch criminal cases. Not all of them directly deal with criminal liability, but they all involve an assessment of the suspect's capacities conducted by inter alia a neurologist. The first case refers to the use of neuroscientific evidence to determine the defendant's capacity to understand prosecution (LJN BM8774). The second case refers to the use of neuroscientific evidence to determine intentionality (LJN BC9296) and the third case refers to the use of neuroscientific evidence to determine premeditation (LJN BB2861). We then briefly describe five cases in which neuroscientific evidence was used to determine culpability. In three of the five cases, the suspect had frontal lobe damage which according to the expert witness impaired his ability to control his impulses (LJN AV1864, LJN BK5962, LJN BA3923). In the fourth of the five cases, a defect at the pituitary gland was considered during the responsibility assessment (LJN BM1948). Cases in which reduced activity in the limbic system plays a role in the determination of culpability are however extremely rare. In the last case, the evidence pertains to the potential side-effects of the antidepressant taken by the suspect (LJN BK4178). To our knowledge, there have not yet been any cases in the Netherlands in which the expert charged with the responsibility assessment has argued for diminished responsibility due to the unwanted side-effects of DBS. So far, frontal lobe dysfunction seems to play the most important role in neuroscientific responsibility assessments in the Netherlands.

3.2.1 Use of neuroscience to determine defendant's capacity to understand prosecution

Before the court assesses whether the charge can be proven and whether the defendant can be held responsible for her act, the court has to answer preliminary questions: whether the

[2] In all cases discussed in this chapter in which a neurologist was involved as one of the expert witnesses, he explained the suspect's behaviour in terms of deficits caused by specific brain damage (with an exception of case LJN BM1948, in which the brain damage was not believed to have affected the suspect's behaviour). On the basis of the summaries of the court decisions it is unclear how exactly the expert assessed the brain damage and associated deficits. In all cases however, the expert referred to some kind of brain damage and explained the suspect's behaviour in terms of this damage.

summons is valid, whether the court has jurisdiction, whether the prosecutor is allowed to prosecute, and whether there are reasons to suspend the prosecution (art. 348 Dutch Code of Criminal Procedure, DCCP). A possible reason to suspend the prosecution is that the defendant is incapable of understanding the prosecution: "If the suspect suffers from poorly developed or pathologically disturbed mental capacities that are such that he is not capable of understanding the gist of the prosecution brought against him, the court will suspend the prosecution, regardless of its stage" (art. 16 para 1 DCCP).

District Court Amsterdam 21 June 2010 / Court of Appeals Amsterdam 27 August 2010

A man was charged with murder in early 2010 (LJN BM8774). The defence called for suspension of the prosecution, arguing that the defendant was incapable of understanding the gist of the prosecution brought against him. A report from, *inter alia*, a psychologist, psychiatrist, and behavioural neurologist showed that the defendant suffered from brain damage in the form of a laesion in the nucleus caudatus which constituted a frontal syndrome of permanent damage. Together with the personal observation of the court in its questioning of the defendant, the court concluded that the defendant did not sufficiently understand the charge, why he was in preventative custody, nor the relationship between the preventative custody and the court hearings. The attorney was not able to have a meaningful conversation with the defendant and could not prepare a defence accordingly. Consequently, the defendant was incapable of understanding the gist of the prosecution, and hence, the court determined the prosecution to be suspended on the basis of article 16 DCCP.

Part of this case hinged on the interpretation of article 16 DCCP, a very rarely used provision with not very clear case-law. Historically, article 16 was meant for situations in which the defendant became mentally ill *after* the crime, but when the provision was changed in 1988, the formulation of the provision allowed an interpretation that the mental illness already existed at the time of the crime. And although the provision suggests that the legislator had temporary mental disturbances in mind (para 2 of article 16 indicates that the suspension be lifted as soon as the defendant has recovered), temporariness was not a necessary condition either. The court based both these interpretations on the phrase "poor development" of the mental capacities, arguing that a poor development is likely to have existed for a long time and to continue to exist.

However, the district court's verdict was quashed in appeal (LJN BN5666), since the court of appeal interpreted article 16 as, in principle, still applying only to cases where a mental illness occurred after the crime. For situations in which the defendant already suffered from a mental defect at the time of the crime, the rules on absence of or diminished culpability (art. 37 et seq. DCC) and on how to prosecute defendants with poorly developed or pathologically disturbed mental capacities (art. 509a et seq. DCCP) will be sufficient for securing a fair trial, according to the appeals court. It also found that the medical experts had not been asked the correct questions: instead of the question "Can the defendant be considered capable of standing trial?", they should have been asked the specific legal questions whether the defendant could be held accountable for his act (art. 37 DCC) and whether he was capable of sufficiently securing his interests (art. 509a DCCP), as well as whether he was capable of understanding the gist of the prosecution (art. 16 DCCP). The appeals court therefore referred the case back to the district court for further behavioural examination.

The follow-up of the case is still pending at the time of writing.

The case is interesting in that it shows that impairments of brain functions can have different effects on the criminal proceedings, depending on the type of impairment in relation to the stage of the procedure. A distinction is made between the (mental) capacity to defend one's interests (art. 509a DCCP) and the capacity to understand the gist of the prosecution (art. 16 DCCP). If the former is impaired, the defendant can be prosecuted, but he is likely not to be

held culpable if the same impairment is found to have influenced his behaviour at the time of the crime; he can then, for example, be sentenced to detention during Her Majesty's pleasure. If the latter capacity is impaired, the defendant will no longer be prosecuted, as the very idea of the prosecution has become meaningless. (Although this does not necessarily imply that the defendant is released; he can still be kept in preventative custody, as provided by article 17 para 2 DCCP, awaiting future examination in case recovery is considered possible.) If the impairment of the latter capacity – to understand the gist of the prosecution – already existed at the time of the crime, however, the impairment is likely to be related to the criminal behaviour, and most courts then find article 16 DCCP inapplicable (in line with the decision of the Court of Appeal in the above case), and instead opt for continuing the prosecution while taking into account art. 509a et seq. DCCP. Only if the brain impairment occurred after the crime does the understanding of the gist of the prosecution come into play. An example of this is a defendant who was charged with having illegally disposed of a dead body in 2001, and who subsequently, in 2004, had various cerebral haemorrhages and infarcts leading to vascular dementia. A neuropsychologist and neurologist reported that the man suffered from multiple cognitive functional impairments directly caused by cerebrovascular accidents, as a result of which no recovery was expected. The court therefore suspended the prosecution on the basis of article 16 DCCP, and – because recovery was extremely unlikely – determined the case closed on the basis of article 36 DCCP (LJN AY8840).

3.2.2. Use of neuroscience to determine intentionality and premeditation

If the court has answered the preliminary questions of article 348 DCCP in the affirmative – and hence the prosecution can be continued – the court has to answer two subsequent questions: first, whether it can be proven that the charged fact has been committed by the suspect and if so, which crime this charged fact constitutes, and, second, if the fact is indeed a crime, whether the defendant can be held culpable and which punishment or measure is appropriate (art. 350 DCCP). If the first part of the first question is answered negatively (i.e. if the suspect is not proven to have committed the charged fact), the suspect will be acquitted (art. 352 para 1 DCCP); if he has committed the fact but it is not a crime, or if the defendant cannot be held culpable, he will be discharged. If the suspect is not held culpable because of article 39 DCC (mental defects), the court can order him to be admitted to a mental hospital or be detained during Her Majesty's pleasure (art. 352 para 2 DCCP).

Neuroscientific evidence can, in principle, play a role in both stages of the court decision. In this subsection, we discuss the first issue: whether it can be proven that the defendant committed the charged facts and which crime this charged facts constitutes. Many criminal provisions contain an explicit element of criminal intent that must be proven, and if a mental impairment is found to be of such a nature that the person cannot be considered to have acted intentionally or with premeditation, he will be acquitted.

District Court Amsterdam 28 March 2008

In 2007, a 63-year-old man stabbed a friend nine times as a result of which she deceased. The suspect declared that he was annoyed by the victim's behaviour. He furthermore declared that he saw that the victim lost a lot of blood as a result of the stabbing and furthermore lost her consciousness several times. When she regained consciousness and tried to get up he stabbed her again. At the time of the incident, the suspect was intoxicated with alcohol and cocaine. According to the expert witness, a behavioural neurologist, the suspect's behaviour during the incident was affected by damage to his frontal lobes. More specifically, the brain damage had rendered the suspect unable to control his impulses and reflect on his actions in difficult situations. The alcohol and cocaine were believed to have aggravated his impulsive behaviour. Additionally, the expert witness stated that the suspect's brain damage interfered with his free

will. The presiding judge decided that the suspect had acted intentionally. More specifically, he stated that although the suspect's behaviour was affected by the frontal lobe damage, he did not lack complete insight into the consequences of his actions. According to the judge, the suspect was aware of the possibility that the victim would die as a result of the harm that he was inflicting on her. Consequently, the court decided that the suspect had committed the act of intentionally killing someone (manslaughter). On the basis of the expert witness' report, however, the judge decided that the suspect had severely diminished responsibility for his actions as a result of the frontal lobe damage, which eventually resulted in reduced sentencing of 18 months' imprisonment, plus detention during Her Majesty's pleasure (LJN BC9296)

This case demonstrates the use of neuroscientific evidence to determine intentionality, which is important in light of deciding whether the suspect committed the charged facts. The case is interesting, because it demonstrates that a diagnosis of serious impairments of the suspect's cognitive functions apparently has little impact on the court's decision concerning the intentionality of the suspect's actions. The brain damage that was diagnosed by the behavioural neurologist was considered serious, after all it resulted in the decision of severly diminished responsibility. Despite its severity however, the damage was not deemed to have affected the suspect's intentionality. The court believed that although the suspect's actions were influenced by the brain damage, he knew what he was doing and therefore acted intentionally. As discussed by Stevens and Prinsen (2009), who analyzed manslaughter cases in the Netherlands in which the presiding judge decided that the suspect lacked intentionality because of a mental disorder, the concept of intentionality is purely legal with little psychological content. The suspect's mental disorder – apparently regardless of its severity – typically has little influence on the court's decision concerning the intentionality of the suspect's actions. It seems that the only diagnosis that convinces the court that the suspect has not acted intentionally is that of dissociation, which is characterized by a disruption of the normal integration of an individual's conscious functioning (Stevens & Prinsen 2009). A case in which the court decided that the suspect did not act intentionally and was therefore acquitted (art. 352 para 1 DCCP) concerns that of a man who caused an accident by knocking over a biker with his car. The suspect himself indicated that he probably had a light epileptic seizure, which the three expert witnesses (a psychiatrist, a psychologist and a neurologist) could not rule out as cause of the suspect's behaviour (LJN BN0983). The above described case is furthermore interesting, because the same evidence that was used to determine that the suspect had acted intentionally, was subsequently used to determine the degree of responsibility. Although the court claimed that the brain damage did not affect the suspect's intentionality, it believed that the damage was severe enough to deem the suspect severely diminished responsible for his actions.

District Court 's-Hertogenbosch 5 September 2007

A 50-year-old man had murdered his wife during a fight about money by smashing her head against the wall, choking and repeatedly stabbing her in the presence of their 9- and 7-year-old children. He gave several accounts of what had happened when he was interrogated by the police and after being confronted with the statements of his children, he said that they were not lying but that he was unable to remember what had happened. On the basis of expert testimonies – from a psychologist, a psychiatrist and a behavioural neurologist – the court judged that the suspect had acted without premeditation and that he had diminished responsibility for his actions. According to the psychiatrist, the suspect was suffering from an autistic spectrum disorder, mental retardation, depression and damage to his frontal lobes at the time he committed the crime, as a result of which he is diminished or severely diminished accountable for his actions. The psychologist's report stated that, at the time he committed the crime, the

> suspect suffered from a pervasive developmental disorder not otherwise specified. In addition, he might suffer from a mental impairment, both of which led the psychologist to conclude that the suspect should be held diminished responsible for his actions. According to the behavioural neurologist, the suspect possibly suffers from damage to his frontal lobes, which is accompanied by disturbances in his executive functions and a loss of impulse control. The behavioural neurologist stated in his report that, if the report of the psychiatrist supports the diagnosis of frontal lobe damage (which it does), the suspect's actions were influenced by his frontal lobe damage. According to the behavioural neurologist, as a result of the frontal lobe damage, the suspect had less control over his impulses, was unable to adequately evaluate the situation, and could no longer disrupt his actions once he had started them, which is why he repeatedly stabbed his wife. The expert witnesses' reports were considered during the determination of which crime the charged fact constitutes; the court interpreted the statements of the experts in favour of the suspect and determined that he had not acted premiditatedly, because his mental disorder had probably caused an unexpected and extreme reaction towards his wife during the fight. Additionally, the statements were considered in the deliberation of the verdict and the suspect, being held diminished responsible, was sentenced to nine years in prison for manslaughter (LJN BB2861).

This case is interesting for several reasons. First of all, the fact that the suspect claimed memory loss could have been taken as an indication for some kind of dissociative disorder, which as described above can be taken as a reason for lack of intent (although of course the possibility that he falsely claimed memory loss to avoid prosecution or at least receive a reduced sentence cannot be excluded). The suspect's mental disorder did however not affect the decision concerning intentionality. It was however taken as evidence for a lack of premeditation. The court interpreted the expert witnesses' testimonies as indicating that the suspect's mental disorder led to an unexpected and extreme reaction as a result of which he acted the way he did. As a consequence of this decision, the suspect was charged with manslaughter. The case is furthermore interesting because although they come to the same conclusion of diminished responsibility, the psychiatrist's and the psychologist's diagnoses are fairly different. The psychiatrist diagnosed an autistic spectrum disorder, mental retardation, depression and damage to the suspect's frontal lobes at the time he committed the crime, whereas the psychologist diagnosed a pervasive developmental disorder not otherwise specified. The psychiatrist's and the neurologist's testimonies are clearly aligned to each other in sofar as they both include a diagnosis of frontal lobe damage. From the neurologist's testimony it seems that he based his diagnosis on the report of the psychiatrist: 'If the other assessments ([...], psychiatric report) confirm a frontal syndrome, the suspect's behaviour was influenced by this damage at the time of the crime. Because of the frontal syndrome, the suspect had less controle over his impulses, was unable to adequately evaluate the situation and could no longer disrupt his actions once he had started them' (LJN BB2861, our translation). Since the consequences of frontal lobe damage are rather severe and so are the conclusions and decisions that the court bases on these assessments, it is somewhat surprising that the neurologist's diagnosis depended on the psychiatrist's diagnosis.
As in the previous case, the experts' testimonies were not only used to determine intentionality and premeditation respectively, but were furthermore used to determine the suspect's responsibility. On the basis of the expert testimonies, the court decided that the suspect was diminished responsible.

3.2.3 Use of neuroscience to determine culpability

As the previous subsection showed that defendants, despite possible mental impairments, are usually considered to have acted with intent, most emphasis comes to lie with the second part

of article 350 DCCP: whether the defendant can be held culpable for his act. Culpability in the sense of attributability is a basic element of criminal liability; Dutch criminal law is often characterised in that respect as a 'guilt-based criminal law system' (*schuldstrafrecht*) (De Hullu 2003, p. 284). This, in principle subjective, approach is contrasted with a more objective approach of an 'act-based criminal law system' (*daadstrafrecht*). In common-law terms, Dutch law could be said to place more emphasis on *mens rea* than on *actus reus* when it comes to attributing criminal responsibility. (Although it is often questioned whether Dutch criminal law still retains such a subjective approach – an issue we will briefly discuss in section 4.)

In determining culpability, the exception of article 39 DCC plays a central role. Whether a defendant can be considered to suffer from impairments in his mental capacities, will depend crucially on expert statements: as soon as the possibility of the exception is raised, behavioural experts enter the criminal procedure. Article 37 para 2 DCC determines that – if a court wants to order forced hospitalisation on the basis of poorly developed or pathologically disturbed mental capacities, it can only do so after being advised by two or more behavioural experts from different disciplines, including a psychiatrist, who have examined the defendant; article 37a para 3 DCC provides the same for the measure of detention during Her Majesty's pleasure. As a result, case-law very frequently discusses reports from behavioural experts when the culpability of the defendant is being questioned. Most often, this concerns psychologists and psychiatrists, but sometimes, also behavioural neurologists have entered the picture, who provide evidence based on their examination of the suspect's brain functioning.

> ***District Court Utrecht 14 February 2006***
> In 2005, a 74-year-old man was charged with sexual and physical abuse of four children. The suspect was working as an alternative healer and had gotten into contact with the four children through their mother who was one of his patients. The children's mother was convinced of the suspect's healing qualities and decided that her four daughters should also see him. The suspect sexually and physically abused the four girls over a period of several years. During the criminal trial he was examined by a psychiatrist, a psychologist and a behavioural neurologist. The psychiatric/psychological report stated that the suspect was suffering from a personality disorder with narcissistic, antisocial and schizotypical characteristics. In addition, he had suffered two cerebrovascular accidents (CVA) which contributed to cognitive impairments. According to the psychiatrist and the psychologist, the suspect's actions were primarily affected by his personality disorder, while the cognitive impairments only had a marginal influence. They furthermore reported that although the suspect was able to realize the wrongness of his actions, he had less capacity to freely determine his will as compared to most people. The psychiatrist and the psychologist believed that as a consequence of this, the suspect has diminished responsibility for his actions. According to the behavioural neurologist, the CVAs caused serious brain damage, which affected his motoric and cognitive functions. The behavioural neurologist furthermore reported that it is therefore very likely that at the time he committed the crimes, the suspect's behaviour was influenced by an impaired judgment, which made it impossible for him to foresee the consequences of his actions. The behavioural neurologist concluded that on the basis of this, the suspect can be considered slightly diminished responsible. The court accepted diminished responsibility and sentenced the suspect to four years in prison, which is the sentence that was demanded by the prosecutor (LJN AV1864).

This case demonstrates the use of neuroscientific evidence to determine the degree of responsibility. All experts came to the conclusion that the CVAs had caused cognitive impairments and that the suspect's capacity to freely determine his will was diminished. However, according to the neurologist, this was the result of the cognitive impairments,

whereas according to the psychiatrist and the psychologist, this was the result of the suspect's personality disorder and the cognitive impairments only had a marginal influence. Regardless of this incongruence, all expert witnesses declared diminished responsibility. Although the court adopted the experts' opinion of diminished responsibility, due to the nature and the severity of the charges, it nevertheless passed the sentence that was demanded by the prosecution. Hence, diminished responsibility did neither lead to mitigated sentencing nor to an order of detention during Her Majesty's pleasure in this case.

District Court Alkmaar 24 June 2008

A man was charged with sexual abuse of a girl under the age of 12. The victim was the daughter of one of the suspect's neighbours who used to visited him to play with his pets. During the criminal trial, the suspect was examined by a behavioural neurologist and a psychologist. The behavioural neurologist detected symptoms of a beginning fronto-subcortical dementia as a result of which the suspect suffers from cognitive limitations and increased impulsivity. According to the expert, the suspect's behaviour was influenced by the brain damage that is related to the dementia. More specifically, due to the cognitive limitations and his impulsivity, the suspect was unable to control his impulses and to foresee the consequences of his behaviour and could no longer disrupt his actions once he had started them. In addition, the behavioural neurologist believed that as a consequence of his brain damage related to the beginning dementia, the suspect lacked the ability to reflect on his own actions which prevented him from checking whether his behaviour was adequate. The psychologist referred to the neurologist's testimony and stated that the suspect was not sufficiently able to control his impulses. He furthermore stated that the dementia was in an initial phase at the time he committed the crimes and that the suspect did not show any other types of disinhibited behaviour which is why he is at least partially accountable for his actions. On the basis of the expert testimonies, the court decided that the suspect is diminished responsible for his actions and imposed a prison sentence of 279 days of which 60 days are provisional and a probation of 2 years (LJN BK5962).

In contrast to the previous case, the suspect's brain damage in this case was believed to have had a greater impact on his behaviour; the suspect was unable to control his impulses and to disrupt his actions once he had started them. Since at the time of the assessment and therefore also at the time of the crime, the dementia was in an initial stage, the suspect was hold at least partially accountable for his actions. The responsibility assessment did not result in an order of detention during Her Majesty's pleasure in this case.

District Court Amsterdam 26 April 2007

In June 2006, a man visited the Rijksmuseum in Amsterdam, randomly chose a painting, poured petrol over the painting and lit it on fire. He was charged with arson and damage to goods. During the criminal trial, the suspect was examined by a psychiatrist, a psychologist and a behavioural neurologist. After consultation with each other, the experts testified that the suspect suffered from frontal lobe damage which resulted from a previous leucotomy. As a result of the brain damage, the suspect had developed a personality disorder with obsessive, neurotic and narcissistic features. He was characterized as living in his own world and being primarily driven by his obsessive beliefs. The experts contemplated that the suspect was aware of the wrongness of his actions, but nevertheless was unable to act upon his free will. The court accepted the experts' judgment of severely diminished responsibility and sentenced him to one year in prison and additionally imposed an order of detention during Her Majesty's pleasure and a compulsory admission to a psychiatric institution (LJN BA3923).

In this case, the suspect was determined severly diminished responsible for his actions due to severe frontal lobe damage which had resluted from a leucotomy, which is a neurosurgical

procedure that consists of cutting the connections to and from the prefrontal cortex. Apparently, according to the expert witnesses, this damage had interfered with the suspect's free will. It seems that in this case the order of detention during Her Majesty's pleasure and the compulsory admission to a psychiatric institution were based on the rather severe mental disorder as well as the suspect's poor physical condition and the high risk for recidivism.

District Court 's-Gravenhage 22 April 2010
A man was charged with the murder of his wife. The suspect had shot at his wife several times during the night in their bedroom and had subsequently reported himself to the police. According to the psychiatrist and the psychologist who assessed the suspect, he was somewhat mentally retarded which however according to them does not imply diminished responsibility. The neurologist detected a tumour in the suspect's pituitary gland, but concluded that there is not sufficient indication for a link between this defect and the suspect's behaviour during the crime. The suspect was considered completely responsible, was convicted for murder and received a sentence of 16 years' imprisonment (LJN BM1948).

Although extremely rare, there seem to be cases in which a defect in the limbic system is considered during the responsibility assessment. In this case, the suspect was suffering from a tumour in his pituitary gland. The pituitary gland is located at the base of the brain underneath the hypothalamus and produces hormones which regulate the other glands in the body. It is part of the limbic system and is functionally connected to the hypothalamus. The neurologist who detected the tumour did not find any evidence for a link between the defect in the limbic system and the suspect's behaviour. He therefore concluded that the suspect was fully responsible for his actions. Whether the defect did actually not play any role in the suspect's behaviour or whether a defect in the limbic system is typically not used as evidence for diminished responsibility or accepted as excuse for criminal behaviour is unclear from this case. The fact that there seem to be very few cases in which the limbic system plays a role in the assessment of responsibility suggests that it is not a common reason to assume diminished responsibility.

District Court Haarlem 24 November 2009
The last case has received a considerable amount of media attention in the Netherlands. It concerns a 63-year-old woman who had murdered her husband and daughter with an axe while they were sleeping before trying to commit suicide. The woman had suffered from depressive episodes since several years and had taken antidepressants to relieve the symptoms. However, a few weeks before the incident she had stopped taking the medication upon the advice of her family, who wanted her to get psychological help instead. Two days before the murder, the suspect had an appointment with her general practitioner who subscribed a higher dose of the antidepressants she had already taken earlier, since there was no improvement of the symptoms. The expert testimonies concerning the impact of her depression and the medication on her behaviour were inconsistent, ranging from slightly diminished responsibility to complete absence of responsibility. According to a court-ordered assessment by a psychiatrist and a psychologist, several factors including the depressive episodes and the woman's personality had contributed to the murder. The experts furthermore stated that they could not exclude the possibility that the effects of the antidepressants played a role in the causation of her behaviour. The defence lawyer subsequently ordered a counter opinion. According to these experts (a psychiatrist and a psychologist), there is a direct causal link between the effects of the antidepressants and the murder, which according to the experts implies that the suspect could not exert her free will during the night she murdered her family. The woman was ultimately convicted for murder, but received a reduced sentence of eight years' imprisonment due to her diminished responsibility (LJN BK4178).

As this case demonstrates, medical interventions are sometimes considered during the responsibility assessment. The court did not accept the opinion of one of the experts who stated that there was probably a causal link between the medication and the suspect's actions. The court did however assume diminished responsibility on the basis of personality problems including the depressive episodes. In addition, the court acknowledged that the medication might have played some role in the suspect's behaviour, probably by contributing to a certain disinhibition. The decision of diminished responsibility resulted in a mitigated sentence in this case. There are some other cases in which a causal link between the psychopharmaca taken by the suspect and the subsequent violent actions was not accepted by the court and therefore did not lead to a decision of diminished or complete abscence of responsibility (LJN BI6332, LJN BL5774). Apparently, the possible side-effects of medical interventions that directly affect specific brain activity is typically not considered as being a reason for diminished responsibility. The reverse could, however, apply, in that people suffering from a brain disorder could be held responsible for *not* having taking medication. In the case of a woman who caused a lethal traffic accident due to an epileptic attack, her not having taken medication was not considered sufficiently negligent to convict her for criminally negligent homicide, because her neurologist had not explicitly prescribed medication. However, because she was a professional taxi driver, the court found she should have asked the neurologist more clearly about the consequences if she was indeed suffering from epilepsy, and she was convicted to 60 hours' community service for causing danger on the road. (LJN BN7251)
Overall, it seems that in cases in which psychopharmaca might have played some role in the suspect's behaviour, it is typically the mental disorder for which the psychopharmaca were prescribed rather than the possible side-effects of the medication that influenced the responsibility assessment.

4. Discussion

The above briefly described cases demonstrate that neuroscientific evidence has already entered the courtroom in the Netherlands. We found a number of cases in which neuroscientific evidence played a role at some stage of the criminal trial – to determine the defendant's capacity to understand prosecution or to determine intentionality, premediation or the degree of responsibility. However, it seems that at present neuroscientific evidence is not used frequently in criminal procedure. In cases in which the court based its decision inter alia on neuroscientific evidence, this evidence was always used in connection with a behavioural assessment by a psychiatrist and in some cases also a psychologist. Apparently, neuroscientific evidence is at least currently only an addition to evidence based on behavioural assessments.
Interestingly, in all cases briefly described above, the same neurologist acted as an expert. It is not entirely clear why this is the case, but it is possible that the neurologist was approached in these cases by one of the other experts ordered with the responsibility assessment, because he expected additional insights from the neurologist's assessment. Nevertheless, without questioning the eligibility and qualifications of this neurologist, including other neurologists during the responsibility assessment might increase the objectivity and validity of neuroscientific evidence in criminal procedure. At least it is important that there are other neurological experts available, if only for counter-appraisal purposes.
On the basis of the cases briefly discussed above, it seems that the frontal lobes play a predominant role in responsibility assessments if some kind of brain damage is believed to underly the suspect's behaviour. In five of the eight cases, some kind of damage to the frontal lobes was diagnosed, which interfered with the suspect's capacity to act upon his free will and to foresee the consequences of his actions. The frontal lobes are involved in various cognitive

processes and executive functions including attention, working memory, planning and decision-making and seem to play an important role in moral judgment and intentional behaviour. It is therefore not surprising that they are deemed relevant to the assessment of responsibility in some cases. As described above, research on frontal lobe dysfunction supports this assumption as it has demonstrated that damage in this area can implicate several deficits in planning and foresight, in moral and social judgment and in the regulation of behaviour. The other three cases briefly described above concern vascular brain damage (in which the affected brain region was not specified), damage to the limbic system in the form of a tumour in the pituitary gland and the influence of psychopharmaca on the suspect's behaviour. From the literature review in section 2, it is clear that other brain damage or impairment of brain functions besides damage to the frontal lobes might as well play a role in explaining some types of criminal behaviour. Defects in the limbic system were found to be linked to antisocial behaviour, in particular to a lack of empathy, remorse and guilt. It seems that cases in which the defence argues for reduced responsibility due to a defect at the limbic system are extremely rare. This may at least be partially due to a reluctance to accept a defect in the limbic system and associated cognitive, affective and behavioural problems as an excuse for criminal behaviour. It seems that intuitively, lacking the capacity to empathise is seen as indicating that someone is bad rather than mad (Maibom 2008; Vincent 2010b). Similarly, the possible side-effects of psychopharmaca are typically not accepted as explaining (some of) the suspect's behaviour. A causal link between the medication and the behaviour is typically not considered plausible by the court, which is why cases in which the defence argues for diminished responsibility due to the side-effects of psychopharmaca typically do not result in a decision of diminished or complete absence of responsibility. If the court assumed diminished responsibility in these cases, it is typically the mental disorder for which the psychopharmaca were prescribed rather than the possible side-effects of the medication that influenced the responsibility assessment. To our knowledge no case in which a DBS patient became criminal as a result of the treatment has yet occurred in the Netherlands. However, given the possible side-effects of this intervention, it seems merely a matter of time before a court is confronted with the first case in which a DBS patient argues for diminished or complete abscence of responsibility due to the neurotechnological intervention and its effect on his behaviour.

Moreover, neuroscientific evidence seems to play a predominant role in determining culpability and to a much lesser degree in determining intentionality or premeditation. Apparently, brain damage associated with diminished impulse control or cognitive deficits may imply that a perpetrator is less to blame for his actions, but they do not easily lead to the judgement that he did not want those actions to happen. This makes sense from a legal perspective, as the threshold for assuming intent is quite low in Dutch law; intent can be assumed, from a criminal-law perspective, when a person knowingly accepts the substantial chance that a consequence of his act will happen (in other words: he should be conscious of the considerable probability of the effect occurring) (De Hullu 2003, p. 236). It seems that from a legal perspective, the capacity to foresee the consequences of certain behaviour is not easily believed to be impaired even if the susepct suffers from cognitive or emotional deficits. From a pychological perspective, however, it is not evident how diminished impulse control can lead to diminished culpability while not leading to absence of intent – can someone really be said to 'knowingly accept the chance' that his behaviour will have a certain effect if he cannot control his impulses? The same may be true for other cognitive or emotional impairments. If insights from a behavioural and/or neurological assessment can be used to answer questions of responsibility, they might as well inform to what degree an individual had certain capacities that make it plausible to assume he acted intentionally or premeditatedly. In this respect, we think that the relationship between current psychological and neurological

insights into brain-behaviour correlates and the legal assessment of intent and premeditation merits further research.

A somewhat related issue is the notion, mentioned in section 3.2.3, that Dutch criminal law is traditionally characterised as a 'guilt-based' rather than an 'act-based' criminal-law system. If this is true, then the importance of establishing guilt in a context- and case-specific sense would seem to suggest that insight into the mental state of a defendant would play a substantial role in criminal procedure. The criminal law system seems to be reticent in this respect: over the past decades, 'guilt' in Dutch criminal law has been 'objectivised' or 'normalised', as evidence of someone's intent and culpability is assessed on the basis of an external perspective, focusing on the act and all its circumstances as much as, or more than, on the person. Partly this has to do with respecting privacy of the mind, but partly it has also a pragmatic reason, in that objectivised intent and guilt are easier to prove than subjective elements (De Hullu 1998, p. 181). Since also other tendencies – such as the rise of the risk society – reinforce the focus on guilt that is determined from an external perspective, the literature is questioning whether the objectivised approach to guilt should not be shifted back to a more subjectivised approach (Buruma 1998). Here, we think, the potential of neuroscientific evidence is important to factor into the equation, as neuroscience could, in principle, provide more insight into the brain-cognition-behaviour interrelationships of individual defendants. Also in this respect, we recommend that the legal, doctrinal interpretation of intent and guilt are studied further in relation to current insights from neuroscientific research.

Despite the potential value of neuroscientific evidence in the assessment of criminal responsibility, however, it is important to mention that there are several significant legal implications of using neuroscientific evidence in legal proceedings. Probably one of the most important challenges of applying neurotechnologies for legal purposes refers to the possibility that neuroscientific evidence is inappropriately persuasive and may therefore unduly affect legal decision-making. This assumption is supported by recent research demonstrating that people view explanations of psychological phenomena as more believable if these explanations contain a neuropsychological component (Weisberg et al. 2008). Additionally, including visual information, i.e. brain images, with explanations of cognitive neuroscience data was found to increase judgments of scientific reasoning (McCabe & Castel 2007). Besides these two studies, that analyzed the influence of neuroscientific explanations on the public's perception of scientific research and not within a legal context, a more recent study empirically supports the concern that neuroimaging evidence unduly affects legal decision-making by showing that students were more likely to find a hypothetical offender not guilty by reason of insanity if he had some kind of brain damage as presented in a brain image (Gurley & Marcus 2008). These preliminary empirical data support the concerns of many researchers who believe that judges and juries may perceive evidence derived by means of insights from neuroscience without sufficient critical appraisal (Aharoni et al. 2008; Garland & Glimcher 2006; Gazzaniga 2005; Jelicic & Merckelbach 2007; Morse 2006; Reeves et al. 2003; Sinnott-Armstrong et al. 2008). It is therefore important to further empirically explore the effect of neuroscientific evidence on legal decision-making in order to ensure the responsible use of this type of evidence.

5. Conclusion and outlook

Insights from neuroscience seem to have the potential to contribute to our understanding of what it means to act intentionally and knowingly. At present, these insights only play a marginal role, which is mainly due to the fact that research on the underlying neural mechanisms of moral judgment and intentional behaviour is still in its infancy, and hence the

responsible use of neuroscientific evidence to answer questions of liability is questionable at this point in time. Nevertheless, the fact that recent empirical studies have established links between brain structures and antisocial or criminal behaviour as well as the fact that neuroscientific evidence has already entered the courtroom in the Netherlands (and other countries) warrants the assumption that neuroscience could play a more important role in assessments of criminal responsibility – and potentially also questions related to other legal concepts such as intentionality and premeditation – in the future. We believe that more empirical research into the neural correlates of impulse control, moral judgment, intentional behaviour and other mental capacities related to the legal concept of responsibility is necessary in order to better understand some of the causes of criminal and antisocial behaviour on the one hand and to assure the responsible use of neuroscientific evidence in the courtroom on the other hand. In this respect, we furthermore think that the relationship between current psychological and neurological insights into brain-behaviour correlates and the legal assessment of intent and premeditation merits further research. Despite the fact that intentionality and premeditation are legal concepts, they are nevertheless strongly linked to mental functioning, which is why insights from behavioural and/or neurological assessments might be useful to determine whether a suspect likely acted with intent or premeditation. Additionally, from a legal perspective, there is a difference in case-law between intent and culpability, and between intent and premeditation. It therefore seems interesting to further explore how neuroscience explains or could explain correlations between brain, cognition and behaviour in terms of these differences; does neuroscience provide insight into cognitive and volitional functions involved in (what legal doctrine interprets as) intent and premeditation? More multidisciplinary research on whether and how insights from neuroscience might be useful in answering questions related to these normative, legal issues seems beneficial. With regard to the responsible use of neuroscientific evidence in the courtroom, we furthermore believe that more research on the (potentially overly persuasive) effect of this type of evidence on legal decision-making is essential.

With regard to the three distinct areas of brain abnormalities that are relevant for assessments of criminal responsibility, it seems conducive to further discuss why certain types of brain damage are accepted as excusing some types of criminal behaviour, whereas others are not. Why is it that intuitively we find psychopaths, who according to recent neuroscientific research suffer from limbic abnormalities, bad rather than mad and are therefore inclined to refuse brain deficiencies as an excuse for their behaviour? With regard to the third area – the potential side-effects of neurotechnologies such as psychopharmaca and DBS – it seems that these at present only play a minor role in questions of criminal responsibility. Since empirical research has demonstrated that some psychopharmaceuticals can have severe side-effects that are associated with increased aggressiveness, this raises the question whether the fact that the side-effects of these medications are only rarely seen as intefering with the suspect's mental capacities is warranted. With regard to DBS, it seems that the growing use of this technology promises for crimes being committed by a DBS patient who subsequently argues for diminished or complete absence of responsibility due to the side-effects of the intervention. Since neurotechnologies raise new concerns for questions of criminal responsibility, there is a great need for further research into ways to deal with these cases once they arise.

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