Bioethical Inquiry (2016) 13:95–103
DOI 10.1007/s11673-015-9680-2

ORIGINAL RESEARCH

Memory Interventions in the Criminal Justice System: Some Practical Ethical Considerations

Laura Y. Cabrera · Bernice S. Elger

Received: 21 July 2014 / Accepted: 2 June 2015 / Published online: 29 December 2015

Abstract In recent years, discussion around memory modification interventions has gained attention. However, discussion around the use of memory interventions in the criminal justice system has been mostly absent. In this paper we start by highlighting the importance memory has for human well-being and personal identity, as well as its role within the criminal forensic setting; in particular, for claiming and accepting legal responsibility, for moral learning, and for retribution. We provide examples of memory interventions that are currently available for medical purposes, but that in the future could be used in the forensic setting to modify criminal offenders' memories. In this section we contrast the cases of (1) dampening and (2) enhancing memories of criminal offenders. We then present from a pragmatic approach some pressing ethical issues associated with these types of memory interventions. The paper ends up highlighting how these pragmatic considerations can help establish ethically justified criteria regarding the possibility of interventions aimed at modifying criminal offenders' memories.

L. Y. Cabrera (✉)
Center for Ethics and Humanities in the Life Sciences and Department of Translational Science and Molecular Medicine, Michigan State University, East Fee Hall, 965 Fee Road, Rm C211, East Lansing, MI 48824, USA
e-mail: laura.cabrera@singularityu.org

L. Y. Cabrera · B. S. Elger
Institute for Biomedical Ethics (IBMB), University of Basel, Bernoullistrasse 28, CH-4056 Basel, Switzerland

Keywords Criminal · Criminal forensic setting · Memory · Neuro-intervention · Retribution

The Importance of Memory

Memory is one of the most fascinating and intriguing topics within neuroscience research and beyond (Editorial 2013; Herculano-Houzel 2003). Memories provide a link between the past and the present, and allow us to project our thoughts into the future; as such, they are essential for a flourishing human life. In particular, memories allow us to attach and integrate meaning and significance to past experiences, and to particular choices and actions within the larger narrative of an individual life (Kolber 2006; Liao and Sandberg 2008; Locke 1975; Luria 1987; Snead 2011). Memory is also an essential part of personal identity (Locke 1975; Schechtman 2007). Karl Popper captured the importance of memory for personal identity when he asserted: "those states of which I have lost my memory completely can hardly be said to be states of myself" (Popper and Eccles 1985, 104). Given the role memories have between the past and the present, they also play a key role in the judgments of and reflections on past actions. In the context of the criminal justice system, memories are then important inasmuch as they are part of the processes through which claims regarding responsibilities, rights, and privileges are made. Memories allow us to demand justice from those who have done wrong to us, as well as to confess and make amends for the wrongs we have committed (Snead 2011). For all these reasons,

it can be argued that memory plays a decisive role within the forensic setting.

Despite the importance memory has in our lives, most discussions around memory modification are based on an unclear concept of what exactly is been modified. Memory is the result of various brain processes, including encoding, recalling and forgetting. Memory is also the result of the interaction of multiple functional systems with different logics, neuroanatomical bases, and specialized functions (Kandel and Squire 2000; Tulving 1972). Depending on the particular aspect of memory that is been modified, different ethical concerns will be at play. For example, technological manipulation of encoding processes will have different ethical implications than manipulation at the recalling stage. Similarly, technological manipulation of episodic memory (memory of experiences and specific events) is likely to have different ethical implications than modification of semantic memory (memory of facts, meanings, concepts, and knowledge about the external world). In addition, different memory processes are influenced and shaped by different factors, such as emotional valence (Phelps 2004; Schmidt 1994), the information available at the moment of recollection (Schacter 2001), reinterpretations and intervening experiences (Popper and Eccles 1985), and desires (Frankfurt 1971). These memory features will play an important role in our discussion around the implications of memory modification interventions.

Memory Modification Interventions in the Forensic Setting

Neuroscience is uncovering new insights on the function of the human brain, which provide new approaches and targets for therapies and other behavioural interventions, including ways to affect memory. Given the various mechanisms and factors that are involved in memory, there are different ways in which memory can be affected. In this section we discuss memory interventions currently available for medical purposes, but that in the future could be used within the criminal forensic setting. We address two potential cases, namely (1) dampening and (2) enhancing criminal offenders' memories.

Here, we are interested in reviewing pharmacological and brain stimulation interventions that could be used within the forensic setting to manipulate memory in a not-too-distant future. Even though some of the examples we put forward might seem futuristic or simply unlikely, we believe it is still important to discuss them, as Rebecca Roache has argued: "restricting ethical debate so as to avoid unacceptably speculative scenarios would leave scientific progress devoid of ethical guidance, but would also rule out some of our most important ethical projects" (2008, 317). In addition, early ethical debate enables us to develop tools and insight connected to how to better deal with these scenarios, if they ever arise, or even similar ones. Moreover, given the importance that memory has for personal identity, responsibility and well-being, ethical reflection should precede technological progress and possible future applications.

Even though, to date, the most common uses of pharmaceutical and brain stimulation interventions occur in the clinical setting, this raises the following question: should we use these interventions to fulfil the penological goals of the criminal justice system?

Pharmacological Interventions

Since the neurotransmitter revolution in biomedicine, chemical interventions targeting different memory processes have been researched widely (Kolber 2006; Farah et al. 2004; Farah 2010; Greely et al. 2008; Lynch 2002). Propranolol—an approved Food and Drug Administration (FDA) drug to treat hypertension—has been found to have potential for dampening the emotional pain associated with memories (Reist et al. 2001) when taken within a few hours of the event (Pitman et al. 2001; Vaiva et al. 2003). According to some scholars, it is a possibility that propranolol might already be used "off-label" by some clinicians to treat traumatic memories (Kolber 2006), in particular for war veterans or people with post-traumatic stress disorder. Given the features of propranolol as a memory manipulation drug, one could imagine its use in the criminal justice system to dampen the memories of offenders.

To date, drugs affecting memory in a targeted way are still within the realm of science fiction. However, recent discoveries of proteins and genes involved in memory processes are likely to enable the development of new pharmaceutical drugs targeting memory in more specific ways, which could warrant their use within the forensic setting (Lynch 2002). Moreover, the fact that memory interventions, such as psychological manipulation and substances such as alcohol and thiopental (a

barbituric used in some places as truth serum), have been used in order to obtain testimony from offenders (Levy 2007; Loftus 2003) should urge us to start discussing the ethical implications of memory manipulation in criminal offenders.

External Methods

Other emerging methods that have the potential to manipulate memories include minimally invasive brain stimulation techniques such as Transcranial Magnetic Stimulation (TMS) and transcranial Direct Current Stimulation (tDCS) (George et al. 2009; Luber et al. 2009; Sparing and Mottaghy 2008). These methods stimulate the brain either by inducing an electrical field using a magnetic coil placed against the head (TMS), or by applying weak electrical currents via electrodes on the scalp (tDCS) (Nuffield Council on Bioethics 2013). For both methods, patients remain conscious while undergoing the procedure, and if appropriate guidelines and precautions are followed they are generally considered safe (Fregni and Pascual-Leone 2007; Rossi et al. 2009). There is evidence suggesting that tDCS can improve recognition memory in Alzheimer's disease (Ferruci et al. 2008) and modulate declarative memory (Javadi and Walsch 2012), while TMS can enhance episodic memory in young and healthy adults (Gagnon et al. 2011) and modulation of memory retrieval of emotional material (Balconi and Ferrari 2012). There is also evidence pointing towards the possibility of using transcranial brain stimulation for disrupting memories (Brasil-Neto 2012; Gagnon et al. 2010). While these technologies are still under research within the clinical setting, it is not far-fetched to think that in the future, as we gather more knowledge, these might also be used within the forensic setting. An example of this would be using these technologies for obtaining confessions from criminal offenders, which is a real possibility considering that recent evidence has shown that TMS can change spontaneous truth-telling/lying rates (Karton and Bachmann 2011).

Memory Interventions: To Dampen or to Enhance?

In the above section we have highlighted a number of different types of memory modification interventions that could be used within the criminal justice system. Different memory interventions will have different ethical issues associated with them. It is not the same to *strengthen the emotional aspect of a memory* (even if only temporarily) connected to an event as it is to *improve the ability to recollect* an event. Similarly, *dampening the emotional aspect of a memory* is not the same as *dampening an entire set of memories* (such as dampening all your memories of a certain person, or your childhood memories). In this section we will be using the terms *dampening* and *enhancing* of memories in connection with these possibilities, although we acknowledge that there could be other ways to modify memories. The specific cases we discuss here are, so far, hypothetical. The described effects cannot yet be achieved with any of the methods discussed above, as none of them yet has the level of specificity that would be needed to render our hypothetical cases fully realistic. However, given the importance that memory has for our well-being and ascription of criminal responsibility, we consider this discussion as a starting point to engage different stakeholders in the development of policy and guidance concerning future uses of memory intervention technologies.

If we already have prisons and even psychotherapy for dealing with criminal offenders, why would we want to use neurotechnologies in the criminal forensic setting? One answer is that incarceration and therapy can take a long time and require a substantial number of resources. In the long run, incarceration and therapy can be more costly than memory interventions. Many prisons around the globe are already overcrowded, and prisoner populations are constantly growing (United Nations 2013). In addition, there might be places lacking the resources to run prisons in ways that are consistent with basic prisoner's rights (in particular as prisoners get older and develop chronic diseases) (Handtke et al. 2012; Human Rights Watch 2012). As the recent Nuffield Report on Neurotechnologies points out, "economic factors present both opportunities and constraints that shape the innovation pathways of novel neurotechnologies" (Nuffield Council on Bioethics 2013). Thus, it is not unreasonable to think that, in the near future, other type of interventions might be considered and introduced in criminal justice systems.

Case 1: Memory Modification Is Aimed at Dampening the Memory of the Offender

Here we want to present the possibility of dampening the *emotional* aspect of the criminal memory. Imagine

the case of criminal offenders who take pleasure in recalling the memories of the harm inflicted in their victims (Porter et al. 2001)—think of a rapist or a paedophile. In these cases, one can think that part of their sanction could be precisely to ensure that they do not recall the memories associated with their crime. Thus, the main penological goal of dampening the emotional aspect triggered by these memories could be seen as retribution via the loss of enjoyment the offender would suffer. Another possible penological goal is that of general deterrence if such offenders were motivated by the anticipation of savouring those memories and came to know that if they were caught they would lose them.[1]

Case 2: Memory Modification Is Aimed at Enhancing Memories

Another way in which memories can be modified is by enhancing them. Here we will explore two possibilities. The first possibility that we will discuss is that of enhancing—that is to say to make more intense—the emotional component of a memory. The second case is that of enhancing recall of memories.

Enhancing the Emotional Component of a Memory

Memory interventions aimed at enhancing the emotional valence attached to those memories could be used in order to make the offender feel the weight of his/her actions, which is relevant for feelings of regret and remorse. These latter types of feelings are needed for our moral learning and responsibility. While the sting of conscience, as feelings of guilt, is more a form of moral punishment rather than a legal one, it might be true that enhancing certain memory aspects could affect feelings of responsibility, which in turn could help in reducing the probability of the offender committing these types of crimes. A concern to be considered here is that augmenting too much the emotional valence of certain memories could result in trauma from the augmented feelings attached to those memories. This brings to mind the aversion therapy undertaken by the character Alex in Kubrick's film *A Clockwork Orange*. While the therapy help "rehabilitated" Alex, the concern is that he stops being not only a wrongdoer but also a being capable of moral action.

Enhancing Recollection of Memories

A second type of memory intervention could be to restore an offender's memories, especially if we consider that memories of the crime one is being accused of are generally seen as necessary to make someone responsible for his/her actions (Vincent 2011). The underlying idea here is that if someone no longer remembers his/her crime(s) he/she might not be the same person—in the relevant psychological respects—who committed those murders, and will not fulfil all the features that the law recognizes as necessary to make someone accountable for an action (Vincent 2011; Dufner 2013).

Thus, memory interventions that enhance recollection of memories could enable the conditions needed for holding offenders accountable for their actions. These conditions have to do with the mental states and attitudes, as well as the actions caused by such states, that an individual sees as belonging to him/her. These, according to Marya Schechtman (2007), are interlinked with our narrative identity, and help highlight the connection between memory and identity.

At present, some jurisdictions regard it as permissible to forcibly medicate an offender for the sole purpose of making him competent to stand trial. This is permitted as long as the intervention is shown to be most likely effective, no better medical alternatives are available, and that important state interests are at stake (Greely 2008; Vincent 2011). More importantly, these interventions are only considered in cases where an offender has developed a neurological disease or has had an accident that might have impaired certain mental capacities. The question is then: should we make use of memory interventions beyond making offenders fit to face trial, to making them fit in order that they can be held responsible for their crimes? Think, for example, of cases where an offender develops amnesia. Should he/she be given a lighter sentence or be cleared of charges (Porter et al. 2001)? Or think of the case of an offender who becomes demented, having his/her memories impaired. In both the amnesia and the demented cases, the offender had no active role in his/her memory impairment, yet strictly speaking the offender no longer fulfil the conditions to be held accountable for his/her crime, in particular if the impaired memories involve the memories connected to his/her crime. If that were the case, should we try to re-establish his/her memories, or just

[1] We owe the latter point to one of our reviewers who brought this to our attention.

move him/her to a mental institution (Dufner 2013)? This is an empirical question, the answer to which will defer depending on different criminal justice systems, but in the light of (1) technologies with the potential to restore or enhance recollection of memories becoming more specific and safer and (2) the increased risk of prisoners developing these memory related impairments as they get older, this question should be given more consideration in the ethical debate around memory interventions in the criminal justice system.

The different scenarios discussed here highlight different ways in which memory interventions could be used in the criminal forensic setting, in particular for criminal offenders. While the different penological goals sought by these interventions are an important consideration for how they might be used, we will focus in the next section on ethical concerns regarding the possible use of this type of memory intervention on criminal offenders' memories.

Ethical Issues Around Memory Modification for Criminal Offenders

Interfering with human memories, whether it is enhancing or dampening, raises a number of ethical concerns. Common objections against memory modification interventions are issues related to authenticity and identity (Erler 2011; Liao and Sandberg 2008; Merkel et al. 2007; President's Council of Bioethics 2003). While these are important considerations when discussing memory interventions, we will not expand on them here; rather, we will briefly mention some more pragmatic considerations that are relevant to the criminal justice system. We will mention four main categories of ethical concern. We acknowledge that some of the ethical concerns within the categories might overlap. Furthermore, there might be other pressing concerns that are not included in the categories presented here that might be worth exploring in the future.

Safety

From an ethical point of view, reliability and safety should be two major aspects to consider when evaluating whether or not these types of memory interventions should be used for criminal offenders. Regardless of the optimism that some could attach to such possibilities we should not overlook issues of safety (Beauchamp and Childress 2001; Farah et al. 2004; Greely 2008), in particular when discussing intervention that will directly affect our brains (Nuffield Council on Bioethics 2013). The relatedness of different memory systems brings forward an inherent higher risk for unwanted or unexpected changes. This is an issue that should be considered seriously when weighting the acceptability of different methods to modify our memories. Considering all this, memory modification interventions that are less invasive, such as pharmaceutical or minimally invasive brain stimulation, should be prioritized over more invasive procedures, which might involve more risks. Similarly, reversible interventions should be considered over irreversible ones. However, one has also to bear in mind that they may involve long-term and perhaps permanent changes that we do not yet understand.

Informed Consent and Coercion

If these interventions were to be used without proper consent from the prisoner, they would be qualified as torture, or inhuman and degrading, as mentioned in Article 3 of the European Convention of Human Rights (Council of Europe 2010), or if used for interrogation they would be considered coercive and illegal under the Geneva Conventions provisos. But even supposing that offenders have given their consent, a main concern in the forensic setting has to do with the number of prisoners who have some form of brain injury or disorder (Williams et al. 2010). This in turn puts into question the capacity of these individuals to make informed decisions about accepting a memory intervention as part of their sentence or as a way to reduce their sentence time. Another main concern would be coercion. Being a prisoner brings forward an extra layer of vulnerability (Luna 2009), and given the conditions lived in prison, we can imagine offenders accepting an intervention that under different circumstances would not be accepted or even considered. Regarding this point, some scholars have argued that the "decisions of persons taken under compulsion of legal norms are no less autonomous than decisions taken under the compelling force of natural circumstances" (Merkel et al. 2007, 381–382). These might be true for some prisons' conditions but certainly not for all, especially considering cases where prisoners and detainees confront conditions that are degrading, abusive, and even dangerous.[2]

[2] See http://www.hrw.org/united-states/us-program/prison-and-detention-conditions.

Social Order

One main concern here would be that these memory interventions are used by the state to "restrict [offender's] powers of critical reflection, or to directly re-shape his values" (Shaw 2014, 14). While it can be said that at least part of the aim of any criminal justice system is to re-shape offenders' values and their ill moral decisions, there is always the worry of these tools being abused by the system to convert its citizens into puppets with no powers of critical reflection to protest against the system. Moreover, limiting a person's capabilities for moral decision would be considered inhumane. Being moral requires individuals to have the possibility to choose between what is right and what is wrong. Once that capacity is taken from us, so is part of our humanness—we turn into no more than a rod in a machine. Thus we should be critical of these types of interventions, even if at first sight they seem to be in accordance with the goals of the criminal system.

Social Institutions Involved (Medical vs. Criminal Justice System)

These type of intervention fall between two important social institutions, namely the medical and the criminal justice system. There could be a tension posed by the cooperation and coordination required by these two different systems: on the one hand, the criminal justice system organized to protect society and punish wrongdoing and, on the other hand, the forensic physicians whose main goal is to treat and care. One issue is connected to the misuse or even abuse of memory interventions that were designed as therapies and later used in the criminal context, such as giving propranolol to criminal offenders to dampen their memories rather than for treating hypertension. Given the role memories have for human flourishing and well-being, intervening in offenders' memories without any clear therapeutical aim can be seen as a cruel and degrading form of punishment or rehabilitation.

One more issue under this category involves the equivalence of care principle, which entails that the forensic setting should be treated just as any other clinical setting, in which prisoners would have a right to request and receive treatment as long as it was likely to be effective and its cost and effectiveness render it a better alternative compared with other available interventions. In addition, the Standard Minimum Rules for the Treatment of Prisoners states that "treatment shall be such as will encourage their self-respect and develop their sense of responsibility … to these ends, all appropriate means shall be used, including … strengthening of moral character" (Office of the United Nations High Commissioner for Human Rights 1977, ¶66). Thus, even if at present the interventions mentioned above are not yet available, it is not too far-fetched to think that in the future, some forms of memory modification technologies with similar goals might become available. For instance, memory interventions that are focused on the "strengthening of moral character" as a form of rehabilitation could be regarded as permissible and even as necessary for some jurisdictions. However, it remains uncertain whether, in all cases, offenders should be regarded as retaining the right to ask for interventions like these, as they are not therapeutical in a strict sense.

The ethical issues presented here should be seen just as a starting point. As new developments come forward, making some memory modification a reality and not just a matter of speculation (i.e., a substantive and targeted erasure of memories), and as new empirical evidence regarding safety, effectiveness, and social acceptance of memory interventions becomes available, we would need to keep the conversation going. Thus, as new technologies to manipulate memories are developed, we should strive to keep a rich and meaningful discussion among healthcare professionals, legal experts and society regarding the following: (1) which interventions should be permitted in the case of offenders' memory modification; (2) for which cases the interventions should be allowed; and (3) which penological goals should be sought. Clearly, the fact that, in the near future, new and more specific forms of memory modification come to existence does not mean that we should accept any form of memory intervention to fulfil retributive or other non-retributive criminal justice goals.

To summarize, the case of memory interventions is already a widely discussed topic in the literature, however one that has not been widely discussed regarding its application for criminal offenders. In cases using new technological advances, or using those already available but not for strictly medical purposes, we "need to be vigilant to avoid the over-enthusiastic adoption of unproven 'treatments'—practiced in the brains of, at best, unsympathetic and, at worst, despised people" (Greely 2008, 1105). In addition, given the complex ethical issues involved, establishing ethically justified criteria regarding the possibility of interventions aimed at

modifying offenders' memories cannot be a "yes or no, they should/shouldn't be allowed" matter. Rather, possible justification has to be discussed on a case-by-case basis. In particular, there are a couple of steps we consider to be key in this assessment. First, identify whether the intervention dampens or enhances a given memory. Second, identify the intended outcome of the intervention; for instance, whether it promotes that the offender will be less likely to commit a similar crime in the future, or that he will remember his acts as a way to take responsibility of his action. Then, the intervention has to be proven sufficiently effective, and with an acceptable level of risk or harm. In particular, if the intervention has proven effective, and if the suggested memory intervention has a higher chance of bringing benefit than harm to the offender, then the memory intervention can be offered and recommended. However, if the balance between benefit and harm is similar, then the intervention can be offered but it should not be recommended. Finally, if the evidence shows that the risk of harm is higher than its possible benefits, then it should not be offered and other available options should be considered. In terms of benefits and harms, one could ask whether the corresponding benefits and harms to society should be considered (if at all). In this regard, we think that this balance is an important part of the evaluation; however, as John Rawls nicely captured it, "each person possesses an inviolability founded on justice, that even the welfare of society as a whole cannot override" (Rawls 2009, 3−4). Thus, when thinking of memory interventions, it is plausible to argue that this is an area in which individuals have rights secured by justice that cannot be subject to the calculus of social interests. However, given the complexity of this issue, here we can only raise this point for further consideration.

In cases where the memory intervention is offered, in order to be considered ethically justified, the offer would need to be a clear genuine offer and not a threat. In cases where the interventions are not offered given the evidence against them, then they should not be made available to offenders even if they request them; instead, an alternative method should be offered. We also have to ensure that an informed, competent adult accepts the intervention voluntarily. If the offender gives his or her informed consent, then we might proceed with the suggested memory intervention; otherwise, alternative available options should be sought. Finally, it is the authors' view that priority should be given to less invasive methods unless there is substantial evidence that a more invasive method outperforms a less invasive method, and has proven to bring more benefits than risks. Similarly, interventions should not cause major changes in the overall personality of the offender or significant harm to his/her cognitive abilities.[3]

Conclusion

Memory interventions, whether carried out for enhancing or dampening memories, should not be taken lightly, in particular because we still do not know much about how different memory systems are connected and how direct and targeted alterations of certain memory processes are or might change individual lives and their moral development/judgment. We hope to have made clear that, given the role our memories have for moral reflection and decision-making, the criteria to be considered for assessing their manipulation have to be defined with great caution and sensitivity to the particular context of application. Thus, we should keep a dynamic and open discussion about the relevant ethical issues connected to memory interventions within the forensic setting. Memory interventions are not inherently morally wrong, but there are many cases in which the justification for undergoing such interventions fulfils neither the criterion of protecting communities, nor the individual possibility of retribution or rehabilitation. Finally, more work remains to be done in gathering empirical data supporting the efficiency and safety of memory intervention technologies, and on the values and assumptions underlying the choices of which interventions we opt for, under which circumstances, and for what purposes they should be used, including questioning what we owe to the victims of crime as well as its perpetrators.

Acknowledgements We kindly thank comments from various commentators in different seminar presentations where earlier versions of this paper were presented, as well as the reviewers' comments, which helped to improve this manuscript.

[3] Greely (2008) has put forward similar criteria, but he argues that the intervention should "not cause major … substantial loss of remembered personal history." In the case of memory modification, this is a criterion that, depending on the memory modification at stake, might be hard if not impossible to fulfil.

References

Balconi, M., and C. Ferrari. 2012. Emotional memory retrieval: rTMS stimulation on left DLPFC increases the positive memories. *Brain Imaging and Behavior* 6(3): 454–461.

Beauchamp, T.L., and J.F. Childress. 2001. *Principles of biomedical ethics*, 5th ed. New York: Oxford University Press.

Brasil-Neto, J.P. 2012. Learning, memory, and transcranial direct current stimulation. *Frontiers in Psychiatry* 3: 80. doi:10.3389/fpsyt.2012.00080.

Council of Europe. 2010. *European convention on human rights*. Strasbourg: Council of Europe. http://www.echr.coe.int/Documents/Convention_ENG.pdf.

Dufner, A. 2013. Should the late stage demented be punished for past crimes? *Criminal Law and Philosophy* 7(1): 137–150.

Editorial. 2013. Focus on memory. *Nature Neuroscience* 16(2): 111.

Erler, A. 2011. Does memory modification threaten our authenticity? *Neuroethics* 4(3): 235–249.

Farah, M.J., J. Illes, R. Cook-Deegan, H. Gardner, and E. Kandel. 2004. Neurocognitive enhancement: what can we do and what should we do? *Nature Reviews Neuroscience* 5(5): 421–425.

Farah, M.J. 2010. *Neuroethics: An introduction with readings*. Cambridge, MA: MIT Press.

Ferruci, R., F. Mameli, I. Guidi, et al. 2008. Transcranial direct current stimulation improves recognition memory in Alzheimer's disease. *Neurology* 71(7): 493–498.

Frankfurt, H.G. 1971. Freedom of the will and the concept of a person. *The Journal of Philosophy* 68(1): 5–20.

Fregni, F., and A. Pascual-Leone. 2007. Technology insight: Noninvasive brain stimulation in neurology—perspectives on the therapeutic potential of rTMS and tDCS. *Nature Clinical Practice Neurology* 3(7): 383–393.

Gagnon, G., S. Blanchet, S. Grondin, and C. Schneider. 2010. Paired-pulse transcranial magnetic stimulation over the dorsolateral prefrontal cortex interferes with episodic encoding and retrieval for both verbal and non-verbal materials. *Brain Research* 1344: 148–158. doi:10.1016/j.brainres.2010.04.041.

Gagnon, G., C. Schneider, S. Grondin, and S. Blanchet. 2011. Enhancement of episodic memory in young and healthy adults: A paired-pulse TMS study on encoding and retrieval performance. *Neuroscience Letters* 488(2): 138–142.

George, M.S., F. Padberg, T.E. Schlaepfer, et al. 2009. Controversy: Repetitive transcranial magnetic stimulation or transcranial direct current stimulation shows efficacy in treating psychiatric diseases (depression, mania, schizophrenia, obsessive-compulsive disorder, panic, posttraumatic stress disorder). *Brain Stimulation* 2(1): 14–21.

Greely, H.T. 2008. Neuroscience and criminal justice: Not responsibility but treatment. *Kansas Law Review* 56: 1103–1138.

Greely, H., B. Sahakian, J. Harris, et al. 2008. Towards responsible use of cognitive-enhancing drugs by the healthy. *Nature* 456(7223): 872–872.

Handtke, V., W. Bretschneider, T. Wangmo, and B. Elger. 2012. Facing the challenges of an increasingly ageing prison population in Switzerland: In search of ethically acceptable solutions. *Bioethica Forum* 5(4): 134–141.

Herculano-Houzel, S. 2003. What does the public want to know about the brain? *Nature Neuroscience* 6(4): 325.

Human Rights Watch. 2012. *Old behind bars: The aging prison population in the United States*. New York: Human Rights Watch.

Javadi, A.H., and V. Walsch. 2012. Transcranial direct current stimulation (tDCS) of the left dorsolateral prefrontal cortex modulates declarative memory. *Brain Stimulation* 5(3): 231–241.

Kandel, E.R., and L.R. Squire. 2000. Neuroscience: Breaking down scientific barriers to the study of brain and mind. *Science* 290(5494): 1113–1120.

Karton, I., and T. Bachmann. 2011. Effect of prefrontal transcranial magnetic stimulation on spontaneous truth-telling. *Behavioural Brain Research* 225(1): 209–214.

Kolber, A. 2006. Therapeutic forgetting: The legal and ethical implications of memory dampening. *Vanderbilt Law Review* 59(5): 1561–1626.

Levy, N. 2007. *Neuroethics*. Cambridge and New York: Cambridge University Press.

Liao, S.M., and A. Sandberg. 2008. The normativity of memory modification. *Neuroethics* 1(2): 85–99.

Locke, J. 1975. On identity and diversity. In *Personal identity*, edited by J. Perry, 32–52. Berkeley: University of California Press.

Loftus, E.F. 2003. Make-believe memories. *American Psychologist* 58(11): 867–873.

Luber, B.C., P.S. Fisher, M. Appelbaum, M. Ploesser, and S.H. Lisanby. 2009. Non-invasive brain stimulation in the detection of deception: Scientific challenges and ethical consequences. *Behavioral Sciences and the Law* 27(2): 191–208.

Luna, F. 2009. Elucidating the concept of vulnerability: Layers not labels. *International Journal of Feminist Approaches to Bioethics* 2(1): 121–139.

Luria, A.R. 1987. *The mind of a mnemonist: A little book about a vast memory*. Cambridge, MA: Harvard University Press.

Lynch, G. 2002. Memory enhancement: The search for mechanism-based drugs. *Nature Neuroscience* 5(11s): 1035–1038.

Merkel, R., G. Boer, J. Fegert, et al. 2007. *Intervening in the brain: Changing psyche and society*. Berlin: Springer.

Nuffield Council on Bioethics. 2013. *Novel neurotechnologies: Intervening in the brain*. London: Nuffield Council on Bioethics.

Office of the United Nations High Commissioner for Human Rights. 1977. *Standard minimum rules for the treatment of prisoners*. Geneva: United Nations.

Phelps, E.A. 2004. Human emotion and memory: interactions of the amygdala and hippocampal complex. *Current Opinion in Neurobiology* 14(2): 198–202.

Pitman, R.K., K.M. Sanders, R.M. Zusman, et al. 2001. Pilot study of secondary prevention of post-traumatic stress disorder with pro-pranolol. *Biological Psychiatry* 51(2): 189–192.

Popper, K.R., and J.C. Eccles. 1985. *The self and its brain*. Berlin: Springer-Verlag.

Porter, S., A.R. Birt, J.C. Yuille, and H.F. Herve. 2001. Memory for murder: A psychological perspective on dissociative amnesia in legal contexts. *International Journal of Law and Psychiatry* 24(1): 23–42.

President's Council of Bioethics. 2003. *Beyond therapy: Biotechnology and the pursuit of happiness*. Washington, DC: President's Council of Bioethics.

Rawls, J. 2009. *A theory of justice*. Cambridge, MA: Harvard University Press.

Reist, C., J.G. Duffy, L. Cahill, and K. Fujimoto. 2001. β–adrenergic blockade and emotional memory in PTSD. *International Journal of Neuropsychopharmacology* 4(4): 377–383.

Roache, R. 2008. Ethics, speculation, and values. *Nanoethics* 2(3): 317–327.

Rossi, S., M. Hallett, P.M. Rossini, et al. 2009. Safety, ethical considerations, and application guidelines for the use of transcranial magnetic stimulation in clinical practice and research. *Clinical Neurophysiology* 120(12): 2008–2039.

Schacter, D.L. 2001. *The seven sins of memory: How the mind forgets and remembers*. Boston: Houghton Mifflin.

Schechtman, M. 2007. *The constitution of selves*. Ithaca, NY: Cornell University Press.

Schmidt, S.R. 1994. Effects of humor on sentence memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 20(4): 953–967.

Shaw, E. 2014. Direct brain interventions and responsibility enhancement. *Criminal Law and Philosophy* 8(1): 1–20.

Snead, O.C. 2011. Memory and punishment. *Vanderbilt Law Review* 64(4): 1195–1264.

Sparing, R., and F.M. Mottaghy. 2008. Noninvasive brain stimulation with transcranial or direct current stimulation (TMS/tDCS)—from insights into human memory to therapy of its dysfunction. *Methods* 44(4): 329–337.

Tulving, E. 1972. Episodic and semantic memory. In *Organization of memory*, edited by E. Tulving and W. Donaldson, 381–402. New York and London: Academic Press.

United Nations. 2013. *Handbook on strategies to reduce overcrowding in prisons*. New York: United Nations.

Vaiva, G., F. Ducrocq, K. Jezekiel, et al. 2003. Immediate treatment with propranolol decreases post-traumatic stress disorder two months after trauma. *Biological Psychiatry* 54(9): 947–949.

Vincent, N. 2011. Capacitarianism, responsibility and restored mental capacities. In *Technologies on the stand: Legaland ethical questions in neuroscience and robotics*, edited by B. van den Berg and L. Klaming, 41–62. The Netherlands: WLP.

Williams, W., W. Huw, A.J. Mewse, et al. 2010. Traumatic brain injury in a prison population: Prevalence and risk for reoffending. *Brain Injury* 24(10): 1184–1188.