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Memory and Punishment

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Memory and Punishment

*O. Carter Snead**

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*Canst thou not minister to a mind diseas'd, / Pluck from the
memory a rooted sorrow, / Raze out the written troubles of the
brain, / And with some sweet oblivious antidote / Cleanse the
stuff'd bosom of that perilous stuff / Which weighs upon the
heart?*

— Macbeth¹

*Retribution, deterrence, incapacitation, and rehabilitation all
presuppose a particular view of a person's existence over time.*

— Rebecca Dresser²

INTRODUCTION

Developments in cognitive neuroscience—the science of how the brain enables the mind—continue to prompt profound scholarly debate and reflection on the practice and theory of criminal law. Advances in the field have raised vexing questions relating to lie detection, interrogation methods, the Fifth Amendment right against compelled self-incrimination, competency to stand trial, defenses to guilt (such as diminished capacity and insanity), sentencing, and the relationship between moral responsibility and punishment.³ Similarly,

1. WILLIAM SHAKESPEARE, *MACBETH* act 5, sc. 3.

2. Rebecca Dresser, *Personal Identity and Punishment*, 70 B.U. L. REV. 395, 397 (1990).

3. See, e.g., Dov Fox, *The Right to Silence as Protecting Mental Control*, 42 AKRON L. REV. 763, 765, 801 (2009) (arguing for Fifth Amendment protection against techniques such as brain imaging that seek to ascertain a person's thoughts); Stephen J. Morse, *Brain Overclaim Syndrome and Criminal Responsibility: A Diagnostic Note*, 3 OHIO ST. J. CRIM. L. 397, 406–10 (2006) (providing a neuroscience perspective on *Roper v. Simmons*, 543 U.S. 551 (2005), which held imposition of the death penalty on defendants under eighteen years old unconstitutional); Michael S. Pardo, *Neuroscience Evidence, Legal Culture, and Criminal Procedure*, 33 AM. J. CRIM. L. 301, 321–37 (2006) (arguing that neuroscience evidence should be subject to the same

for the past decade, philosophers, scientists, clinicians, and legal scholars have been engaged in a major debate about the cognitive neuroscience of memory and new capacities to modify it by neurobiological means. The primary focus of such debate has been on the ethical dimensions of memory modification.⁴ To date, however,

Fourth and Fifth Amendment protections as other types of evidence); Michael L. Perlin, "And I See Through Your Brain": Access to Experts, Competency to Consent, and the Impact of Antipsychotic Medications in Neuroimaging Cases in the Criminal Trial, 2009 STAN. TECH. L. REV. 4, <http://stlr.stanford.edu/pdf/perlin-and-i-see.pdf> (discussing the impact of neuroimaging evidence in criminal procedure); O. Carter Snead, *Cognitive Neuroscience and the Future of Punishment*, in TECHNOLOGY AND THE FUTURE OF CONSTITUTIONAL DEMOCRACY (Jeffrey Rosen ed., forthcoming), available at http://www.brookings.edu/~media/Files/rc/papers/2010/1228_neuroscience_snead/1228_neuroscience_snead.pdf (relating developments in cognitive neuroscience to conceptions of punishment in the criminal law); O. Carter Snead, *Neuroimaging and the "Complexity" of Capital Punishment*, 82 N.Y.U. L. REV. 1265, 1318–27 (2007) (exploring the relationship between emerging neuroimaging technology, capital mitigation, and theories of punishment); Sean Kevin Thompson, *The Legality of the Use of Psychiatric Neuroimaging in Intelligence Interrogation*, 90 CORNELL L. REV. 1601, 1611–36 (2005) (examining the legality of using neuroimaging during interrogations of foreign detainees); see also Bruce A. Arrigo, *Punishment, Freedom, and the Culture of Control: The Case of Brain Imaging and the Law*, 33 AM. J.L. & MED. 457, 464–72 (2007) (examining neuroimaging as a mechanism of a "culture of control" as understood through critical social theory); Teneille Brown & Emily Murphy, *Through a Scanner Darkly: Functional Neuroimaging as Evidence of a Criminal Defendant's Past Mental States*, 62 STAN. L. REV. 1119, 1128–30 (2010) (commenting on the use of brain mapping technology to establish requisite state of mind in criminal cases); Owen Jones et al., *Brain Imaging for Legal Thinkers: A Guide for the Perplexed*, 2009 STAN. TECH. L. REV. 5, <http://stlr.stanford.edu/pdf/jones-brain-imaging.pdf> (providing an overview of brain imaging and its use in legal proceedings); J.W. Looney, *Neuroscience's New Techniques for Evaluating Future Dangerousness: Are We Returning to Lombroso's Biological Criminality?*, 32 U. ARK. LITTLE ROCK L. REV. 301 (2010) (looking at predictive neuroscience as it relates to the criminal law); Julie Elizabeth Myers, Comment, *The Moment of Truth for fMRI: Will Deception Detection Pass Admissibility Hurdles in Oklahoma?*, 6 OKLA. J.L. & TECH. 47 (2010), <http://www.okjolt.org/images/pdf/2010okjoltrev47.pdf> (commenting on whether or not neuroimaging as a reliable form of lie detection will pass admissibility tests in Oklahoma).

4. See, e.g., BRITISH MED. ASS'N, BOOSTING YOUR BRAINPOWER: ETHICAL ASPECTS OF COGNITIVE ENHANCEMENTS 16–28 (2007) (discussing ethical implications of cognitive enhancements); PRESIDENT'S COUNCIL ON BIOETHICS, BEYOND THERAPY: BIOTECHNOLOGY AND THE PURSUIT OF HAPPINESS 44–56 (2003) (discussing the ethical implications of genetic engineering); Martha J. Farah et al., *Neurocognitive Enhancement: What Can We Do and What Should We Do?*, 5 NATURE REVIEWS NEUROSCIENCE 421, 421–24 (2004) (discussing possible neurocognitive enhancements and the resulting ethical and policy implications); Adam J. Kolber, *Therapeutic Forgetting: The Legal and Ethical Implications of Memory Dampening*, 59 VAND. L. REV. 1561, 1595–613 (2006) (analyzing the ethical issues surrounding memory-dampening technology); see also Henry T. Greely et al., *Towards Responsible Use of Cognitive-Enhancing Drugs by the Healthy*, 456 NATURE 702, 703–05 (2008) (suggesting some general ethical guidelines for the development of cognitive-enhancing drugs); Michael Henry, Jennifer R. Fishman & Stuart J. Youngner, *Propranolol and the Prevention of Post-Traumatic Stress Disorder: Is It Wrong to Erase the "Sting" of Bad Memories?*, AM. J. BIOETHICS, Sept. 2007, at 12, 12 (discussing specific memory erasure to prevent PTSD, and followed by academic responses and critiques of the authors' position); Erik Parens, *The Ethics of Memory Blunting and the Narcissism of Small Differences*, 3 NEUROETHICS 99, 104–06 (2010) (discussing disagreement

there has been no in-depth scholarly synthesis of these two important and related avenues of inquiry. This Article means to open the discussion about the implications of neurobiological memory modification for criminal law. Its point of entry is the fertile context of criminal punishment, in which memory plays a crucial role. Specifically, this Article will argue that there is a deep relationship between memory and the foundational principles justifying how punishment should be distributed, including retributive justice, deterrence, rehabilitation, incapacitation, moral education, and restorative justice. For all such theoretical justifications, the questions of *whom* and *how much* to punish are inextricably intertwined with how a crime is remembered—by the offender, by the sentencing authority, and by the broader community. Because this is so, new neurobiological techniques to modify memory—including interventions to erase some or all memory, to dampen the emotional or affective content of memory, and to enhance the duration and intensity of memory—pose, in principle, special challenges for the just and effective distribution of punishment. This Article explores the substance and contours of these challenges. It is meant to prepare the necessary groundwork for future scholarship on how the law, as enacted, enforced, and interpreted, should respond (if at all) to such concerns.

To that end, Part I offers a necessarily compressed and basic account of the cognitive systems and biological mechanisms of memory. It discusses how revolutionary developments in molecular and systems biology prepared the way for a cognitive neuroscience of memory. It concludes with a discussion of the biological role of emotion in memory. Part II explores a variety of techniques for modifying memory, including memory erasure, memory “dampening” (down-regulating the emotional content of memory), and memory enhancement. Part III offers a humanistic account of memory and its role for the individual and his relationship with others (both on a small and large scale). This Part concludes with a brief reflection on memory, emotion and morality. Part IV explores the implications of memory modification for punishment. It includes a reflection on law and memory as a general matter. It then takes each traditional distributive principle of punishment (retributive justice, deterrence, rehabilitation, incapacitation, moral education, and restorative justice) and shows how the central animating aims of each depend in

regarding the different circumstances in which memory blunting might be ethically and socially acceptable).

crucial ways upon the true (meaning accurate) and fitting (in terms of emotional modulation) memory of the defendant, the sentencing authority, and the broader community. Part IV uses hypothetical cases to illustrate the variety of ways in which memory modification might confound the effective and just distribution of punishment (especially capital punishment). The Article concludes by flagging future questions for consideration.

Before proceeding, it is necessary to state clearly that this Article is *not* claiming that the era of widespread and effective neurobiological memory modification is upon us. To the contrary, the science of this field is in its infancy. Moreover, the chief clinical applications of the memory modification interventions discussed below are for individuals suffering from diseases and disorders that touch and concern memory (for example, Alzheimer's disease and PTSD). The Article is certainly not meant as a criticism of this avenue of research or those applications. That said, there is widespread interest (and thus a potentially lucrative market) for memory enhancement in healthy people (for example, improving memory beyond the normal range). This Article does not engage the ethical question of enhancement as such. Instead, it takes these projected uses as a fruitful opportunity to consider the relationship between memory and punishment and thus prepare the groundwork for a future discussion of how, if at all, the law should respond. It is always useful to consider such questions *before* novel biotechnological interventions move into widespread use. In this way, this Article means to follow the wise (and pithy) observation of Steven P.R. Rose that "it is important that we try to be proactive in advance of the technological development, rather than constantly trying to close already open stable doors."⁵

I. WHAT IS MEMORY? A COGNITIVE AND SCIENTIFIC ACCOUNT

During the past two centuries, the study of memory, and the study of cognition in general, has been central to three disciplines: first philosophy, then psychology, and now biology.

— Larry R. Squire⁶

To explore fully the challenges posed by new neurological techniques of memory modification for criminal punishment, it is first necessary to discuss the cognitive and biological dimensions of

5. Stephen P.R. Rose, 'Smart Drugs': Do They Work? Are They Ethical? Will They Be Legal?, 3 NATURE REVIEWS NEUROSCIENCE, 975, 978 (2002).

6. Larry R. Squire, *Memory Systems of the Brain: A Brief History and Current Perspective*, 82 NEUROBIOLOGY LEARNING & MEMORY, 171, 175 (2004).

memory. The science of memory is obviously a vast and contested domain. It would require many volumes to engage this field responsibly. This, however, is far beyond the scope of the present inquiry. Rather, the following will be a necessarily cursory treatment, with special emphasis on the forms of memory most relevant to the question at hand.

Though memory has long been the focus of philosophical reflection,⁷ the first empirical study of memory and its function was done by Hermann Ebbinghaus in 1885, who conducted an experiment (using himself as the sole subject) meant to measure the temporal relationship between encoding, retrieving, and forgetting information. He memorized long sequences of nonsense syllables, and tested his own memory, varying the length of time between learning the lists and trying to recall them. He found that the longer the delay, the less he could recall.⁸ He also learned that memories are strengthened by repetition.⁹ Later, in 1904, evolutionary biologist Richard Semon¹⁰ published a monograph, *Die Mneme* (a reference to the Greek goddess of memory, "Mnemosyne"), in which he "tried to unite the biological analysis of heredity with the psychological analysis of memory."¹¹ Semon conceived of memory as a biologically-based mechanism for preserving experiences over time.¹² One of Semon's lasting contributions to the science of memory was his term "engram," denoting the "enduring change in the nervous system ('memory trace')

7. See, e.g., PLATO, THEAETETUS 163a–64c (Bernard Williams ed., M.J. Levett trans., Hackett Publ'g Co. 1992) (n.d.); ARISTOTLE, ON MEMORY & REMINISCENCE *passim* (G.R.T. Ross trans., Arno Press 1973) (n.d.); AUGUSTINE, II CONFESSIONS 93–145 (William Watts trans., Harvard Univ. Press 1999) (1631); RENÉ DESCARTES, PASSIONS OF THE SOUL 41–42, 59, 90–91, 132, 134 (Stephen Voss trans., Hackett Publ'g Co. 1989) (1649); THOMAS HOBBS, LEVIATHAN 14 (Oxford Univ. Press 1958) (1651); JOHN LOCKE, AN ESSAY CONCERNING HUMAN UNDERSTANDING 141–43, in 33 GREAT BOOKS OF THE WESTERN WORLD (Mortimer J. Adler ed., Robert P. Gwinn, 2d ed. 1990) (1690); DAVID HUME, AN ENQUIRY CONCERNING HUMAN UNDERSTANDING *passim*, in 33 GREAT BOOKS OF THE WESTERN WORLD, *supra* (1748); FRIEDRICH NIETZSCHE, ON THE GENEALOGY OF MORALS 57–96 (Walter Kaufmann & R.J. Hollingdale trans., Vintage Books 1969) (1887); GEORGE SANTAYANA, 1 THE LIFE OF REASON 394–96 (Prometheus Books 1998) (1905); BERTRAND RUSSELL, THEORY OF KNOWLEDGE *passim* (Elizabeth Ramsden Eames ed., George Allen & Unwin 1984) (1913).

8. DANIEL L. SCHACTER, SEARCHING FOR MEMORY: THE BRAIN, THE MIND, AND THE PAST 73 (1996).

9. LARRY R. SQUIRE & ERIC R. KANDEL, MEMORY: FROM MIND TO MOLECULES 4 (1999).

10. Semon was a student of Ernst Haeckl. DANIEL L. SCHACTER, FORGOTTEN IDEAS, NEGLECTED PIONEERS: RICHARD SEMON AND THE STORY OF MEMORY 3 (2001).

11. SCHACTER, *supra* note 8, at 57.

12. See *id.* (describing the origins of *Die Mneme*).

that conserves effects of experience over time.”¹³ As will be discussed further below,¹⁴ this notion of a “memory trace” closely tracks the modern view that a new pattern of neural connections in the brain, strengthened over time, is the “brain’s record of the event.”¹⁵

Thereafter, psychology continued to be the principle disciplinary locus of the study of memory. The founder of modern psychology, William James, devoted much attention to the question of memory.¹⁶ Researchers Georg Müller and Alfons Pilzecker suggested that lasting memory becomes “consolidated” over time.¹⁷ The “Behaviorist Revolution” led to important innovations (such as the work on classical conditioning by Pavlov and trial and error learning by Thorndike) allowing for the study of learning and memory in animals.¹⁸ The “Cognitive Revolution” further deepened the study of memory, including especially the work of Frederic C. Bartlett, who studied memory in a naturalistic way in human subjects.¹⁹

Many important early developments in the science of memory in human subjects emerged from research involving amnesiacs. The famous case of Henry Molaison (“H.M.”), studied by Scoville and Milner in 1951,²⁰ for example, shed light on the distinctive systems of memory and their reliance on different regions of the brain. As a treatment for seizures, H.M. had a number of structures in his medial temporal lobes (“MTL”) removed, including much of his hippocampus, his amygdala, and some adjacent portions of the temporal cortex. This erased his memories of personal experiences shortly before the operation, though he could still retain some memories predating that event. He was incapable, however, of forming new memories of personal experiences, though he could learn new skills.²¹ The case of

13. *Id.* Schacter notes Semon’s other terminological contributions, including “engraphy” (encoding information), and “ecphory” (retrieval of information). Famed U.S. psychologist Henry J. Watt thought that Semon’s most important contribution was the “concept of the ecphoric stimulus.” *Id.*

14. *See infra* Part II.B.

15. SCHACTER, *supra* note 8, at 59. Schacter notes that Donald Hebb, a Canadian psychologist, was the first researcher to suggest this conception of memory. *Id.*

16. *See* WILLIAM JAMES, 1 THE PRINCIPLES OF PSYCHOLOGY 643–89 (1890) (devoting an entire chapter to a discussion of memory).

17. SQUIRE & KANDEL, *supra* note 9, at 4.

18. *Id.* at 5.

19. *Id.* at 6.

20. William Beecher Scoville & Brenda Milner, *Loss of Recent Memory After Bilateral Hippocampal Lesions*, 20 J. NEUROLOGY, NEUROSURGERY & PSYCHIATRY 11 (1957).

21. *Id.* at 17; *see also* SCHACTER, *supra* note 8, at 137 (discussing H.M.’s memory loss); C. Stark, *Declarative Memory*, in 1 ENCYCLOPEDIA OF BEHAVIORAL NEUROSCIENCE 371, 371 (2010) (discussing H.M.).

H.M. revealed that the MTL plays a time-limited role in encoding certain kinds of memories, memory and cognition are separate and distinct, short-term (working) memory does not rely on the same structures in the MTL, and some types of long-term memory (motor skills, etc.) do not rely on the MTL.²²

Finally, the "Biological Revolution" saw developments in molecular biology (including especially the work of Watson and Crick on the structure of DNA) and, later, systems biology (augmented by developments in structural and functional imaging techniques) that advanced the science of memory further than ever before.²³ As a result, there is now a large and growing understanding of how certain genes (and related factors), the molecular mechanisms of neural signaling, and the various circuits and regions of the brain all support and sustain human memory.²⁴

In short, in the fairly recent past, an interdisciplinary synthesis of clinicians (including psychologists, neurologists, and psychiatrists), cognitive psychologists, and neuroscientists revolutionized the science of memory.²⁵ This has opened the possibility of a *cognitive neuroscience of memory* integrated with a *molecular biology of cognition*.²⁶ As a result, memory can now be explored in terms of cognition, cellular and molecular mechanisms, and the neural systems of the brain.²⁷ In this way, "[m]emory promises to be the first mental faculty to be understandable in a language that makes a bridge from molecules to mind, that is, from molecules to cells, to brain systems, and to behavior."²⁸

A. The Cognitive "Systems" of Memory

Modern scientists, clinicians, and scholars have long suspected that memory is a multifaceted faculty, composed of distinctive

22. See Stark, *supra* note 21, at 371; see also SQUIRE & KANDEL, *supra* note 9, at 15 (using the case of H.M. to describe the difference between declarative and nondeclarative memory).

23. SQUIRE & KANDEL, *supra* note 9, at 7.

24. See *id.* at 135-40 (discussing the molecular biology of memory and the effect of genetics on memory).

25. SCHACTER, *supra* note 8, at 4-6.

26. SQUIRE & KANDEL, *supra* note 9, at 211.

27. *Id.* at 7 ("[T]he biology of memory can now be studied at two different levels, one aimed at nerve cells and the molecules within nerve cells, and the other aimed at brain structures, circuitry, and behavior.").

28. *Id.* at 3.

divisions.²⁹ Around 1980, as part of the culmination of memory research involving human and animal subjects, scientists “converged on the view that a fundamental distinction could be drawn between a kind of memory that is accessible to conscious recollection and another kind that is not.”³⁰ This view was gradually expanded into a more complex array of “systems” of memory, cognitively distinguishable, and relying upon different structures of the brain.³¹ The current understanding is that memory includes an array of distinctive processes and systems, involving different neural structures.³² It has been suggested that various memory systems evolved because they serve starkly different purposes.³³ Nevertheless, the systems of memory do not operate in isolation—one experience can produce many forms of memory, and different kinds of memory may recruit overlapping regions of the brain.³⁴

The term “declarative” memory was introduced to capture one system, and “nondeclarative” memory to capture “an umbrella term referring to several memory systems.”³⁵ “Nondeclarative” memory (also called “implicit” memory) includes:

a large family of different memory abilities sharing one feature in particular. In each case, memory is reflected in performance—in how we do something. This kind of memory includes various motor and perceptual skills, habits, and emotional learning, as well as . . . habituation, sensitization, and classical and operant conditioning.³⁶

Nondeclarative memory is unconscious—it cannot be called to mind. It is not true or false. Examples include “procedural memory” for skills and habits (for example, riding a bicycle), “priming” (also called “perceptual representation,” which denotes an increased capacity to

29. Squire, *supra* note 6, at 171 (noting that Maine de Biran in 1804 “wrote about mechanical memory, sensitive memory, and representative memory”; William James in 1890 distinguished memory from habit; Henri Bergson likewise made such a distinction; McDougall (1923), Tolman (1948), Ryle (1949), and Bruner (1969) also drew various distinctions among different kinds of memory). Note, however, that the earliest theories of memory assumed that it was a unitary faculty. See S. Matthew Liao & Anders Sandberg, *The Normativity of Memory Modification*, 2008 *NEUROETHICS* 85, 86 & n.2 (citing PLATO, *supra* note 7).

30. Squire, *supra* note 6, at 171.

31. See *id.* at 172, 174.

32. SCHACTER, *supra* note 8, at 5; see also Squire, *supra* note 6, at 175 (“[T]he notion of multiple memory systems is now widely accepted.”).

33. See Squire, *supra* note 6, at 174 (noting, for example, that “the gradual changes that occur in birdsong learning are fundamentally different from and have a different function than the rapid learning that occurs when a bird catches food for later recovery”).

34. SQUIRE & KANDEL, *supra* note 9, at 70.

35. Squire, *supra* note 6, at 173 (citation omitted).

36. SQUIRE & KANDEL, *supra* note 9, at 24.

detect or identify objects after a recent encounter with them³⁷, perceptual learning ("an improvement in the ability to discriminate simple perceptual attributes, such as tones or line orientations, simply as the result of performing the discriminations repeatedly"³⁸), simple classical conditioning, and nonassociative learning.³⁹

By contrast, "declarative" memory (also called "explicit" or "conscious" memory") is present in the individual's conscious and can be intentionally called to mind. It is memory of "knowledge that can potentially be *declared*, that is, brought to mind as a verbal proposition or as a mental image."⁴⁰ This is what meant by "memory" in the colloquial sense. Declarative memory can be further divided into what is sometimes called "short-term" and "long-term" memory. "Short-term" memory denotes the cognitive faculty that retains information only temporarily until it is forgotten or consolidated into a more long-term form of storage.⁴¹ "Short-term memory" includes "immediate memory," which captures information that is the object of current attention (it is thought that for most people, this can include up to approximately seven items, such as a U.S. phone number).⁴² Immediate memory can be retained for several minutes if it rehearsed actively (for example, repeating a phone number to oneself prior to dialing). Another form of "short-term" memory is "working memory"—a term coined by Alan Baddeley.⁴³ "Working memory" includes immediate memory that is retained for several minutes, the "phonological loop" (which temporarily stores memory of spoken words and meaningful sounds⁴⁴), and the "visuospatial sketchpad" (which stores visual images like faces and spatial configurations).⁴⁵

"Long-term" declarative memory can be divided into "semantic" and "episodic." "Semantic" memory (a term first discussed at length by

37. *Id.* at 160.

38. *Id.* at 164.

39. *See id.* at 24–25 (discussing nonassociative learning and classical conditioning, a type of associative learning, as parts of nondeclarative memory).

40. *Id.* at 70–71.

41. *See id.* at 84 (describing short-term memory). Squire and Kandel caution against using the phrase "short-term memory," and prefer to speak in terms of its subdivisions for purposes of clarity. *Id.*

42. *Id.*

43. *Id.*

44. *Id.* at 84–85.

45. *Id.* at 85. Baddeley recently added a fourth element of his model of working memory, the "episodic buffer," which links information across phonological and visual contexts in chronological fashion. *See generally* Alan Baddeley, *The Episodic Buffer: a New Component of Working Memory?*, 4 TRENDS COGNITIVE SCI. 417 (2000).

Endel Tulving in 1972⁴⁶), is a-contextual factual knowledge that does not require remembering any particular past event (for example, the knowledge that *Tyrannosaurus Rex* was a carnivore).⁴⁷ By contrast, episodic memory (sometimes called “source memory”) is autobiographical—it pertains to personal, contextual information gathered directly by the individual through experience, at a particular place and time.⁴⁸ Remembering a trip to Paris requires the exercise of episodic memory; remembering that Paris is the capital of France requires semantic memory. Episodic memory “stores spatial and temporal landmarks that identify the particular time and place when an event occurred.”⁴⁹ This form of memory is recently evolved (growing out of semantic memory).⁵⁰ It allows one to re-experience past events in one’s life, and has been likened to a form of time travel.⁵¹ “The essence of episodic memory lies in the conjunction of three concepts—self, autonoetic awareness, and subjectively sensed time.”⁵² It is arguably the richest form of memory and is certainly most directly relevant to the relationship between memory and punishment.

B. Biological Mechanisms of Memory

There is a vast and rich scientific literature on the biology of memory. For present purposes, however, it is necessary only to review briefly the scientific findings most relevant to memory (and its modification) and punishment. Thus, the following discussion will focus primarily on the basic biological mechanisms of long-term declarative memory (with special emphasis on episodic memory), and will briefly touch on how emotion augments such memory. By necessity, the discussion to follow will be brief and stated in the simplest possible terms.

46. Endel Tulving, *Episodic and Semantic Memory*, in ORGANIZATION OF MEMORY 381, 383 (Endel Tulving & Wayne Donaldson eds., 1972).

47. See *id.* at 387 (describing, and providing examples of, semantic memory).

48. See generally SQUIRE & KANDEL, *supra* note 9, at 106 (comparing episodic and semantic memory).

49. *Id.*

50. Endel Tulving, *Episodic Memory: From Mind to Brain*, 53 ANN. REV. PSYCHOL. 1, 5 (2002).

51. See *id.* at 2 (comparing recalling memories to time traveling).

52. *Id.* at 5.

1. Systems Neuroscience of Long-Term Declarative Memory

"Memory in the biological sense is best understood as the systems underlying our capacity for retaining, storing, and recalling experiences."⁵³ Stimuli encountered through the senses activate networks of neurons throughout the brain.⁵⁴ As Larry Squire and Eric Kandel have explained: "In each of the relevant areas, persistent changes are thought to occur in the strengths of connections among neurons, and as a result neurons respond differently after learning. It is thought that the aggregate activity in the collection of altered neurons comprises the long-term memory of what is perceived."⁵⁵ The strength of connections among neurons is increased through a process called "Long-Term Potentiation" ("LTP").⁵⁶

Neither memory in general, nor long-term declarative memory in particular, is "stored" in any one particular region of the brain. "The modern view is that memory is widely distributed but that different areas store different aspects of the whole."⁵⁷ Moreover, declarative memory of objects appears to be stored in a distributed manner across those brain regions that are activated while visually perceiving attributes of such objects in the first instance, including size, color, shape, and the like.⁵⁸ Retrieving declarative memory thus seems to involve the reconstruction of information (reactivation of the original network) distributed across these brain regions in response to a cue.⁵⁹ But it is not simply the activation of the original network. The network likewise incorporates new information from the present environment. Thus, "when we remember, we complete a pattern with the best match available in memory; we do not shine a spotlight on a stored picture."⁶⁰ Retrieval is likewise affected by emotion, mood, and state of mind.⁶¹

A key region of the brain for storing long-term declarative memory is the medial temporal lobe ("MTL"). The MTL is necessary for the initial encoding of new information, and remains essential for the consolidation of the memory and its ultimate establishment in the

53. Liao & Sandberg, *supra* note 29, at 86.

54. *See id.* (describing chemical processes in the brain).

55. SQUIRE & KANDEL, *supra* note 9, at 88.

56. *See id.* at 111 (discussing LTP and its features).

57. *Id.* at 10.

58. *Id.* at 72-73.

59. *Id.* at 74. For additional discussion of retrieval, including the theories of Antonio Damasio, Morris Moscovitch, and others, see SCHACTER, *supra* note 8, at 69-73.

60. SCHACTER, *supra* note 8, at 71.

61. SQUIRE & KANDEL, *supra* note 9, at 74.

cortex.⁶² Within the MTL, the hippocampus and adjacent cortical structures⁶³ appear to play a significant role in the conversion and storage of long-term declarative memory. Squire and Kandel offer a useful framework for understanding this process:

One possibility . . . is that, after an event occurs, the [MTL] rapidly stores links or pointers that connect it with the multiple cortical areas that together store a representation of the whole event. By this view, the [MTL] is needed initially to support both storage and retrieval of the event, and it directs the gradual linking together in cortex of the neuronal ensembles that participate in the memory. Eventually, the network of interconnected cortical areas is able to support storage and retrieval without the help of the [MTL] structures.⁶⁴

Thus, the MTL plays a temporary but crucial role in the transition of declarative memory from short-term to long-term memory. The observation of patients such as H.M., whose MTL had become disabled, has confirmed this. H.M. and others like him lost those memories that had not yet been consolidated into long-term storage in networks across the cortex, and were unable to form new long-term memories—a form of anterograde amnesia. Nevertheless, those memories that had undergone consolidation and relocated to the cortex (distributed across various networks), or did not otherwise depend on the MTL (for example, procedural or skills memory) remained intact.

The foregoing account applies to long-term declarative memory, including semantic memory. It is thought that episodic memory is encoded and consolidated in similar fashion, but that it additionally requires the work of the frontal lobes to store information about where and when the memory was acquired.⁶⁵ Some patients with frontal lobe damages suffer from confusion about where and when they acquired certain memories.⁶⁶ Endel Tulving describes a patient, “K.C.,” who suffered from extensive brain lesions in cortical and subcortical regions, including his MTL.⁶⁷ K.C.’s semantic memory appeared to be intact, even regarding aspects of his own life (for example, his address, the names of schools he attended, the location of his parents’ summer cottage), but he lacked episodic memory. He could not remember any experiences from his own life, save those occurring in the past minute or two. “It is apprehension of subjectively experienced time, the

62. *Id.* at 83.

63. The entorhinal, perirhinal, and parahippocampal cortices. *Id.* at 98.

64. *Id.* at 105.

65. *Id.* at 106.

66. *Id.*

67. Tulving, *supra* note 50, at 12–14.

autonoetic (self-knowing) consciousness, that is grossly impaired.”⁶⁸ And his impairment was both forward- and backward-looking. He could not remember his past, nor did he have any conception of what he would do or experience in the future. The fact that K.C.’s semantic memory was intact while his episodic memory was decimated strongly suggests that different brain regions subserve these distinct forms of memory.

Additional support for the notion that the frontal lobes are required for episodic memory to a greater degree than semantic memory comes from functional neuroimaging studies (PET and fMRI) of healthy adults. Such studies show differential involvement of the prefrontal cortices in encoding and retrieval of episodic memories. That is, “left prefrontal cortex is differentially more involved than right in encoding information into episodic memory, whereas right prefrontal is differentially more involved than left in episodic memory retrieval.”⁶⁹ Tulving holds that this empirical regularity, called “HERA” (hemispheric encoding/retrieval asymmetry), provides evidence of another biological distinction between episodic and semantic memory because semantic retrieval (unlike episodic retrieval) is seldom observed in the right hemisphere. Thus, the two processes may very well be biologically distinct.⁷⁰

2. Molecular Mechanisms of Long-Term Declarative Memory

The transition of short-term memory to long-term memory, described above, requires anatomical changes in the neurons themselves. Beginning in the early 1960s, several research scientists found that the formation of long-term memory in mice (unlike short-term memory) requires the synthesis of new proteins.⁷¹ They discovered that interference with protein synthesis shortly after training severely impaired long-term memory formation.⁷² This suggested that consolidation of short-term memory into long-term storage involved protein synthesis. Subsequent discoveries as to which proteins were required and how they were formed came later from study of other animal models, including *Aplysia* (a marine slug).⁷³

68. *Id.* at 14.

69. *Id.* at 17.

70. *See id.* at 18 (summarizing these processes).

71. *See* SQUIRE & KANDEL, *supra* note 9, at 132–33 (describing the experiments, which involved running mice through a T-shaped maze).

72. *Id.*

73. *Id.* at 133.

Study of *Aplysia* revealed that protein synthesis within a particular time window is crucial for long-term changes in synaptic connectivity—strengthening the neural connections that comprise memory.⁷⁴ Drawing on the work of other molecular biologists, researchers further surmised that specific genes must be “switched on” to synthesize the relevant proteins, and thus facilitate long-term memory.⁷⁵

Genes encode the information necessary to produce proteins on which all biological processes (including memory) depend. Gene expression (that is, “turning on” or “turning off”) determines cellular specialization: “a kidney cell is a kidney cell and a neuron a neuron” because they each express a different combination of the genes found in the nucleus.⁷⁶ In the human brain there are 10^{11} neurons, composed of roughly one hundred cell types “that can be distinguished by their shape and their connections, features determined both by the distinctive combination of genes expressed within each cell and by the combination of genes expressed in the target cells with which each cell type interacts.”⁷⁷ Gene expression—activation (turning on) and repression (turning off)—is most commonly regulated by “transcriptional control mechanisms.”⁷⁸

Regulation of gene expression in this way is crucial to consolidation of memory from short-term to long-term. Eric Kandel and colleagues discovered a transcription factor, CREB-1 (cAMP-response element binding protein-1), that activates some of the genes necessary to build proteins that support long-term memory.⁷⁹ Kandel likewise discovered an *inhibitory* transcription factor, CREB-2, that constrains the actions of CREB-1, and hinders the formation of long-term memory.⁸⁰ Researchers have found that in *Drosophila* (a fruit fly), inducing overexpression of CREB-1 greatly enhances formation of long-term memory, whereas inducing expression of CREB-2 severely impairs such formation.⁸¹ The time it takes for genes activated by CREB-1 to cause the synthesis of the relevant proteins for long-term

74. *Id.* at 135.

75. *Id.*

76. *Id.*

77. *Id.* at 136.

78. *Id.*

79. *Id.* at 139–40 (including a technical discussion of the experiments and the molecular processes involved). The pages that follow likewise discuss additional epigenetic and genetic mechanisms of memory.

80. *Id.* at 140.

81. *Id.* at 141 (discussing the work of Tim Tully at Cold Spring Harbor Laboratory).

memory marks the period of *consolidation*. Disruption of this protein synthesis likewise disrupts formation of long-term memory.⁸²

What are the epigenetic and genetic mechanisms for long-term declarative memory? This is a complex question, but for present purposes it is sufficient to note a key finding of Kandel and others regarding Long-Term Potentiation ("LTP")—modification of the synaptic connections in the network of neurons that comprise memory. In the brain regions necessary for consolidation of long-term declarative memory (for example, the medial temporal lobe), LTP depends on mechanisms of gene transcription that increase the number of synaptic contacts in a manner similar to the process for consolidation of nondeclarative long-term memory.⁸³ For example, Squire and Kandel note that in the late phase of LTP, "the activity of CREB-1 in the hippocampus appears to lead to the activation of a set of immediate response genes, and these genes act to initiate the growth of new synaptic sites."⁸⁴ Studies involving genetically modified mice with defects in late phase LTP further revealed the connection to long-term memory: these mice likewise had normal short-term memory, but severely impaired long-term memory.⁸⁵ Another research finding indicates that receptors in the hippocampus for amino acid derivative NMDA (N-methyl-D-aspartic acid) play a significant role in synaptic plasticity, LTP, and, by extension, formation of long-term memory.⁸⁶ Another transmitter receptor crucial in this regard is AMPA (α -amino-3-hydroxyl-5-methyl-isoxazole-propionate), which depolarizes NMDA receptors, facilitating the induction of LTP.⁸⁷ Researchers have genetically engineered mice to over-express NMDA receptors. Such mice have shown superior learning and memory abilities.⁸⁸ Likewise, it is thought that drugs that target NMDA

82. *Id.* at 142.

83. *See id.* 146–53.

84. *Id.* at 151.

85. *See id.* 151–52.

86. *See, e.g.,* Anjan Chatterjee, *Cosmetic Neurology: The Controversy over Enhancing Movement, Mentation, and Mood*, 63 NEUROLOGY 968, 970 (2004) (citing John A. Kemp & Ruth McKernan, *NMDA Receptor Pathway as Drug Targets*, 5 NATURE NEUROSCIENCE SUPPLEMENT 1039, 1039–42 (2002)).

87. *See, e.g.,* Gary Lynch, *Memory Enhancement: The Search for Mechanism-Based Drugs*, 5 NATURE NEUROSCIENCE SUPPLEMENT 1035, 1035–38 (2002) (describing the "consensus induction model").

88. *See* Ya-Ping Tang et al., *Genetic Enhancement of Learning and Memory in Mice*, 401 NATURE 63, 63–64 (1999).

receptors (for example, ampakines, discussed further below) will promote the acquisition and consolidation of new memories.⁸⁹

Squire and Kandel have offered a useful comparison of the different molecular mechanisms of storing short-term versus long-term memory:

With both forms of memory [i.e., nondeclarative and declarative], short-term memory is achieved by modifying pre-existing proteins and strengthening pre-existing connections through the activity of one or another protein kinase. These short-term forms of memory do not require new protein synthesis. By contrast, long-term memory requires the activation of genes, new protein synthesis, and the growth of new synaptic connections.⁹⁰

Thus, in both declarative and nondeclarative memory, it appears that consolidation into long-term storage requires anatomical changes that depend on new protein synthesis—which, of course, depends on specific genetic and epigenetic mechanisms. For present purposes, this is an important insight, as many of the novel interventions for modifying memory make use of this new knowledge.

C. Role of Emotion in Memory

“Emotional Memory” acquired by fear conditioning is not a form of declarative memory,⁹¹ and relies on different structures of the brain (for example, the amygdala).⁹² Nevertheless, the emotions (and the brain function that subserves them) play a crucial role in understanding declarative memory, and, by extension, efforts to modify it by neurobiological means. As pioneer in the science of memory and emotion, Joseph LeDoux has noted, “Emotional and declarative memories are stored and retrieved in parallel, and their activities are joined seamlessly in our conscious experience.”⁹³

A surfeit of emotions can directly affect the clarity and durability of declarative memory. The amygdala, a region of the brain crucial to emotion, plays “an essential part in modulating the storage

89. See Lynch, *supra* note 87, at 1035–36 (explaining how certain drugs modulate AMPA receptors, which depolarize and thus unblock NMDA receptors, thereby inducing LTP).

90. SQUIRE & KANDEL, *supra* note 9, at 155. Squire and Kandel likewise point out that this sharing by nondeclarative and declarative memory of a common mechanism for encoding and consolidation may indicate evolutionary conservation: “they are found in both simple invertebrates such as *Drosophila* and *Aplysia* and complex mammals such as mice.” *Id.*

91. Joseph LeDoux, *Emotions, Memory, and the Brain*, in THE SCIENTIFIC AMERICAN BOOK OF THE BRAIN 116, 116 (Antonio R. Damasio ed., 1999).

92. See *id.*; see also PRESIDENT’S COUNCIL ON BIOETHICS, *supra* note 4, at 222 (describing processes affecting the amygdale).

93. LeDoux, *supra* note 91, at 116.

and strength of memories.”⁹⁴ LeDoux explains: “Emotion is not just unconscious memory; it exerts a powerful influence on declaratory memory and other thought processes.”⁹⁵ In some instances, increased stress and emotion can enhance declarative memory—the memories are longer-lived, clearer, and suffused with emotional content.⁹⁶ Mysteriously, stress and emotion can likewise (and sometimes at the same time) induce retrograde amnesia.⁹⁷

As will be discussed in detail below, these insights about the relationship between emotion and long-term declarative memory have been an important foundation for efforts at developing neurobiological techniques of memory modification.

D. Conclusions

The foregoing (necessarily compressed and basic) discussion of the biology of memory reveals a number of important conclusions directly relevant to the project of neurobiological memory modification. First, there are multiple neurocognitive “systems” of memory, defined according to function. Second, different regions of the brain play distinctive roles in encoding, consolidating, and retrieving memory. Third, memory is encoded and distributed across networks of neurons. Fourth, the strength of memory, and its consolidation from short-term to long-term storage, depends on the strength of connections between neurons in the distributed network. Converting short-term memory into long-term memory requires changes in synaptic connections that depend on anatomical changes in the neuron itself. Fifth, these anatomical changes occur through genetic and epigenetic mechanisms involving the synthesis of proteins. Sixth, and finally, the neurobiological processes that subserve emotion, though distinct from those that support and sustain long-term declarative memory, nevertheless exert a strong effect on this latter faculty. That is, the presence of emotion (and the attendant proliferation of stress hormones throughout the brain) can deepen the clarity and durability of declarative memory. Alternatively, in some instances, it can induce retrograde amnesia.

94. *Id.*

95. *Id.*

96. See, e.g., Larry Cahill, *Similar Neural Mechanisms for Emotion-Induced Memory Impairment and Enhancement*, 100 PROC. NAT'L ACAD. SCI. 13,123, 13,123–24 (2003).

97. See *id.* (discussing B.A. Strange, R. Hurlmann & R.J. Dolan, *An Emotion-Induced Retrograde Amnesia in Humans Is Amygdala- and β -Andrenergic-Dependent*, 100 PROC. NAT'L ACAD. SCI. 13,626 (2003)).

All of these scientific findings play a role in present and projected efforts to modify memory by neurobiological means.

II. NEUROBIOLOGICAL METHODS OF MEMORY MODIFICATION

Memory is a biological process that can be manipulated by modern biology like anything else. Not only can you disrupt it, you can improve it. Descartes was wrong.

— Dr. Timothy Tully, Founder of Helicon Therapeutics⁹⁸

The revolutionary scientific advances described above have spurred wide-ranging interest in developing drugs to modify and alter memory for therapeutic purposes.⁹⁹ There are myriad diseases and disabilities that touch and concern memory. It is estimated that by 2050, over 100 million people will have Alzheimer's disease or other forms of dementia, and vastly more will suffer from memory decline associated with aging.¹⁰⁰ There is thus a pressing need for medical interventions that will restore the capacity to remember, or at least arrest the rate of memory decline. At the other end of the memory spectrum, the problem of pathologically persistent memories of pain or fear bedevils the roughly 5.2 million adults who suffer from Post-Traumatic Stress Disorder ("PTSD") each year.¹⁰¹ These and other disorders give rise to the need for therapies that will reduce the incidence of or blunt the anxiety associated with memories that will not go away. Beyond such patients suffering from serious illnesses and debilitating conditions affecting memory, there is intense interest among biotechnology and pharmaceutical firms for the development of drugs aimed at the wider population who merely seek to remediate normal forms of forgetfulness:

The big score: treating 76 million middle-aged folks who aren't demented but may welcome a way to reverse the frustrating forgetfulness that comes with age. "People in the industry are thinking about it. It would be a huge market, but the drugs would have to be very safe," says Novartis research chief, Paul Herrling. James McGaugh, a

98. Robert Langreth, *Viagra for the Brain*, FORBES, Feb. 4, 2002, at 46.

99. See, e.g., Lynch, *supra* note 87, at 1035–38 ("The emergence of LTP as a widely accepted substrate of many (though not all) commonplace forms of memory, coupled with rapidly expanding information on the molecular biology of synaptic plasticity in general, has resulted in a new effort to invent mechanism-based memory drugs.").

100. Benedict Carey, *So You Just Want to Forget? Science Is Working on Eraser*, N.Y. TIMES, April 6, 2009, at A1; see also PRESIDENT'S COUNCIL ON BIOETHICS, TAKING CARE: ETHICAL CAREGIVING IN OUR AGING SOCIETY 7–15, 36 (2005) (discussing the effects of aging and projected population experiencing such effects).

101. Nat'l Ctr. for Posttraumatic Stress Disorder, *How Common Is PTSD?*, U.S. DEPT. OF VETERANS AFF., <http://www.ptsd.va.gov/public/pages/how-common-is-ptsd.asp> (last visited Apr. 4, 2011).

neuroscientist at the University of California, Irvine, adds: "Drug companies won't tell you this, but they are really gunning for the market of unimpaired people—the 44-year-old salesman trying to remember the names of his customers."¹⁰²

Development of memory enhancing agents is well underway at numerous drug companies, including Merck, Johnson & Johnson, and GlaxoSmithKline.¹⁰³

Neurobiological techniques for modifying memory are manifold. The following sections will discuss novel interventions for memory erasure, "dampening" (that is, modulating the affective content of memory), and enhancement. Though connected to enhancement, there will be no discussion of improving executive function related to memory formation (for example, enhancing attention, concentration, working memory, and the like). Moreover, there will be no discussion of inducing false memories.¹⁰⁴

A. Memory Erasure

Memory erasure has long captured the imagination of clinicians, scientists, artists, and the broader public. Novels and films have taken up the subject, and the real-world accounts of memory loss have drawn the attention of a wide array of readers and viewers.¹⁰⁵ Induction of memory loss is not merely the stuff of fiction. Increased knowledge of the structure and function of the brain has opened the door to several different techniques of memory erasure.

102. Langreth, *supra* note 98.

103. *See id.* (listing companies, products, and timelines for availability).

104. For a discussion of this topic, see PAUL R. MCHUGH, TRY TO REMEMBER: PSYCHIATRY'S CLASH OVER MEANING, MEMORY, AND MIND 58 (2008) (noting that techniques used to help people remember events from the past could easily create false memories); Ira E. Hyman, Jr. & Elizabeth F. Loftus, *Errors in Autobiographical Memory*, 188 CLINICAL PSYCHOL. REV. 933 (1998); Ira E. Hyman, Troy H. Husband & F. James Billings, *False Memories of Childhood Experiences*, 9 APPLIED COGNITIVE PSYCHOL. 181 (1995); Elizabeth F. Loftus, *Creating False Memories*, 277 SCI. AM. 70 (1997); Elizabeth F. Loftus & Jacqueline E. Pickrell, *The Formation of False Memories*, 25 PSYCHIATRIC ANNALS 720 (1995); Daniel L. Schacter & Tim Curran, *The Cognitive Neuroscience of False Memories*, 25 PSYCHIATRIC ANNALS 727 (1995); Yana Weinstein & David R. Shanks, *Rapid Induction of False Memory for Pictures*, 18 MEMORY 533 (2010).

105. For movies, see, for example, ETERNAL SUNSHINE OF THE SPOTLESS MIND (Anonymous Content 2004); FIFTY FIRST DATES (Columbia Pictures 2004); MEMENTO (Newmarket Capital Grp. 2000); MISTER BUDDWING (Metro-Goldwyn-Mayer 1966); PAYCHECK (DreamWorks SKG 2003); REGARDING HENRY (Paramount Pictures 1991); TOTAL RECALL (Carolco Int'l 1990); WO SHI SHEI [WHO AM I?] (Golden Harvest Co. 1998). For novels, see UMBERTO ECO, THE MYSTERIOUS FLAME OF QUEEN LOANA (Geoffrey Brock trans., 2005); IAN FLEMING, MOONRAKER (1955); GABRIEL GARCIA MARQUEZ, ONE HUNDRED YEARS OF SOLITUDE (1967); WILLIAM GIBSON, NEUROMANCER (1984); OLIVER SACKS, THE MAN WHO MISTOOK HIS WIFE FOR A HAT AND OTHER CLINICAL TALES (1985).

It has long been known that electroconvulsive therapy (“ECT”) can induce retrograde amnesia in patients, blocking out memories of events from the past (in some cases many years) prior to treatment.¹⁰⁶ It is equally well known that one side effect of alcohol ingestion can be anterograde (forward-looking) amnesia. The same is true for certain common benzodiazepines, such as Valium, Halcion, and Clonazepam, as well as less common (and indeed, illegal) drugs like Rohypnol (the “date rape” drug).¹⁰⁷ Also, anticholinergic¹⁰⁸ drugs like atropine or scopolamine can prevent the formation of new memories in a similar fashion.¹⁰⁹

More recently, drawing upon new understanding of the molecular and systems biology foundations of memory, researchers are exploring new techniques for extinguishing memories. A dramatic and widely reported array of experiments has raised the possibility of selectively deleting nondeclarative fear memories. Most involve animal models. For example, in 2009 researchers reported that, in mice, selective deletion (using a diphtheria toxin) of neurons that overexpress CREB “blocked expression of . . . fear memory” in a way

106. See, e.g., Connie Cahill & Chris Frith, *Memory Following Electroconvulsive Therapy*, in HANDBOOK OF MEMORY DISORDERS 319, 327–30 (Alan D. Baddeley et al. eds., 1995) (discussing retrograde memory functioning); *Remembering and Forgetting: Physiological and Pharmacological Aspects: Hearings Before the President's Council on Bioethics* (Oct. 17, 2002) (testimony of James L. McGaugh) [hereinafter *Hearings*], available at <http://bioethics.georgetown.edu/pcbe/transcripts/oct02/session3.html> (“I already mentioned that electroconvulsive shock will [erase memory]. That’s been known since 1949 approximately, and it’s known both for humans and animals that if you give such a treatment, there will be a selective forgetting of things that have just been learned.”).

107. See *Hearings*, *supra* note 106 (discussing benzodiazepines); see also Liao & Sandberg, *supra* note 29, at 88 (citing D.J. King, *Benzodiazepines, Amnesia, and Sedation: Theoretical and Clinical Issues and Controversies*, 7 HUM. PSYCHOPHARMACOLOGY: CLINICAL & EXPERIMENTAL 79 (1992)); see also *id.* at 92 (citing A.M. Daderman et al., *Violent Behavior, Impulsive Decision-Making, and Anterograde Amnesia While Intoxicated with Flunitrazepam and Alcohol or Other Drugs: A Case Study in Forensic Psychiatric Patients*, 30 J. AM. ACAD. PSYCHIATRY & L. 238 (2002); A.M. Daderman & L. Lidberg, *Flunitrazepam (Rohypnol) Abuse in Combination with Alcohol Causes Premeditated, Grievous Violence in Male Juvenile Offenders*, 27 J. AM. ACAD. PSYCHIATRY & L. 83 (1999)).

108. “Anticholinergic” drugs block acetylcholine receptors in the brain. Acetylcholine is a neurotransmitter that enhances the activity of cortical neurons and promotes memory formation. *Acetylcholine and Memory*, CTR. FOR MEMORY & BRAIN PROGRAM IN NEUROSCIENCE, <http://www.bu.edu/hasselmo/ACH.html> (last visited Apr. 4, 2011). The neurons that produce Acetylcholine are some of the first to be damaged by Alzheimer’s disease. N. Tabet, *Acetylcholinesterase Inhibitors for Alzheimer’s Disease: Anti-Inflammatories in Acetylcholine Clothing!*, 35 AGE & AGEING 336, 336 (2006).

109. See Liao & Sandberg, *supra* note 29, at 88 (discussing scopolamine and citing J.M. FUSTER, *MEMORY IN THE CEREBRAL CORTEX* (1995)); *Hearings*, *supra* note 106 (discussing scopolamine and atropine).

that appears to be permanent.¹¹⁰ In 2007, Dr. Todd Sacktor and colleagues reported that they had successfully erased long-term fear memories in the mouse brain by interfering with a particular protein kinase, PKM ζ , simply by injecting a drug (ZIP) into the brain: As published in *Science*, inhibiting PKM ζ with a drug caused the erasure of memories that had been learned a day, or even a month before. PKM ζ inhibition did not damage the brain and, after the drug had been eliminated, new long-term memories could be learned and recalled. Thus PKM ζ is the first functionally important memory storage molecule.¹¹¹

The fear memories erased by Dr. Sacktor's team were, in some cases, three months old (the equivalent of decades-old memories in humans).¹¹² Similarly, in 2008, researchers reported that inhibition of PKM ζ in mice had rapidly erased "memories for specific places, both unpleasant and rewarding, memories for background information, associations between a sound and a fearful event . . . and memories for performing a specific action."¹¹³

Other researchers have similarly extinguished fear memories in animals. In 2007, researchers reported successful elimination of a fear memory through the use of a drug and a technique called "reconsolidation blockade." As noted above, there is a period between initial encoding and transfer to long-term storage (consolidation) in which newly formed memories are fragile. Scientists have found that memory recall involves a similar process—reconsolidation—in which memories might be uniquely susceptible to modification: "Later memory retrieval triggers a new phase of liability, during which the memory may be updated and stabilized again for long-term storage."¹¹⁴ Building on this insight, scientists devised a new technique to selectively erase fear memory. First, they created a fear memory in rats involving two distinct tones and electric shock. Later, the researchers injected some of the rats with a drug known to block

110. Jin-Hee Han et al., *Selective Erasure of a Fear Memory*, 323 *SCIENCE* 1492, 1492 (2009).

111. Reut Shema et al., *Rapid Erasure of Long-Term Memory Associations in the Cortex by an Inhibitor of PKM ζ* , 317 *SCIENCE* 951, 951 (2007). See also Carey, *supra* note 100 (discussing PKM ζ); Todd C. Sacktor, SUNY DOWNSTATE MED. CTR. DEPT. OF PHYSIOLOGY & PHARMACOLOGY, <http://www.downstate.edu/pharmacology/faculty/sacktor.html> (last visited Aug. 7, 2010) (same).

112. Fred R. Conrad, *Erasing Your Memories*, N.Y. TIMES: CONSULTS, Apr. 13, 2009, <http://consults.blogs.nytimes.com/2009/04/13/memory-erasing/>. Note, however, that later in the interview, Sacktor expressed his skepticism that this was a valid analogy. *Id.*

113. Peter Serrano et al., *PKM ζ Maintains Spatial, Instrumental, and Classically Conditioned Long-Term Memories*, 6 *PLOS BIOLOGY* 318, 318 (2008).

114. Valerie Doyere et al., *Synapse-Specific Reconsolidation of Distinct Fear Memories in the Lateral Amygdala*, 10 *NATURE NEUROSCIENCE* 414, 414 (2007).

consolidation and reconsolidation (MAPK inhibitor U0126). They then reactivated the fearful memory in all the rats by replaying one tone (but not the other). The next day, the researchers found that the rats receiving the drug were not afraid of the tone that they had recalled under the influence of the drug, though they retained the fear memory of the other tone (which they had not recalled while drugged). Thus, the researchers were able to selectively eliminate *a single* fear memory, while leaving closely related memories intact.¹¹⁵ Researchers achieved a very similar result using an “inducible and reversible chemical-genetic technique” to erase object-recognition and fear memories, while leaving other memories untouched.¹¹⁶

Even more recently, Merel Kindt and fellow researchers induced erasure of a fear memory in *human beings* using a drug coupled with reconsolidation blockade.¹¹⁷ The research team integrated two insights from the science of memory to produce memory erasure. First, they drew upon the findings, discussed above (and below), that proliferation of certain stress and emotion-related neurotransmitters (like norepinephrine) plays an important role encoding memory clearly and durably.¹¹⁸ Second, they integrated the technique of reconsolidation blockade, discussed above.

In the experiment itself, adult volunteers were shown pictures of two different spiders. The researchers induced a fear memory by delivering an unpleasant electrical shock with one of the photos. Eventually, the subjects would have a startle response when shown that photo, even in the absence of the shock. One day later, some of the subjects were given propranolol—a β -adrenergic antagonist or “beta blocker” that inhibits the activation of neurological stress hormone systems—before reactivating the fear memory by showing the startling photo of the spider. Some subjects were given propranolol

115. *Id.*; see also Kerri Smith, *Wipe Out a Single Memory*, NATURE, Mar. 11, 2007, <http://www.nature.com/news/2007/070305/full/news070305-17.html> (describing the same experiment).

116. Xiahua Cao et al., *Inducible and Selective Erasure of Memories in Mouse Brain via Chemical-Genetic Manipulation*, 60 NEURON 353, 353 (2008).

117. Merel Kindt et al., *Beyond Extinction: Erasing Human Fear Responses and Preventing the Return of Fear*, 12 NATURE NEUROSCIENCE 256, 256 (2009).

118. See, e.g., Larry Cahill et al., *β -Adrenergic Activation and Memory for Emotional Events*, 371 NATURE 702, 702 (1994) (“Substantial evidence from animal studies suggests that enhanced memory associated with emotional arousal results from an activation of β -adrenergic stress hormone systems during and after an emotional experience.”); Larry Cahill & James McGaugh, *Mechanisms of Emotional Arousal and Lasting Declarative Memory*, 21 TRENDS IN NEUROSCIENCES 294, 295 (1998) (discussing the role of stress-related hormones in memory consolidation).

without reactivating the memory by viewing the photo. According to the researchers:

On the third day it was found that the volunteers who had been administered the propranolol no longer exhibited a fear response on seeing the spider, unlike the control group who had been administered a placebo. The group that had received propranolol but whose memory was not reactivated still exhibited a strong startle response.¹¹⁹

The group whose fear response had been eliminated still retained the episodic memory of the training and the electric shock that accompanied the one photo. But the nondeclarative fear memory was erased.¹²⁰ Apparently, reconsolidating the memory without the stress hormones (blocked by propranolol) allowed the affective content to be altered.¹²¹

All of the instances of memory erasure noted above involved the elimination of a nondeclarative fear memory. What about declarative memory in general and episodic memory in particular? Might it ever be possible to directly edit these memories in the same way? First, as will be discussed further below in the context of dampening, fear memories—though nondeclarative—exist in a seamlessly integrated fashion with declarative memories, adding affective content that deeply influences how such declarative memories are understood and experienced. Second, editing fear memory has potentially profound consequences for the remaining episodic memory of the same event. Some scholars have expressed optimism that this might be the case. According to one such scholar, “given the evidence for reconsolidation in a variety of brain systems and memory paradigms, [reconsolidation-based editing of episodic memory] appears likely.”¹²² Relatedly, in a recently published paper,

119. *Spotless Mind? Fear Memories in Humans Weakened with Beta-Blocker Propranolol*, SCI. DAILY, Mar. 12, 2009, <http://www.sciencedaily.com/releases/2009/03/090311103611.htm>.

120. *Id.*

121. A very similar result has been achieved using “extinction training” rather than drugs. See, e.g., Marie-H. Monfils et al., *Extinction-Reconsolidation Boundaries: Key to Persistent Attenuation of Fear Memories*, 324 SCIENCE 951, 955 (2009) (“[E]xtinction training applied shortly after fear conditioning can prevent memory consolidation and the return of fear.”); Gregory J. Quirk & Mohammed R. Milad, *Editing Out Fear*, 463 NATURE 36, 36 (2010) (discussing extinction training in rodents and humans); Daniela Schiller & Joshua Johansen, *Prelimbic Prefrontal Neurons Drive Fear Expression: A Clue for Extinction-Reconsolidation Interactions*, 29 J. NEUROSCIENCE 13,432, 13,433–44 (2009) (discussing the relation between fear expression and extinction); Daniela Schiller et al., *Preventing the Return of Fear in Humans Using Reconsolidation Update Mechanisms*, 463 NATURE 49, 50–51 (2010) (discussing reconsolidation following extinction training).

122. Liao & Sandberg, *supra* note 29, at 88 (citing N.C. Tronson & J.R. Taylor, *Molecular Mechanisms of Memory Reconsolidation*, 84 NATURE REVIEWS NEUROSCIENCE 262 (2007)). Dr. Todd Sacktor has noted, “PKM ζ has also been found to maintain long-term memories in the neocortex, the final repository for many types of memory.” *Todd C. Sacktor, supra* note 111.

researchers concluded that “new learning impedes the reconsolidation of neutral autobiographical memories.”¹²³ In that study, researchers directed subjects to recall (and thus reconsolidate) emotionally positive, neutral, and negative episodic memories. Shortly thereafter, the subjects memorized an emotionally disturbing short story. Two weeks later, the researchers found that the emotionally neutral episodic memories were markedly diminished, “suggesting reconsolidation blockade in autobiographical memory.”¹²⁴ Also, James McGaugh told the President’s Council on Bioethics that cortisol (a stress hormone) can temporarily block declarative memory (as in stage fright).¹²⁵

B. Memory “Dampening”

Memory “dampening” refers to modulation of the affective content of a declarative memory. As suggested in the above discussion of the Kindt study, memory dampening might involve the erasure of an accompanying, parallel, nondeclarative emotional memory. That is, memory dampening might entail the disaggregation of the declarative memory of a traumatic event from the attendant emotional memory that would otherwise give it affective content, deepen it, and make it more durable.

Larry Cahill and colleagues have explored the relationship between emotion and declarative memory in humans—identifying the mechanisms by which stress hormones in the brain increase the clarity, intensity, and duration of memory.¹²⁶ In an iconic study, he showed how suppressing the β -adrenergic stress hormones through the administration of β -blocker propranolol could mute the intensity of a traumatic memory.¹²⁷ The President’s Council on Bioethics concisely described the experiment in the following way:

The researchers showed their subjects a series of slides and told them one of two stories to explain the events depicted; one story was mundane and emotionally neutral, the other was tragic and emotionally gripping. Two weeks later, the participants were asked to recall the story, and those who had heard the emotionally arousing story were found-

123. Lars Schwabe & Oliver T. Wolf, *New Episodic Learning Interferes with the Reconsolidation of Autobiographical Memories*, 4 PLOS ONE e7519, e7519 (2009).

124. *Id.*

125. *Hearings*, *supra* note 106 (discussing glucocorticoids).

126. *See, e.g.*, Cahill et al., *supra* note 118, at 702 (“Substantial evidence from animal studies suggests that enhanced memory associated with emotional arousal results from an activation of β -adrenergic stress hormone systems during and after an emotional experience.”); Cahill & McGaugh, *supra* note 118, at 410–11 (discussing how emotional arousal influences memory).

127. Cahill et al., *supra* note 118, at 702–03.

as expected to recall what was depicted in the slides in far greater detail than those who had heard the mundane version. The experiment was then repeated, except that half the participants were given an injection of the beta-blocker propranolol and half were injected with a saline placebo one hour before the slide show. What they found was that, after two weeks, those who had heard the more mundane version of the story had the same level of recollection regardless of whether they had received the beta-blocker or the placebo. But of the subjects who had heard the more arousing version of the story, only those receiving the placebo showed an enhanced level of recollection. Those who heard the arousing story after receiving the beta-blocker found it extremely sad and emotional at the time, but two weeks later they remembered it at the same emotional level as the group that had heard the neutral story.¹²⁸

Thus, through the administration of β -blocker propranolol, Cahill and his team were able to prevent the typical memory-enhancing effects of emotional arousal. Under the influence of propranolol, subjects remembered an emotionally arousing story as though it were neutral. At the same time, propranolol can also preserve memories that would otherwise be erased by stress.¹²⁹

Memory researcher Roger K. Pitman conducted a pilot study involving sufferers of PTSD. He administered propranolol to patients six hours following the traumatic event, and for ten days thereafter. Pitman found that the patients receiving the propranolol exhibited less pronounced PTSD symptoms when exposed to a re-telling of the traumatic events.¹³⁰ Thus, Cahill, Pitman, and others have demonstrated that the administration of β -blockers contemporaneously with or shortly after a traumatic event can prevent the formation of emotional memories that adversely color episodic memories of the same event.

Other researchers (like Kindt, described above) are investigating the possibility of dampening memory retroactively through reconsolidation blockade (with propranolol) as a potential means towards helping people who suffer from PTSD or other conditions, such as addiction, that are characterized by recurrent memories that impel them towards harmful behavior.¹³¹ Indeed, several clinical trials are currently underway to test such

128. PRESIDENT'S COUNCIL ON BIOETHICS, *supra* note 4, at 223.

129. B.A. Strange et al., *supra* note 97, at 13,626.

130. Roger K. Pitman et al., *Pilot Study of Secondary Prevention of Posttraumatic Stress Disorder with Propranolol*, 51 BIOLOGICAL PSYCHIATRY 189, 192 (2002) (noting that the patients treated with propranolol showed less adverse symptoms in response to "internal cues (i.e., mental imagery) that symbolized or resembled the initial traumatic event").

131. E.g., Alain Brunet et al., *Effect of Post-Retrieval Propranolol on Psychophysiologic Responding During Subsequent Script-Driven Traumatic Imagery in Post-Traumatic Stress Disorder*, 42 J. PSYCHIATRIC RES. 503, 503 (2008); Jean Przybylski et al., *Attenuation of Emotional and Nonemotional Memories After Their Reactivation: Role of β Adrenergic Receptors*, 19 J. NEUROSCIENCE 6623, 6623 (1999).

interventions.¹³² As Kindt illustrates, the administration of propranolol during reconsolidation can mute the emotional content of traumatic memories.

C. Memory Enhancement

Man is not going to wait passively for millions of years before evolution offers him a better brain.

— Corneliu E. Giurgea¹³³

As noted above, the rationale for developing drugs to enhance memory is primarily for the treatment of patients suffering from illnesses (such as Alzheimer's disease) or conditions that rob them of their memory. But there is also much interest in developing agents that will enhance memory capacities "beyond the normal" for reasons relating more to desire than clinical need.

Many methods for memory enhancement are under consideration. One strategy involves the use of drugs called "cholinesterase inhibitors." Acetylcholine is a neurotransmitter that enhances the activity of cortical neurons and promotes memory formation.¹³⁴ Normally, certain enzymes (acetylcholinesterase) eventually remove excess acetylcholine from the synapse. Cholinesterase inhibitors prevent this process, thus leaving acetylcholine in the synapse longer.¹³⁵ The neurons that produce acetylcholine are some of the first to be damaged by Alzheimer's disease. Thus, the primary clinical application for drugs in this category (for example, Aricept) is to slow the memory loss associated with that disease. Some researchers report, however, that use of such drugs can offer memory enhancement in normal adults. In one such

132. See Alain Brunet, Douglas Mental Health Univ. Inst., *A Novel Treatment for Chronic Posttraumatic Stress Disorder (PTSD) Using Post-Reactivation Propranolol*, CLINICALTRIALS.GOV (May 20, 2010), <http://clinicaltrials.gov/ct2/show/NCT01127568> (describing ongoing clinical trials); A. Eden Evins, Mass. Gen. Hosp., *Memory Reconsolidation Blockade as a Novel Intervention for Nicotine Dependence*, CLINICALTRIALS.GOV (May 3, 2010), <http://clinicaltrials.gov/ct2/show/NCT00916721> (same); Roger K. Pitman, Mass. Gen. Hosp., *A Psychophysiologic Study of Weakening Traumatic Combat Memories with Post-Reactivation Propranolol*, CLINICALTRIALS.GOV (Apr. 27, 2010), <http://clinicaltrials.gov/ct2/show/NCT00709735> (same).

133. Corneliu Giurgea, *Vers une Pharmacologie de l'Activite Integrative du Cerveau: Tentative du Concept Nootrope en Psychopharmacologie*, 25 ACTUALITÉS PHARMACOLOGIE 115 (1972) (Fr.), quoted in Rose, *supra* note 5, at 975.

134. See *Acetylcholine and Memory*, *supra* note 108.

135. Tim Tully et al., *Targeting the CREB Pathway for Memory Enhancers*, 2 NATURE REVIEWS DRUG DISCOVERY 267, 267 (2003) (discussing the relationship between cholinesterase and acetylcholine).

experiment, researchers found that aircraft pilots using the drug demonstrated a greater ability than the placebo group to retain the capacity to perform a complex set of tasks in a flight simulator.¹³⁶

Another strategy for memory enhancement involves development of drugs that target the induction of LTP. To understand how such drugs work, it is necessary to enlarge a bit on the roles of neurotransmitter receptors AMPA and NMDA, mentioned in Part I. First, "facilitation of glutamatergic transmission promotes [LTP], presumed to foster synaptic plasticity and memory formation."¹³⁷ As Gary Lynch has explained:

The consensus induction [of LTP] model involves the two classes of transmitter receptors co-localized at excitatory (glutamatergic) synapses. AMPA-type glutamate receptors generate depolarization needed to unblock voltage-sensitive NMDA-type glutamate receptors, which then admit calcium into the dendritic side of the synapse. Today, most researchers hold that the enhanced postsynaptic currents that define LTP expression are caused by changes in AMPA receptors¹³⁸

AMPA receptors depolarize and thus unblock NMDA receptors, which induces LTP. A class of drugs called "Ampakines" was developed to modulate AMPA receptors so as to enhance and prolong the synaptic currents, thus "augment[ing] excitatory transmission in [the] brain."¹³⁹ Such modulation has shown profound effects for the enhancement of memory of animals across species: "in all, positive modulation of AMPA receptors reduces the requirement for the encoding of memory, whether the memory is of a type that normally persists for only a few minutes or instead normally lasts for an indefinite period."¹⁴⁰ Ampakines have achieved such memory enhancement effects in normal humans.¹⁴¹ Other drugs to modulate AMPA receptors (albeit with different chemical structures than ampakines) are being explored, including benzothiadiazides and biarylpropylsulfonamide variants.¹⁴² Relatedly, mice genetically engineered to overexpress NMDA receptors have demonstrated

136. J.A. Yesavage et al., *Donepezil and Flight Simulator Performance: Effects on Retention of Complex Skills*, 59 NEUROLOGY 123, 124–25 (2002). A study led by Martha Farah suggests that even though this does appear to be an effective avenue of memory enhancement for normal individuals, drug companies prefer to pursue other avenues. Farah et al., *supra* note 4, at 422.

137. Chatterjee, *supra* note 86, at 969–70.

138. Lynch, *supra* note 87, at 1035 (citation omitted).

139. *Id.* at 1036.

140. *Id.*

141. Martin Ingvar et al., *Enhancement by an Ampakine of Memory Encoding in Humans*, 146 EXPERIMENTAL NEUROLOGY 553, 553 (1997).

142. See Lynch, *supra* note 87, at 1036 (discussing these and other drugs as modulating AMPA receptors).

strikingly superior learning and memory skills.¹⁴³ As for drug development for human uses, “several companies (Cortex, Lilly, Organon, Servier) have aligned themselves with particular modulator strategies, giving the impression that something of a race is on to produce an AMPA receptor-based memory drug.”¹⁴⁴

Other efforts to develop effective memory enhancement focus on improving consolidation. As discussed above, consolidation of memory requires protein synthesis, which depends on gene expression. Recall from the above discussion in Part I that CREB-1 is a crucial transcription factor that activates genes necessary to build the proteins that support long-term memory. Researchers have had much success in enhancing the memory of animal subjects by modulating CREB-1. *Drosophila* genetically engineered to overexpress CREB-1 demonstrated long-term conditioning to an aversive stimulus (an odor coupled with a shock) after only one trial instead of the usual ten trials necessary to condition normal subjects.¹⁴⁵ Similarly, mice given a drug (rolipram) that augments CREB-1 needed only half the trials of normal mice to form a long-term memory.¹⁴⁶ According to Gary Lynch, “multiple efforts are now underway to develop drugs that facilitate CREB’s contributions to long-term memory.”¹⁴⁷

Dr. Todd Sacktor has suggested that his discoveries regarding the memory-storage function of PKM ζ , might prove useful for developing memory-enhancement interventions. As noted above, PKM ζ “maintains synaptic enhancement” crucial to preservation of long-term memories. Silencing PKM ζ erases memory. Sacktor has speculated that conversely, increasing PKM ζ might convert short into long-term memories.¹⁴⁸

143. Tang et al., *supra* note 88, at 63.

144. Lynch, *supra* note 87, at 1036. In 2007 the FDA rejected Cortex Pharmaceuticals’ bid to enter into Phase IIB clinical trials with its AMPA receptor drug CX717 to treat ADHD due to toxicity concerns. Cortex responded by maintaining it would continue to study the drug’s ability to combat Alzheimer’s disease, but the FDA decision caused a fifty-nine percent decrease in Cortex’s stock price. *Movers & Shakers*, WALL ST. J. (Oct. 11, 2007), <http://www.marketwatch.com/story/thursdays-biggest-gaining-and-declining-stocks-20071011163900?dist=WSJfeed&siteid=WSJ>.

145. See J.C.P. Yin et al., *CREB as a Memory Modulator: Induced Expression of a dCREB2 Activator Isoform Enhances Long-Term Memory in Drosophila*, 81 CELL 105, 105 (1995).

146. Tully et al., *supra* note 135, at 272 fig.3. When tested in humans, rolipram caused severe nausea and vomiting. Langreth, *supra* note 98.

147. Lynch, *supra* note 87, at 1036 (noting that at least two pharmaceutical companies, Memory Pharmaceuticals and Helicon, are pursuing such drugs).

148. See Conrad, *supra* note 112 (“Developing memory enhancers that convert short- into long-term memories by increasing PKMzeta in the brain is also a possibility.”).

Finally, researchers have pursued memory enhancement by employing the findings of Cahill, McGaugh, and others regarding the relationship between emotional arousal and memory. If blocking stress hormones reduces the strength and durability of traumatic memories, then perhaps amplifying the effect of these same stress hormones will likewise enhance memory. Rudimentary techniques not involving drugs seem to confirm this possibility. Larry Cahill enhances memory by directing human subjects to place their hand in ice water.¹⁴⁹ Similarly, Dr. Robert Jensen achieves memory enhancement in elderly patients by having them squeeze a hand dynamometer, which causes the brain to release adrenaline: "[T]hey found that the memory, squeezing this thing, enhanced memory in the elderly subjects," though not for those subjects who were taking beta-blockers.¹⁵⁰ Larry Cahill and James L. McGaugh similarly found that emotional arousal increases retention of learned stories.¹⁵¹

The stress hormones that enhance and deepen memory are endogenous, that is, produced by the brain of the subject himself. But, in principle, it would seem possible to induce such enhancement through the extrinsic administration of stress hormones directly to the subject. In 2003, researchers published a paper that involved the intravenous infusion of epinephrine to human subjects after viewing a series of slides. Testing recall one week later revealed that those subjects receiving epinephrine had stronger memories for at least some of the slides compared with the group of subjects who had received a placebo.¹⁵²

D. Caveats

To responsibly reflect on the challenges of memory modification to theories of punishment (or any aspect of human life, for that matter), several caveats are in order. First, it is necessary to keep in mind that all of the foregoing techniques for erasing, dampening, and enhancing memory are in their infancy and clinical applications

149. *Hearings*, *supra* note 106 ("I know that doesn't sound very sophisticated, but it certainly gets the heart going, and it releases adrenalin massively right at that time, and Larry Cahill has now found that memory for ordinary verbal material is significantly enhanced. Subjects learn something and put their hand in this tub of ice water.")

150. *Id.*

151. Larry Cahill & James L. McGaugh, *A Novel Demonstration of Enhanced Memory Associated with Emotional Arousal*, 4 CONSCIOUSNESS & COGNITION 410, 410 (1995).

152. Larry Cahill & Michael Alkire, *Epinephrine Enhancement of Human Memory Consolidation: Interaction with Arousal at Encoding*, 79 NEUROBIOLOGY LEARNING & MEMORY 194, 195 (2003).

remain largely speculative. Targeted and directed memory modification is not on the immediate horizon. Moreover, the principle aim of these techniques is to remediate memory defects owing to diseases or other conditions. The primary purpose is manifestly not to create superhuman memory in normal people. That said, there is widespread desire (and thus a very large market) for memory enhancement in healthy individuals. And the legal framework for “off label” prescriptions makes it at least possible that once developed, these drugs would make their way to the general, healthy public. The widespread use of psychopharmacological drugs such as Ritalin and Prozac offers instructive illustrations in this regard.¹⁵³

Another caveat is that much of the scientific research in this area has been developed using animal models. While there are extremely striking and useful similarities (owing to evolutionary conservation) in the molecular and systems biology of memory among sea slugs, fruit flies, mice, and humans, caution is in order in taking the analogies too far. Steven Rose has noted the disappointing results in translating successful memory enhancement in animals when generalized to human subjects and has speculated on why this might be:

There are several possible reasons for this. One is that the biochemical specificity of the processes that lead to decline in humans might differ from the effects of pharmacological manipulation in animal models. Perhaps more importantly, assumptions about the similarity of human memory to animal models of learning and recall (which must always be tested by the criterion of performance of some task, whether it be maze navigation or the expression of preference) might be false. Animal models cannot reprise the subtleties of human verbal, recognition, and autobiographical memory. General “cognition” is hard to test in animal models (except perhaps in tasks with primates), and memory is but one aspect of cognition in humans.¹⁵⁴

Thus, one should be cautious in applying the findings of memory research in animal models, especially for questions involving declarative (in particular, episodic and semantic) memory.

Also, there is more work to be done in illuminating the molecular and systems mechanism of memory and its modification. As Matthew Liao and Anders Sandberg have noted, while much new

153. See, e.g., RICK MAYES, CATHERINE BAGWELL & JENNIFER ERKULWATER, *MEDICATING CHILDREN 1* (2009) (noting that one in every ten to fifteen school-aged children has been diagnosed with ADHD, and one in every twenty to twenty-five uses a stimulant treatment, such as Ritalin); LAWRENCE H. DILLER, *THE LAST NORMAL CHILD 4–7* (2006) (describing an anecdote involving an intelligent but absentminded child whose private school teacher insisted on Ritalin-based ADHD treatment instead of more traditional discipline and work management); LAWRENCE H. DILLER, *RUNNING ON RITALIN 97* (1998) (describing the common practice among some adults of “doctor-shopping” for attention-enhancing stimulants).

154. Rose, *supra* note 5, at 978.

knowledge in this regard has been uncovered by the pioneering work of scientists, there is more to learn.¹⁵⁵ For example, "we still do not know in general to what extent 'weakening' memory traces are due to an actual change in the synaptic network underlying the memory, a loss of retrieval ability or the development of an inhibiting secondary memory."¹⁵⁶ Moreover, the interconnectedness of memories and necessary cues pose serious challenges for memory editing. Also, many of the techniques of memory modification are insufficiently targeted and selective to be of great use.¹⁵⁷

All that said, it is still extremely important to understand the state of memory modification efforts and their potential consequences for all aspects of human life. Indeed, it is always advisable to explore the normative issues arising from advance in biotechnology and biomedical science *before* they enter routine practice.

III. WHAT IS MEMORY? A HUMANISTIC ACCOUNT

Memory . . . would come like a rope let down from heaven to draw me up out of the abyss of not-being . . .

— Proust¹⁵⁸

A crucial step towards understanding the relationship between memory and punishment is to reflect briefly on the role of memory in human life more generally, both as an individual and collective matter. Memory—including the activities of encoding, remembering, and forgetting¹⁵⁹—is indispensable to the essential and distinctive activities of human life as such.

A. Memory and the Individual

On an individual level, memory is crucial to life as humanly lived. The abilities to encode and remember undergird our capacities to learn, reason, and make decisions. Memory permits the gathering and retention of basic skills necessary to daily life.¹⁶⁰ It allows the

155. Liao & Sandberg, *supra* note 29, at 89.

156. *Id.*

157. *See id.*

158. MARCEL PROUST, A LA RECHERCHE DU TEMPS PERDU [REMEMBRANCE OF THINGS PAST] 4 (1927).

159. The following discussion will focus almost entirely on declarative memory—episodic and semantic.

160. Rose, *supra* note 5, at 975 ("Our personal memories—the autobiographical record—are in many ways what define each of us as individuals. And in an increasingly skills-driven and

individual to formulate and pursue future plans, and avoid past mistakes. Indeed, “memory is central to human flourishing . . . precisely because we pursue happiness in time, as time-bound beings.”¹⁶¹ The ability to forget facilitates abstraction from one’s experiences and discrimination between important and trivial information. Without the ability to forget, one would be like Borges’s fictional character, Funes the Memorious, who famously described his perfect memory as a “garbage heap—it’s all there.”¹⁶² Similarly, patient “A.J.” described his perfect recall in the following way: “Whenever I see a date flash on the television (or anywhere else for that matter) I automatically go back to that day and remember where I was, what I was doing, what day it fell on and on and on and on . . . It is nonstop, uncontrollable and totally exhausting.”¹⁶³ William James, one of the founders of modern psychology, likewise observed that remembering everything is as useless as remembering nothing.¹⁶⁴

More fundamentally, memory is crucial to the integration and awareness of one’s *personal identity*.¹⁶⁵ It allows an individual to understand himself as a unitary being that persists over time. That is, it allows him to conceive of himself as having a past, present, and

socially interactive world, memory—individual or technologically enhanced—is one of the keys to success.”).

161. PRESIDENT’S COUNCIL ON BIOETHICS, *supra* note 4, at 215–16.

162. JORGE LUIS BORGES, *Funes the Memorious*, in LABYRINTHS: SELECTED STORIES AND OTHER WRITINGS 63–64 (Donald A. Yates & James E. Irby eds., New Directions 1964) (1962), *quoted in Hearings*, *supra* note 106.

163. Kolber, *supra* note 4, at 1568 (quoting Elizabeth S. Parker et al., *A Case of Unusual Autobiographical Remembering*, 12 NEUROCASE 35, 35 (2006)).

164. “Selection is the very keel on which our mental ship is built. And in the case of memory its utility is obvious. If we remembered everything, we should on most occasions be as ill off as if we remembered nothing.” JAMES, *supra* note 16, at 680, *quoted in Cahill & McGaugh*, *supra* note 118, at 294.

165. To be sure, the “problem of personal identity” is a very ancient and vexed philosophical question. Philosophers have long argued about whether or not personal identity can be defined exclusively and reductively according to physical and/or psychological criteria. A full exploration of this issue is beyond the scope of this Article. For an introduction to the manifold approaches to personal identity, see, for example, Dresser, *supra* note 2, at 397–410 (discussing various reductive and nonreductive theories of personal identity (including the works of Parfit, Descartes, Hume, Kant, Locke, Nagel, and others) with accompanying citations to original sources). See also David Wasserman, *Making Memory Lose Its Sting*, 24 PHIL. & PUB. POL’Y Q. 12, 13 (2004) (discussing the work of David DeGrazia and Hilde Nelson on the concepts of narrative identity and numerical identity). This Article makes a more modest claim, namely, that personal identity *self-understood* depends in crucial ways upon memory. Moreover, the Article follows Ross Poole’s insight that while memory may or may not be a self-sufficient ground of identity (Poole seems certain that it is not), “it remains an inescapable part of the process through which we claim or accept the burdens of responsibilities, rights, and privileges, of any complex form of human existence. As such, it is an essential part of moral life.” Ross Poole, *Memory, History and the Claims of the Past*, 1 MEMORY STUD. 149, 156 (2008).

future.¹⁶⁶ Indeed, the individual's very concept of "self" depends on holding together the past in continuity with the present. German physiologist, Ewald Hering, famously noted that "memory collects the countless phenomena of our existence into a single whole . . . our conscious would be broken up into as many fragments as we had lived seconds but for the binding and unifying force of memory."¹⁶⁷ Augustine likewise invokes vivid imagery to capture this function of memory, writing that in the "huge hall of my memory . . . I met with myself; I recall what, when, and where I did something and in what way I was affected when I did it."¹⁶⁸

The relationship between personal identity and memory is likewise illustrated by instances of memory's failure or eradication. As Gilbert Meilaender has noted, the sixth book of Virgil's *Aeneid* offers one rich example in this regard. There, Aeneas seeks out his father, Anchises, in the underworld. When they meet, Anchises explains to Aeneas that the souls that will be reincarnated first drink from Lethe, the river of forgetfulness, to erase all memory of their past lives: "Souls for whom / A second body is in store: their drink / is water of Lethe, and it frees from care / In long forgetfulness / That there unmemoried they may see again / The heavens and wish re-entry into bodies."¹⁶⁹

Here it is clear that the erasure of all memory, among other things, amounts to the annihilation of identity. Indeed, the Greek word "lethe" (λήθη) means "oblivion."¹⁷⁰ The souls described by Anchises who are later "re-membered" with new bodies are, in fact, new and distinct individuals.¹⁷¹

The famous case of "Jimmie" described by Oliver Sacks in "The Lost Mariner," further illustrates the connection between memory and identity, albeit in a different fashion. Jimmie suffered from both retrograde and anterograde amnesia. That is, when he met Dr. Sacks in 1975, he had virtually no recollection of past events after 1945 (a

166. See, e.g., John Sutton, *Memory*, in STANFORD ENCYCLOPEDIA OF PHILOSOPHY (Edward N. Zalta ed., 2010), <http://plato.stanford.edu/archives/sum2010/entries/memory/> ("[A]n understanding of memory is likely to be important in making sense of the continuity of the self . . .").

167. SQUIRE & KANDEL, *supra* note 9, at 1.

168. AUGUSTINE, *supra* note 7, bk. 8.

169. VIRGIL, *AENEID* 170 (Patric Dickinson trans., Penguin Putnam 2006), *quoted in* Gilbert Meilaender, *Why Remember?*, FIRST THINGS, Aug./Sept. 2003, at 20, 23.

170. H.G. LIDDELL & ROBERT SCOTT, AN INTERMEDIATE GREEK-ENGLISH LEXICON 470-71 (2003).

171. That said, Anchises's larger point is to show Aeneas his descendants. So, there may be a certain sense in which those souls observed in the underworld are connected to their later selves.

limited kind of retrograde—backwards-looking—amnesia). Moreover, Jimmie could not form new memories lasting longer than a few seconds (a profound form of anterograde—forward looking—amnesia).¹⁷² Jimmie could remember the end of World War II and his plans for the future at that time. He could remember autobiographical information predating 1945, including his hometown, military service, and the like. He retained the ability to communicate using Morse Code and was adept at puzzles that could be solved quickly. But his personal identity was permanently frozen in time. For Jimmie, he was still a nineteen-year-old living in the year 1945. Though he had new experiences, none could be retained or integrated into his self-understanding. Moreover, Jimmie had no ability to recognize his condition. It was impossible to explain his condition to him in a manner that he could retain. Thus, Jimmie's defect of memory radically altered his personal identity as he understood it. Jimmie's "self" was defined (and disrupted) by the limits of his memory. Crucial aspects of his "self" were irretrievably lost. Sacks captured the deep and in this case tragic connection between memory and identity here illustrated when he wrote: "If a man has lost a leg or an eye, he knows he has lost a leg or an eye; but if he has lost a self—himself—he cannot know it, because he is no longer there to know it."¹⁷³

Memory also supports and sustains the narrative quality of an individual's life. As Gilbert Meilaender has written, "each present moment is a 'tensed' present. It stretches out in two directions—incorporating the past and reaching out towards the future. Each moment, therefore, contains a narrative in miniature, and every life is a story whose plot may be partially hidden in the present."¹⁷⁴ The above discussion of reincarnation of souls in the *Aeneid* and the case of Jimmie both show that memory holds together discrete moments of experience in a continuous and intelligible narrative. Moreover, as Meilaender likewise points out, the integration and continuity made possible by memory also (after the passage of time) allow for the possibility of contextualizing and understanding experiences as part of life's larger story.¹⁷⁵ For example, with time and reflection (enabled by memory), originally painful (or even shameful) experiences can be

172. Meilaender, *supra* note 169, at 23–24.

173. SACKS, *supra* note 105, at 35–36.

174. Meilaender, *supra* note 169, at 22 (quoting Stephen Crites, *The Narrative Quality of Experience*, 39 J. AM. ACA. REL. 291, 301 (1971)).

175. Meilaender, *supra* note 169.

understood as ultimately redemptive.¹⁷⁶ As the President's Council on Bioethics observed:

Our experiences at age sixteen will have a different meaning to us when remembered at age eighteen, and a very different meaning yet again when remembered at age fifty. As we grow older, memories become less vivid, but perhaps their significance becomes more clear; although they are less immediate, they are now part of the larger story of who we are. We can consciously re-examine the meaning of remembered events and, as a result, change how they are remembered.¹⁷⁷

Memory thus allows for the possibility of integrating and attaching *meaning* to the myriad experiences within the larger narrative of an individual's life. Memory thus allows one, in the words of the President's Council on Bioethics, to "give new meaning to old happenings."¹⁷⁸

The attachment of meaning to painful past experiences within life's larger narrative can serve an important adaptive function. The case of the Piper Alpha disaster—involving a major fire on a North Sea oil rig—provides an instructive example in this regard. There, two sets of rescuers were sent in to retrieve the badly burned and mutilated bodies of the victims.¹⁷⁹ One set of rescuers was attended by psychiatrists who continually reinforced the narrative that the work being done, while gruesome and horrific, was crucially important to the surviving loved ones: "[it was] stinking, dirty, violent work, but it [meant] something to somebody else."¹⁸⁰ The other set was simply sent in to do the work without the reinforcement of this redemptive narrative. The team members able to contextualize their own painful memories within this redemptive story were able to recover emotionally more quickly and fully than those who could not.¹⁸¹ Without memory, this adaptive process is not possible. In the film

176. Meilaender argues further that this insight counsels extreme caution in preemptively erasing or dampening memories before their full meaning can be understood. *Id.* at 23 ("If, on the contrary, we know ourselves as bodies who live in time, whose lives must have a narrative quality but who cannot know the end or full meaning of our life story, then our task is not to erase memory but to connect and integrate memories—to live the story as best one can who does not yet know how the plot will work out.").

177. PRESIDENT'S COUNCIL ON BIOETHICS, *supra* note 4, at 215.

178. *Id.*

179. D.A. Alexander, *Psychiatric Intervention after the Piper Alpha Disaster*, 84 J. ROYAL SOC'Y MED. 8, 8–9 (1991); D.A. Alexander & A. Wells, *Reactions of Police Officers to Body Handling After a Major Disaster: A Before and After Comparison*, 159 BRIT. J. PSYCHIATRY 547, 547–48 (1991).

180. *Beyond Therapy: Better Memories: Hearings Before the President's Council on Bioethics* (Mar. 6, 2003) (testimony of Paul McHugh), available at <http://bioethics.georgetown.edu/pcbe/transcripts/march03/session4.html>.

181. Alexander, *supra* note 179, at 11; Alexander & Wells, *supra* note 179, at 552.

Memento, the protagonist (who suffers from severe anterograde amnesia) pointedly asks, “How am I supposed to heal if I can’t feel time?”¹⁸²

While remembering is integral to adaptation and preservation of coherence in life’s narrative, so too is forgetting. Indeed, Daniel Schacter—one of the foremost researchers on the science of memory—has argued that the “sins” of memory connected to forgetting are “by-products of otherwise desirable and adaptive features of the human mind.”¹⁸³ Forgetting (in the right measure) allows the pruning of inessential experiences from the individual’s story.¹⁸⁴ The inability to forget properly (or, put another way, the problem of remembering too much) can “engulf[] us in trivia or imprison[] us in the past.”¹⁸⁵ At an extreme, the failure of forgetting can lead to crippling obsession—the constant re-experiencing of past events. This is one of the tragic features of PTSD.¹⁸⁶ One sufferer of PTSD described the horror of this condition stating that she would “sell [her] soul to the devil himself to be rid of [her] 24/7 hellish flashbacks and night terrors.”¹⁸⁷

B. Memory and the Other

The above discussion reflects on the role of memory and human life as individually lived. But persons are not atomized units disconnected from others. Human beings exist in community—in a particular social context. Here, too, memory plays an indispensable role in integrating and sustaining life as humanly lived as a collective matter. “Much of our moral and social life depends on the peculiar ways in which we are embedded in time.”¹⁸⁸ We rely on the memories of those closest to us for an account of our lives at its earliest stages, before we could form durable memories.¹⁸⁹ Later, “as we acquire a

182. *MEMENTO*, *supra* note 105, *quoted in* Meilaender, *supra* note 169, at 20.

183. *Hearings*, *supra* note 106 (testimony of Daniel L. Schacter).

184. Rose, *supra* note 5, at 976 (“The psychological mechanisms of perceptual filtering, and of short-term, recognition and working memory, are clearly beneficial in blocking the accumulation of irrelevant or transiently required information in longer term stores.”).

185. PRESIDENT’S COUNCIL ON BIOETHICS, *supra* note 4, at 219.

186. Kolber, *supra* note 4, at 1568–69 (“A person may be diagnosed with PTSD after experiencing at least one traumatic event that has given rise to a cluster of symptoms which typically include ‘recurrent and painful reexperiencing of the event, phobic avoidance of trauma-related situations and memories, emotional numbing and withdrawal, and hyperarousal.’”).

187. *Id.* at 1565 (quoting Lisa, Posting to COGNEWS (Mar. 7, 2005, 5:13 A.M.), http://cognews.com/1072217907/index_html#1109285564).

188. Sutton, *supra* note 166.

189. PAUL RICOEUR, *MEMORY, HISTORY, AND FORGETTING* 132, *quoted in* Charles Reagan, *Reflections on Paul Ricoeur’s Memory, History, and Forgetting*, 49 *PHIL. TODAY* 309, 311 (2005).

memory, we learn what it is that we have to remember.”¹⁹⁰ Our memories are continually formed, shaped and reinforced in conjunction with those of our close relations.¹⁹¹ We likewise have a profound interest in how we are remembered by others after we have passed away.¹⁹²

At the most basic level, memory makes possible symbolic communication, which in turn enables social arrangements. More deeply, memory undergirds and sustains our deepest attachments. The capacity to remember is necessary for loyalty, empathy, and gratitude. It allows us to honor and memorialize those whom we love or admire. Strong bonds of memory are a crucial feature of the closest human relationships. Hebrew University Professor Emeritus of Philosophy, Avishai Margalit, has noted that “memory is the cement that holds thick relations together.”¹⁹³ The prophet Isaiah, in one of the most evocative passages in the Old Testament, captures this role of memory in the kinship between mother and child and God and the Chosen People: “Can a mother forget the baby at her breast and have no compassion on the child she has borne? Though she may forget, I will not forget you!”¹⁹⁴ According to Margalit, “a conditional sense of memory is necessary for caring.”¹⁹⁵ Conversely, defects of memory can distort and even annihilate our deepest and most dearly held connections with others. The heartbreaking stories of dementia erasing a patient’s memory of his wife or children confirm that this is so.¹⁹⁶

(“It is they who have the memories of my birth, which, by the way begins my personal existence as a member of a community.”).

190. See Poole, *supra* note 165, at 155 (“We learn to remember aspects of our own past only insofar as we learn that certain public objects and practices represent a past that is common to those we are interacting with. It is only by learning to place our experience in the framework of collective memory that we are able to remember our own past.”).

191. See, e.g., MAURICE HALBWACHS, ON COLLECTIVE MEMORY 38 (1992) (“It is in society that people normally acquire their memories. It is also in society that they recall, and localize their memories.”). Halbwachs argued that memories are, in fact, not possible outside of the group context. *Id.*

192. See, e.g., *Cruzan v. Dir., Mo. Dep’t of Health*, 497 U.S. 261, 344 (1990) (Stevens, J., dissenting) (“Nancy Cruzan’s interest in life, no less than that of any other person, includes an interest in how she will be thought of after her death . . .”).

193. AVISHAI MARGALIT, THE ETHICS OF MEMORY 8 (2002). Here, Margalit distinguishes “morality” (which governs remote or “thin” relationships among people, and concerns itself with basic human obligations owed to all) and “ethics” (which regulates close or “thick” relationships and concerned with matters such as loyalty and betrayal). *Id.*

194. *Isaiah* 49:15 (New International Version).

195. MARGALIT, *supra* note 193, at 30.

196. Cf. DAVID SHENK, THE FORGETTING 104–07 (2003) (describing Ralph Waldo Emerson’s inability to remember his wife’s name).

The remembrance of names plays a special role in human relationships.¹⁹⁷ As Margalit observes, Edward Albee's work, *The Play about the Baby*, illustrates this by negative contrast, portraying the absurdity of a son who forgets his mother's name.¹⁹⁸ Similarly, David Edgar's play, *Pentecost*, presents the horrifying circumstance of starving children en route to a concentration camp eating their own cardboard nametags, effectively erasing any trace of their existence.¹⁹⁹ Likewise, the Book of Deuteronomy includes examples of the role of names in this form of double killing: "And the Lord shall blot out the name from under the heaven."²⁰⁰

Memory allows us to make and keep promises. Conversely, it permits us to hold others to their promises, and vice-versa. Memory enables altruism—it empowers us to "transcend our own perspectives and interests" by preserving in mind our relationships and commitments to others that "are not defined by the intensity of present experience."²⁰¹

Memory also allows us to confess and make amends for the wrongs we do to others, and to demand justice from those who do wrong to us. The capacity to forget aspects of the past (or remember them in a different way) is deeply connected to the power to forgive others. Forgiveness is, of course, mysterious and has been conceptualized in different ways as a response to the memory of grievances—blotting out, covering up, bearing, or cancelling a debt.²⁰² Avishai Margalit has described forgiveness as "exclusionary reason, . . . a reason for acting against certain reasons."²⁰³ No matter how forgiveness is conceived, however, it is clear that the inability to modulate the emotional content of the memory of an affront severely

197. See, e.g., MARGALIT, *supra* note 193, at 21 (describing Edgar's play and noting the "memory of personal names as referring to the essence of human beings in a way nothing else does").

198. *Id.* at 26–27.

199. *Id.* at 20–21.

200. Deuteronomy 29:20, cited in MARGALIT, *supra* note 193, at 21.

201. Poole, *supra* note 165, at 154.

202. MARGALIT, *supra* note 193, at 185–86. Margalit contrasts the Biblical conceptions of God's forgiveness (*salakh*—perhaps meaning "to wash"—which is described as "forgetting") with that of man's (*nasa*—meaning "to bear"). *Id.* Meilaender likewise recalls this distinction. Meilaender, *supra* note 169, at 22 ("[T]he prophet Ezekiel describes the restored and reconstituted Israel—in which, presumably, God will no longer remember Israel's sin—Israel's own task is described quite differently. 'Then you will remember your evil ways, and your deeds that were not good.'"). One might wonder what "forgetting" means in the case of God, if one assumes that God lives outside of, and is not bound by time.

203. MARGALIT, *supra* note 193, at 202 (quoting JOSEPH RAZ, PRACTICAL REASONS AND NORMS (2d ed. 1999)).

diminishes the capacity to forgive it.²⁰⁴ That is, if one acutely re-experiences the humiliation or pain of the offense whenever the memory comes to mind, it is unlikely that he will be able to forgive successfully. We are well familiar with stories of *too much memory* in this sense, in which families and relationships are forever destroyed by disordered and persistent memories of grievances suffered.²⁰⁵ In this way, overly vivid memory of the pain of an offense keeps resentment alive and, at an extreme, "breathes revenge."²⁰⁶ Margalit argues persuasively that successful forgiveness requires "the overcoming of resentment" that attends the memory of the wrong done.²⁰⁷

One key to successful forgiveness may be *our own* memory of wrongs that *we* have done to others, our imperfections, and desire for forgiveness—which, in turn, supports empathy for those who have hurt us. Similarly, the capacity to let go of the painful emotions associated with our memory of wronging others is integral to *accepting their forgiveness* for our faults. George Elliot captures this notion vividly in Book 6 of *Middlemarch*:

With memory set smarting like a reopened wound, a man's past is not simply a dead history, an outworn preparation of the present: it is not a repented error shaken loose from life: it is a still quivering part of himself, bringing shudders and bitter flavours and the tingling of a merited shame.²⁰⁸

Reflecting on the relationship between remembering, forgetting, and forgiveness reveals a deep connection between emotion, memory, and moral judgment.

C. Memory and the Polity

Memory does not merely enable and sustain social interactions among individuals on a small or intimate scale. Memory is also integral to the life of a polity. Just as for the individual, the shared (or

204. See, e.g., *id.* at 205 ("[A]s long as the offended one retains any scars from the injury, the forgiveness is not complete.").

205. Cf. OTIS K. RICE, *THE HATFIELDS AND THE MCCOYS* 1 (1978) (noting that the famous feud between the Appalachian Hatfield and McCoy families did not end until the parties ceased open hostilities and "both families chose to forget an ugly chapter in their history"); WILLIAM SHAKESPEARE, *ROMEO AND JULIET* act 1, Prologue ("Two households, both alike in dignity,/ In fair Verona, where we lay our scene,/ From ancient grudge break to new mutiny,/ Where civil blood makes civil hands unclean . . .").

206. MARGALIT, *supra* note 193, at 5.

207. *Id.* at 208.

208. GEORGE ELIOT, *MIDDLEMARCH*, 616–17 (Folio Soc'y 1972) (1871).

“collective”²⁰⁹) memory of a people is crucial to defining and preserving its identity: its origins, its boundaries of membership, the goods it holds most dear, its *obligations in justice to others, its demands for justice from others, its accomplishments, its failures, atrocities suffered and perhaps committed, and even its animating purpose and future goals. In the words of one commentator, “it is through a narrative that the identity of a country or people, or an individual is constructed.”²¹⁰ Shared or collective memory—the stories a society tells about momentous events in its history, the events that most profoundly affect the lives of its members and arouse their passions for long periods²¹¹—creates and sustains this narrative. Moreover, collective memory is *normative*. As Ross Poole has written, it has a “teleological character” and “sets the moral agenda” for the polity or nation in question:

It is because certain things were done or not done in the name of the group that its present members, the *we* who make up the group, now have a responsibility to do certain things—perhaps to carry out the commitments made in the past, or perhaps to compensate for wrongs.²¹²

In this way, collective memory of the past transmits *present* responsibilities.²¹³

Collective memory exists first and foremost, of course, in the minds of the individual members of a polity. Indeed without individual recollection, there would be no common or shared memory.²¹⁴ That said, there are external repositories of shared memory—“[t]he

209. The term “collective memory” is originally attributed to Emile Durkheim, who wrote about social practices and rituals, and was used by Durkheim’s student, Maurice Halbwachs (1877–1945). See, e.g., Jeffrey K. Olick, *Collective Memory*, in INTERNATIONAL ENCYCLOPEDIA OF SOCIAL SCIENCES 7, 7 (William A. Darity ed., 2d ed. 2008). The term “collective memory” has been used in a variety of ways, and has been described as a “woolly concept,” capable of bearing multiple meanings. Mark Osiel, *Ever Again: Legal Remembrance of Administrative Massacre*, 144 U. PA. L. REV. 463, 475 n.48 (1995). Along with Osiel, this Article will use the phrase pragmatically to denote “an ideal type, for its heuristic value alone.” *Id.* “Collective memory” need not be first-person memory; indeed, it rarely is. It is more properly understood, in the words of Osiel, as the “memory of memory.” *Id.*; see also MARGALIT, *supra* note 193, at 58–63 (making the same distinction).

210. Reagan, *supra* note 189, at 311.

211. Osiel, *supra* note 209, at 475. Here, shared or collective memory is distinguished from “history.” For extended reflections on the distinctions between shared memory, history, and related concepts, see generally Olick, *supra* note 209 (discussing memory, history, mnemohistory, social memory studies, and the like); Poole, *supra* note 165 (discussing—and offering a qualified defense to—the challenges of historians to the epistemic status of shared or collective memory).

212. Poole, *supra* note 165, at 159.

213. *Id.*

214. See EVA BRANN, WHAT, THEN, IS TIME? 168 (1999) (asserting that “our common social memory . . . requires individual recollections”).

identified visible remains from sherds to monuments, together with the surviving tales, accounts and documents, and the histories later based on them.”²¹⁵ Eva Brann calls this “external memory.”²¹⁶ Pierre Nora captured this material aspect of shared memory with his evocative phrase, *lieux des memoires* (“places of memory”).²¹⁷ Examples abound.²¹⁸ Jews pray and mourn the destruction of the Temple at the Wailing Wall in Jerusalem. Fans in the United States sing the national anthem before many sporting events. Rituals such as funerals, weddings, and the celebration of national holidays are “social repetitions of memories.”²¹⁹ Even the law itself is both a product and a reflection of shared memory. As Oliver Wendell Holmes observed, “the law embodies the story of a nation’s development through many centuries.”²²⁰ The U.S. Constitution is a key locus of shared memory (though the content and present relevance of that memory is the subject of spirited debate among scholars and jurists).

It is evident from the foregoing that collective memory creates and sustains the identity of a people—it “provides a narrative of struggle and achievement, victory and defeat, in which the members of the group can find their present identity.”²²¹ It is a source of solidarity, connection, and purpose. That said, there is a dark side of collective memory. When a persistent collective memory of grievance and humiliation is attended by raw and powerful emotions, a thirst for vengeance and violence often quickly follow. Such memories can distort and disfigure the life of entire nations, fueling perpetual cycles of revenge. As reporter Michael Ignatieff observed, in such states (for example, the former Yugoslavia) there is great temporal disorientation:

[T]he past continues to torment because it is not the past. These places not living in a serial order of time but in a simultaneous one, in which the past and present are a continuous, agglutinated mass of fantasies, distortions, myths, and lies. Reporters in the Balkan wars often observed that when they were told atrocity stories they were

215. *Id.* at 167.

216. *Id.*

217. The materiality of shared memory is related to what some have termed “extended mind theory.” See Poole, *supra* note 165, at 163 n.4 (discussing the theory of Andy Clark and others that “insofar as external objects . . . play precisely the same role as an ‘internal object,’ . . . then for that reason they must also be counted as mental.”).

218. *See, e.g., id.* at 151 (“[C]ultural memory exists in artifacts, such as monuments, in rituals and other social practices, in codes of dress and behavior, and in a range of other social objects. It also exists in the rhetoric of politicians, editorials, opinion makers and those attempting to mobilize public opinion in one direction or another.”).

219. Reagan, *supra* note 189, at 310.

220. OLIVER WENDELL HOLMES, *THE COMMON LAW* 1 (ABA Classics 2009) (1881).

221. Poole, *supra* note 165, at 158–59.

occasionally uncertain whether these stories had occurred yesterday, or in 1941, 1841, or 1441 . . . [This] is the dreamtime of vengeance. Crimes can never safely be fixed in the historical past; they remain locked in the eternal present, crying out for vengeance.²²²

Indeed, it has been written that for many Serbs, simply seeing “1389” written in graffiti—the year of their loss of the Battle of Kosovo to the Turks—is enough to provoke a profound sense of humiliation and rage even today.²²³ Thus, persistent shared memories combined with strong emotions can lead to devastating consequences for a people, internally and externally.

At the same time, failing to remember injustices committed either against or in the name of a people (with the attendant appropriate sense of indignation or shame) can be equally corrosive to the life of a people. As Martha Minow has written, such forgetting “implies no responsibility and no commitment to prevent inhumanity in the future.”²²⁴ To drive the point home, she invokes the Russian proverb: “Dwell on the past and you will lose an eye. Forget the past and you will lose both eyes.”²²⁵ This insight elucidates the tension and animosity that attended the “Historian’s debate” between Jurgen Habermas and certain conservative German historians about whether and how to contextualize the Holocaust compared with other twentieth century atrocities. It was a debate, it turns out, not merely over an academic question, but rather about the memory and identity of German people in light of their nation’s shared culpability for the gross injustices perpetrated by the Nazis.²²⁶

Given its potential to unify or divide, it is not surprising that governments regularly take steps to steward and shape shared memory. This is particularly true of those governments whose legitimacy is grounded in past events.²²⁷ President Lincoln invoked

222. Michael Ignatieff, *The Elusive Goal of War Trials*, HARPER’S, Mar. 1996, reprinted in Michael Ignatieff, *Articles of Faith, Index on Censorship*, HARPER’S, Sept.–Oct. 1997, at 15–17, quoted in MARTHA MINOW, *BREAKING THE CYCLES OF HATRED* 28 (2003).

223. MARGALIT, *supra* note 193, at 97.

224. MINOW, *supra* note 222, at 28. Minow argues that official forgiveness in the form of amnesty can promote such destructive forgetting. Charles Reagan interprets Paul Ricoeur to agree at least in part, writing that “[a]mnesty . . . sacrifices truth on the alter [sic] of state rationalization” and connecting “amnesty” etymologically with “amnesia.” Reagan, *supra* note 189, at 314 (construing RICOEUR, *supra* note 189).

225. MINOW, *supra* note 222, at 16 (citation omitted).

226. For further discussion of this debate, see Poole, *supra* note 165, at 161–62 (giving an overview of the debate between Jurgen Habermas and conservative German historians).

227. See MARGALIT, *supra* note 193, at 12–13.

the “mystic chords of memory” as part of his call to unify the nation in his First Inaugural Address.²²⁸

When regimes transition from an authoritarian to a democratic form of government, the citizenry often needs to address the crimes of the past. One technique, for better or worse, has been a kind of communal decision to forget. Examples of this include the shredding of some portion of the Stasi files following German reunification²²⁹ and the censorship of memories of Vichy France by DeGaulle²³⁰ (which one historian described not so much as “forgetting” as an implicit agreement “not to tear one another apart”²³¹). By contrast, governments sometimes also take special care to preserve certain important shared memory. For example, some countries (including Italy, Germany, France, Austria, Belgium, Spain, Portugal, and Switzerland) have criminalized “negationism”—denial of the Holocaust.²³² Other regimes (for example, South Africa) have used mechanisms such as Truth and Reconciliation Commissions to unearth and preserve the memory of past crimes by the predecessor regime in a manner that is meant to do justice while allowing for the possibility of a *modus vivendi* for survivors and their former oppressors.²³³

There are, of course, many tragic examples of regimes manipulating and abusing memory for sinister and illegitimate ends. In the face of flagging legitimacy, governments sometimes respond “by propagating fictional pasts and a sense of their institutions’ ancientness.”²³⁴ Orwell captured this tendency in this chilling passage from his iconic novel, *1984*:

And if the facts say otherwise, then the facts must be altered. Thus history is continuously rewritten . . . The mutability of the past is the central tenet . . . Past events . . . have no objective existence, but survive only in written records and in human memories. The past is whatever the records and the memories agree upon. And since the Party is in full control of all records . . . it follows that the past is whatever the Party chooses to make it . . . [W]hen [the past] has been recreated in whatever shape is needed

228. President Abraham Lincoln, First Inaugural Address (Mar. 4, 1861), *available at* <http://www.bartleby.com/124/pres31.html>.

229. *See* MARGALIT, *supra* note 193, at 13.

230. *Id.* at 5.

231. Osiel, *supra* note 209, at 480 (quoting Judith Miller).

232. Emanuela Fronza, *The Punishment of Negationism: The Difficult Dialogue Between Law and Memory*, 30 VT. L. REV. 609, 616–17 (2006).

233. TRUTH & RECONCILIATION COMM’N, 1 TRUTH AND RECONCILIATION COMMISSION REPORT 103–34 (1998) (S. Afr.), *available at* <http://www.justice.gov.za/trc/report/index.htm>.

234. Olick, *supra* note 209, at 8.

at the moment, then this new version is the past, and no different past can ever have existed.²³⁵

Far worse than merely disseminating false claims about the past, some governments, in an effort to distort or uproot shared memory, have ordered mass killings, followed by attempted erasure of any evidence of the slaughter. Stalin liquidated the Kulaks, the agrarian middle class the Czar created in 1905 to be loyal to him, in 1929.²³⁶ The Nazis conceived "Operation Black Hole" in an effort to eliminate any witness who might later testify to the horrors of the death camps: "no witness was to survive, no document was to remain, and all traces of the 'ovens' were to be eradicated so that no material sign would remain to attest to the evil."²³⁷ In this way, the Nazis tried to complete the annihilation of their victims. As Jean Baudrillard famously wrote, "forgetting the extermination is part of the extermination itself."²³⁸

There is, however, a counterpoint to officially coerced forgetting that reveals another salutary function of memory in political life. That is, the role of the *moral witness*. The moral witness secures, preserves, and proclaims the first-person memory of injustice over and against efforts by the powerful to snuff it out.²³⁹ As Margalit noted, Primo Levi believes the moral witness plays an indispensable part in exposing evil and holding malefactors to account: "the most solid materials for uncovering the facts of the crime are the memories of the survivors."²⁴⁰

235. GEORGE ORWELL, 1984, at 175–76 (Signet Classics 1950) (1949) *quoted in* Brian F. Havel, *In Search of a Theory of Public Memory: The State, the Individual, and Marcel Proust*, 80 IND. L.J. 605, 608 (2005). Havel goes on to discuss some of the techniques by which "official memory" is manipulated, including "selectivity, constructivism, mythopoesis (mythmaking), incorporation, and presentism." *Id.* at 612. Michel Foucault likewise observed the deep connection between controlling memory and retaining political control: "[M]emory is . . . a very important factor in struggle [I]f one controls people's memory, one controls their dynamism. . . . It's vital to have possession of this memory, to control it, administer it, tell it what it must contain." *Film and Popular Memory: An Interview with Michel Foucault*, 11 RADICAL PHIL. 24, 25 (1975) *quoted in* Osiel, *supra* note 209, at 624.

236. MARGALIT, *supra* note 193, at 70–71.

237. *Id.* at 165.

238. MINOW, *supra* note 222, at 16 (citing JAMES E. YOUNG, *THE TEXTURE OF MEMORY: HOLOCAUST MEMORIALS AND MEANING* 1 (1993)). Milan Kundera likewise captured the role that forced forgetting can play in political oppression: "[T]he struggle of man against power is the struggle of memory against forgetting." MILAN KUNDERA, *THE BOOK OF LAUGHTER AND FORGETTING* 3 (Michael H. Heim trans., 1980), *quoted in* Osiel, *supra* note 209, at 464.

239. MARGALIT, *supra* note 193, at 147 ("Collective memory has agents and agencies entrusted with preserving and diffusing it."). Margalit goes on to reflect on the nature and characteristics of the moral witness. *Id.* at 148–82.

240. MARGALIT, *supra* note 193, at 166.

But the role of the moral witness is not merely to give a cold, rote account of atrocities observed. Having experienced the atrocities recounted firsthand, he is in a position to infuse his story with an authentic emotional content that is fitting to the horrors witnessed.²⁴¹ The moral witness is able to "tell[] it like it felt."²⁴² This affective dimension serves at least two important purposes. First, it illustrates the injustice in a way that resonates humanly with those who hear the account.²⁴³ Margalit borrows from Wittgenstein's discussion of human sacrifice to illustrate the point:

In trying to understand a ritual of human sacrifice, it is not the historical account of how the ritual evolved that yields understanding but rather our grasp of the deep and sinister impression that the ritual makes on us. This kind of understanding is not gained by a mechanical enumeration of the dead or the badly injured but by an elucidatory description of what took place so that we can link the experience of the victims with our own meager experience.²⁴⁴

Thus, the moral witness is able to convey more vividly the evils suffered, in a language that connects to the listener in a deeper, more human way. The enormity of the injustice is understood viscerally as well as intellectually. Empathy for the moral witness is stronger. Moreover, the richer, full textured first-person account also allows us to recognize ourselves *in the perpetrators of atrocity*—it allows us, in Gilbert Meilaender's words, to "remember "the evil of which we ourselves are capable."²⁴⁵ Accordingly, this richer understanding of the suffering and injustice serves as a more powerful incentive to remain vigilant against similarly evil future acts.

A second value to the affective content of the richer, first-person account of the moral witness is that its particularity allows us to honor the victims as individuals. It gives faces and names to those harmed. Martha Minow has powerfully underscored the dangers of generalized memory in this domain:

[A]s Judith Miller writes, "Abstraction is memory's most ardent enemy." It encourages distance and often, indifference. Etty Hillesum, who died in Auschwitz, wrote in her diary: "[t]he outside world probably thinks of us as a grey, uniform suffering mass of Jews, and knows nothing of the gulfs and abysses and subtle differences that exist

241. For this reason, Margalit notes it is crucial for the moral witness to have "congruence between his emotions and his avowals." *Id.* at 170.

242. *Id.* at 168.

243. *Id.* at 169 ("[T]his deep and sinister aspect is not obvious just from learning the history of the external action, but 'we impute it from an experience in ourselves.' " (quoting LUDWIG WITTGENSTEIN, REMARKS ON FRAZER'S GOLDEN BOUGH 16 (1967))).

244. *Id.* (generalizing Wittgenstein's interpretations on symbolic behavior to the context of the moral witness).

245. Meilaender, *supra* note 169, at 22.

between us." She anticipated our problem even to this day: how to remember her and all the others as distinctive individuals.²⁴⁶

Mass atrocities sever individuals (who, of course, comprise distinctive groups) from the circle of human care and concern. Restoration requires "re-membering" the victims as irreplaceable, particular individuals who are the bearers of human rights and human dignity.²⁴⁷ The testimony of the moral witness is crucial to this process.

D. Brief Reflection on Memory, Emotion, and Morality

From the foregoing discussion, it is clear that memory is integral to life as humanly lived, both on an individual and collective level. Before proceeding further, it is worth underscoring two interrelated insights that have likewise emerged from the previous discussion, both of which are highly relevant to the question of memory and punishment. First, memory is inextricably intertwined with moral judgment and action.²⁴⁸ Second, the affective content of memory—the emotional dimension of memory—largely determines a memory's character, effect, and function.

As noted above, memory makes moral reflection and decisionmaking possible. Memory is the mechanism by which moral responsibilities are transmitted, learned, retained, and recalled. By integrating an individual's past, present, and future, memory enables us to honor our moral obligations, as well as to hold others to account. Conversely, by sustaining personal identity, memory makes it possible for others to fully hold *us* to account for our moral obligations. We have a moral obligation to remember our promises and responsibilities to others. Memory undergirds altruism—acting in the interests of others, perhaps contrary to present inclinations and desires. Memory makes empathy possible, which is the basis of granting, seeking, and accepting forgiveness, and is a key to reconciliation. Memory is necessary for gratitude, honor, and loyalty. Memory is the foundation and *sine qua non* of moral witness. We have an obligation to remember and bear witness to instances of radical evil and injustice. We have an obligation to fittingly remember the victims of such acts.

246. Martha Minow, *The Work of Re-Membering: After Genocide and Mass Atrocity*, 23 *FORDHAM INT'L L.J.* 429, 432 (1999) (citations omitted).

247. See *id.* Minow also uses the term "re-membering" to denote the reconstruction of the community following mass atrocity, including victims and oppressors alike. *Id.* at 430.

248. Unlike Margalit, this Article does not engage the question of a distinction between "morality" versus "ethics"—it uses the terms interchangeably.

Memory allows us to rectify past wrongs and restore others to membership in the human community. As Ross Poole has written, memory "remains an inescapable part of the process through which we claim or accept the burdens and responsibilities, rights and privileges, of any complex form of human existence. As such, it is an essential part of the moral life."²⁴⁹

Emotion is crucial to memory. As noted above, modern science has confirmed that memories accompanied by emotional stress (and the attendant proliferation of certain neurotransmitters such as norepinephrine) are clearer and more durable than those that are not.²⁵⁰ Mysteriously, in still other cases, a surfeit of stress and emotion can cause amnesia.²⁵¹ The adaptive value of this process is obvious. So too are the problems associated with a superabundance of stress in memory that can lead to burdensome persistent memories of painful experiences (for example, PTSD). René Descartes noted the adaptive value of affective memory in the seventeenth century:

[T]he utility of all the passions consists only in their strengthening thoughts which it is good that the soul preserve and which could otherwise easily be effaced from it, and causing them to endure in the soul. So too all the evil they can cause consists either in their strengthening and preserving those thoughts more than necessary or in their strengthening and preserving others it is not good to dwell upon.²⁵²

Emotion amplifies the force of memory and catalyzes action. Marcel Proust's *À la Recherche du Temps Perdu* captures this power of emotion for memory, which has been described as "transcendent . . . since it overcomes the distance that normally separates recall of past events from the lived experience of those events."²⁵³

The relationship between memory and morality turns largely on how and to what extent such memories are animated by emotion. As Margalit has observed, "the emotions engage us with objects in a way that makes the objects lose their neutrality for us and become 'marked': fearful, loveable, disgusting, exciting and so on."²⁵⁴ Thus, the meaning of a memory and its impact on future actions depend on the emotions that attend it. Ideally, indignation and empathy should accompany memories of injustice and of the unjustly treated victims; regret and shame should accompany memories of wrongs committed against others; gratitude should accompany memories of receiving

249. See Poole, *supra* note 165, at 156.

250. See *supra* Part I.C.

251. See *supra* note 97 and accompanying text.

252. DESCARTES, *supra* note 7, at 59.

253. Havel, *supra* note 235, at 611.

254. MARGALIT, *supra* note 193, at 129.

forgiveness and compassion. When rightly ordered, and modulated at the right pitch, the emotions that infuse a memory can suggest the fitting response to a moral judgment: to come to the aid of those suffering, to defend the vulnerable, to stop wrongdoers and hold them to account, consistent with the demands of justice and mercy. However, when the attending emotions are wrongly ordered, asymmetrical, or disproportionately strong or weak in regard to memories of an injustice or moral wrong done, the results produced can be devastating. A flat emotional response to memory of atrocity can produce indifference, muting the desire to aid survivors and pursue corrective justice. Such indifference inhibits vigilance in preventing future atrocities. By contrast, a disproportionately strong and persistent emotional response to memory of humiliation can fan the flames of revenge or produce debilitating trauma. While it is certainly beyond the scope of this Article to offer a calculus for finding the proper relationship between emotions and memory, it is clear that such a balance must be found. As Martha Minow has rightly observed, memory is “double-edged . . . [it] fuels cycles of hatred but it is also essential to personal integrity and for bearing witness to injustice.”²⁵⁵

IV. MEMORY MODIFICATION AND PUNISHMENT

Before exploring the challenges that neurobiological techniques for memory modification hold for criminal punishment, it is necessary to reprise the caveat stated at the outset that none of these techniques are on the immediate horizon. Developmentally, they are at various stages of infancy. Moreover, their prospective applications are first and foremost aimed at patients suffering from diseases and other pathological conditions that concern memory (for example, Alzheimer’s disease and PTSD). This Article is not arguing that the era of widespread memory modification is upon us. Rather, it is taking the speculative and projected application of memory modification techniques for healthy individuals as an opportunity to reflect on the heretofore underexplored relationship between memory and punishment. That said, it is a useful exercise to consider the consequences for criminal punishment if such memory modification techniques ever actually come into routine use among the healthy. The present demonstrates how this might occur in the future, given the widespread demand for such drugs and the current proliferation of off-label prescription (and illegal distribution) of other kinds of

255. MINOW, *supra* note 221, at 4.

psychopharmaceuticals (for example, Ritalin) by a large and growing population of individuals who may not meet the diagnostic criteria for the diseases for which those drugs were intended.²⁵⁶

A. Brief Reflection on Law and Memory

Obviously, memory plays a crucial role in the administration of law generally—especially in the courtroom. Accurate factfinding, a central aspiration of both the civil and criminal trial, depends in crucial ways upon memory, as recorded in documents or other material evidence, or in the minds of witnesses. More deeply, the law itself is a product and reflection of memory. As the above quote from Holmes reflects, law is the embodiment of a polity's evolution. Like the human genome, it includes the conserved remnants of prior moments in a long train of developmental stages culminating in the organism's current state. This is particularly true of the common law. The law (positive and decisional) reflects the judgments that the polity have come to regarding important goods to be pursued and harms to be avoided, as well as the means calculated to attain such ends.

The law is not, however, merely a product and reflection of memory. It also shapes and sustains memory in important ways, both in the substance of its doctrine and in its implementation. Contract law aims to ensure that promises are remembered. Tort law facilitates remembrance of the duties of care owed by all members of the polity to one another. Property law sustains memory of ownership and its transfer. Constitutional law sustains memory of the government's structural design as well as the nation's foundational principles and commitments. Criminal law amplifies the memory of the most serious boundaries of behavior that must be respected by all. And so on. Law, like memory, is "a locus of present responsibility" and "sets the moral agenda" for the future.²⁵⁷

256. *See supra* note 153.

257. Poole, *supra* note 165, at 156.

*B. Punishment and the Importance of Remembering
Fitly and Truly*

Of all the topics that constitute social (and political and legal) philosophy, punishment—its rationale, nature, methods, purposes, and occasions—looms large if not largest.

— Hugo Adam Bedau²⁵⁸

The human context of criminal punishment is profound. It implicates thick concepts of moral agency (and free will), responsibility, the authority (and legitimacy) of state action, individual rights and liberties, the obligations of citizenship, solidarity, empathy, mercy, and justice (in its manifold forms). It is also inextricably intertwined with *memory*, individual and collective. This Section unpacks the relationship between punishment and memory. More specifically, it examines how memory animates the various (and, in some cases, competing) distributive theories of punishment.²⁵⁹ And, by extension, it explores the unique theoretical challenges novel neurobiological techniques of memory modification raise. For clarity of focus, the analysis is mostly limited to the capital sentencing process.

These questions of “whom” to punish and “how much” punishment is warranted are deeply intertwined with memory, from a variety of angles, across contexts, including the traditional distributive justifications for punishment such as just deserts (or retributive justice), deterrence, incapacitation, and rehabilitation. This is also true of the relatively more novel distributive justifications such as the education of the polity and the restoration and repair of the relationship between offender and victim, as well as among these individuals and the broader community. Because memory is integral to these justifications, the possibility of neurobiological memory modification (for any of the individuals or groups touched by the

258. Hugo Adam Bedau, *Feinberg's Liberal Theory of Punishment*, 5 BUFF. CRIM. L. REV. 103, 104 (2001).

259. H.L.A. Hart distinguished the “General Justifying Aim” of punishment from its distributive justifications. The former constitutes the ultimate legitimating goal of punishment, whereas the latter is a limiting or qualifying principle that informs the scope of liability (namely, *who* should or should not be punished) and the amount of punishment that may be meted out (i.e., *how much* or *little* to punish the convicted offender). See H.L.A. HART, PUNISHMENT AND RESPONSIBILITY: ESSAYS IN THE PHILOSOPHY OF LAW 8–13 (1968) (applying distinction to retributive justice and concluding that one need not hold retribution as sole justifying aim of punishment in order to accept its limitations on scope and severity of such punishment); O. Carter Snead, *Neuroimaging and the “Complexity” of Capital Punishment*, 82 N.Y.U. L. REV. 1265, 1333 (2007) (discussing same with reference to Hart).

process and execution of punishment) poses unique challenges and potential disruptions.

This analysis of memory, memory modification, and punishment takes as its point of departure a concept introduced by the President's Council on Bioethics in its 2003 report, *Beyond Therapy: Biotechnology and the Pursuit of Happiness*. In its discussion of memory modification, the Council suggested that remembering one's experiences "fitly and truly" is essential to leading an ethical life.²⁶⁰ Remembering an experience "truly" requires forming and preserving an accurate memory—one that comports with the facts as they occurred. Remembering "fitly" requires that the memory be infused with an appropriate affective content, in light of the memory's substance. That is, the memory should be animated by a morally appropriate sentiment (for example, admiration or indignation, pride or shame) and *modulated* proportionately (neither too strong or persistent, nor too weak or transient).

This Section will argue that remembering fitly and truly is likewise essential to vindicating the manifold distributive principles of punishment noted above. The substantive and affective content of the memory—of the convicted defendant, the judge and jury, the victim, and the broader society—are integral to just and effective punishment. Memory modification, should it become reliable and widespread, thus represents a challenge in this regard (as discussed in the sections to follow).

1. Remembering Fitly and Truly Is Essential to Retributive Justice

Memory looms large for retributive justice. Retributive justice—also called punishment according to desert or "just deserts"²⁶¹—is the oldest principle of punishment.²⁶² It is a distributive

260. See PRESIDENT'S COUNCIL ON BIOETHICS, *supra* note 4, at 226–33. The Council touched very briefly on the question of memory dampening and criminal justice, noting that both criminals and totalitarian societies have acute interests that their crimes be forgotten (both by their victims, the broader society, and even by themselves).

261. This Article will use these phrases interchangeably. Recently, Paul Robinson has offered a typology of desert. See *infra* note 264.

262. 1 WAYNE R. LAFAVE, SUBSTANTIVE CRIMINAL LAW § 1.5 (2d ed. 2003). Retributive justice has been much criticized by the legal commentariat as a source of brutality and inhumanity. See, e.g., Dan Markel, *State, Be Not Proud: A Retributivist Defense of the Commutation of Death Row and the Abolition of the Death Penalty*, 40 HARV. C.R.-C.L. L. REV. 407, 410–13 (2005) ("Countless cases in the Supreme Court equate retributivism with revenge or the desire to make criminals suffer or both. . . . [V]arious commentators reflexively embrace this view"); Edward Rubin, *Just Say No to Retribution*, 7 BUFF. CRIM. L. REV. 17, 49–55 (2003); Mitchell N.

theory²⁶³ that allocates punishment “according to the offender’s personal blameworthiness for the past offense, which takes account not only of the seriousness of the offense, but also the full range of culpability, capacity, and situational factors that we understand to affect an offender’s blameworthiness.”²⁶⁴ The emphasis on the offender’s *culpability* is the key distinguishing feature of retributive justice.

This principal animating emphasis on culpability has concrete entailments for *who* may be punished, and *how much* punishment is just. First and foremost, retributive justice requires that only the guilty be punished. As Gerard V. Bradley has noted, “[t]he most important moral signature of retribution is its exceptionless protection of the innocent from conviction.”²⁶⁵ Even for those duly convicted, retributive justice imposes important constraints on the amount of punishment rendered. Indeed, there are many instances in which retributive justice offers far more robust protections to the criminally convicted than the competing distributive theories of punishment (especially deterrence and incapacitation). As Albert Alschuler has observed:

Sometimes, however, withholding punishment does not undercut the social contract or the general sense of reciprocity and mutual obligation. The wrongdoer may not seem to be a free rider; he may appear to be more sinned against than sinning; he may have had no real choice; he may have been subjected to extraordinary temptations; he may have been too immature to be responsible; he may have suffered enough; we may accept his apology and expression of remorse as sincere. Retributivism takes these circumstances into account without strain or rationalization. The other textbook purposes of

Berman, *Punishment and Justification* 2–3 & n.5 (Univ. of Tex., Pub. Law Research Paper No. 129, 2006), available at <http://ssrn.com/abstract=956610> (“Retributivists are said to be unable to make clear either why wrongdoers deserve to suffer or why it is permissible for a state institution to inflict suffering even if deserved. They are also deplored as savage or barbaric.”). For reasons discussed below, this is an incomplete account of the doctrine and its effects.

263. John Finnis and Gerard V. Bradley have defended retributive justice also as the first-order justification for punishment—not merely a distributive principle. See John Finnis, *Retribution: Punishment’s Formative Aim*, 44 AM. J. JURIS. 91, 102 (1999); Gerard V. Bradley, *Retribution and the Secondary Aims of Punishment*, 44 AM. J. JURIS. 105 (1999). For additional accounts of retributive justice as a general justifying aim, see Rebecca Dresser, *Personal Identity and Punishment*, 70 B.U. L. REV. 395, 420–21 (1990) (describing alternative approaches).

264. Paul H. Robinson, *The A.L.I.’s Proposed Distributive Principle of “Limiting Retributivism”: Does It Mean Anything in Practice Other Than Pure Desert?*, 7 BUFF. CRIM. L. REV. 3, 5 (2003). Robinson offers a comprehensive typology of “desert” in *Competing Conceptions of Modern Desert: Vengeful, Deontological, and Empirical*, 67 CAMBRIDGE L.J. 145 (2008) (distinguishing “vengeful desert” which exacts the same measure of suffering from the defendant as that which he caused the victim, from “deontological desert,” which judges blameworthiness according to abstract notions of good and evil, and “empirical desert,” which focuses on blameworthiness as defined by shared intuitions of justice in the relevant community).

265. Bradley, *supra* note 263, at 109.

punishment do not The formula “an eye for an eye” is horrifying precisely because it does not adequately take account of an offender’s culpability.²⁶⁶

Retributive justice has been the lynchpin of the Supreme Court’s “narrowing jurisprudence”²⁶⁷ for the death penalty, which limits death eligibility to “a narrow category of the most serious crimes” and defendants “whose extreme culpability makes them ‘the most deserving of execution.’ ”²⁶⁸ Precisely because of its commitment to retributive justice, the Supreme Court has barred the execution of mentally retarded defendants,²⁶⁹ defendants who were under the age of eighteen when their offense was committed,²⁷⁰ defendants convicted of felony murder who did not actually kill or attempt to kill the victim,²⁷¹ defendants convicted of raping an adult woman,²⁷² and child rapists.²⁷³

Retributive justice’s requirement that punishment be tailored to culpability can be seen in the structure of the capital sentencing process, most obviously in the jury’s consideration of aggravating and mitigating factors. While specifics vary from jurisdiction to jurisdiction, nearly all capital sentencing regimes require the jury to consider mitigating²⁷⁴ and aggravating²⁷⁵ factors in assessing whether

266. Albert W. Alschuler, *The Changing Purposes of Criminal Punishment: A Retrospective on the Past Century and Some Thoughts About the Next*, 70 U. CHI. L. REV. 1, 18–19 (2003). Alschuler also notes that a commitment to retributive justice does not foreclose acceptance of consequentialist benefits that flow from adoption of this punishment theory. See *id.* at 15 (clarifying that retributivists “need not deny the legitimacy of other goals of punishment”).

267. *Atkins v. Virginia*, 536 U.S. 304, 319 (2002). For a discussion of the Court’s discussion of retributive justice, see Dan Markel, *Executing Retributivism: Panetti and the Future of the Eighth Amendment*, 103 NW. U. L. REV. 1163, 1180–81 (2009) (discussing *Kennedy v. Louisiana*, 128 S. Ct. 2641 (2008), *Panetti v. Quarterman*, 551 U.S. 930 (2007), and *Atkins*, 536 U.S. 304, among other cases).

268. *Roper v. Simmons*, 543 U.S. 551, 568 (2005) (quoting *Atkins*, 536 U.S. at 319).

269. *Atkins*, 536 U.S. at 321.

270. *Roper*, 543 U.S. at 571.

271. *Enmund v. Florida*, 458 U.S. 782, 801 (1982).

272. *Coker v. Georgia*, 43 U.S. 584, 592 (1977).

273. See *Kennedy v. Louisiana*, 554 U.S. 407, 442 (2008) (citing *Atkins*, 536 U.S. at 319; *Furman v. Georgia*, 408 U.S. 238, 308 (1972) (Stewart, J., concurring)) (“The goal of retribution, which reflects society’s and the victim’s interests in seeing that the offender is repaid for the hurt he caused . . . does not justify the harshness of the death penalty here.”).

274. See, e.g., KAN. STAT. ANN. § 21–4626 (2007 & Supp. 2010) (repealed 2010) (listing several common statutory mitigating factors, such as lack of prior criminal history, minor or accomplice role in crime commuted by another, “the influence of extreme mental or emotional disturbances,” and when defendant’s capacity “to appreciate the criminality of [his] conduct or to conform [his] conduct to the requirements of the law was substantially impaired”).

275. See, e.g., *Ring v. Arizona*, 536 U.S. 584, 592–93 & n.1 (2002) (listing statutory aggravating factors, including prior conviction for a “serious offense,” commission of offense for “anything of pecuniary value,” and commission of offense “in an especially heinous, cruel or

the convicted defendant deserves the death penalty.²⁷⁶ The Supreme Court has held that that defendants are entitled to present mitigating evidence related to “any aspect of [the] defendant’s character or record and any of the circumstances of the offense that the defendant proffers as a basis for a sentence less than death.”²⁷⁷

Those defendants reaching the sentencing phase of the capital trial have already satisfied the prerequisite legal thresholds for sanity, competence, and the capacity to formulate the relevant mens rea. At this stage of the criminal process, therefore, “it is impossible to offer an ‘excuse’ for the defendant’s acts. The jury already knows that no justifiable excuse exists for what the defendant did.”²⁷⁸ Mitigation evidence is thus not intended to excuse from guilt. Rather it is submitted to “inspire[] compassion . . . offer[ing] neither justification, nor excuse for the capital crime.”²⁷⁹ A mitigation claim is an appeal to the jurors’ sense of empathy, seeking leniency on the grounds that some aspect of the defendant’s character, background, or life experiences diminish his culpability such that he deserves a punishment less than death. Mitigation claims are thus rooted squarely in the principle of retributive justice: “Underlying [the Supreme Court precedents bearing on the doctrine of mitigation] is the principle that punishment should be directly related to the personal culpability of the criminal defendant.”²⁸⁰

depraved manner”) (citing ARIZ. REV. STAT. ANN. § 13–703(G) (2001)); Jonathan Simon & Christina Spaulding, *Tokens of Our Esteem: Aggravating Factors in the Era of Deregulated Death Penalties*, in THE KILLING STATE: CAPITAL PUNISHMENT IN LAW, POLITICS, AND CULTURE 81, 91 tbl.4.2 (Austin Sarat ed., 1999) (listing aggravating factors in various states).

276. See *Kansas v. Marsh*, 548 U.S. 163, 172–74 (2006) (noting that states may weigh aggravating and mitigating factors as they please, provided they observe fundamental principles of the Supreme Court’s Eighth Amendment jurisprudence that all capital sentencing schemes must “(1) rationally narrow the class of death-eligible defendants; and (2) permit a jury to render a reasoned, individualized sentencing determination based on a death-eligible defendant’s record, personal characteristics, and the circumstances of his crime”). For a discussion of different approaches to comparing aggravating and mitigating factors, see James R. Acker & Charles S. Lanier, *Matters of Life or Death: The Sentencing Provisions in Capital Punishment Statutes*, 31 CRIM. L. BULL. 19, 33–52 (1995).

277. See *Marsh*, 548 U.S. at 174 (internal quotation marks omitted) (quoting *Lockett v. Ohio*, 438 U.S. 586, 604 (1978)).

278. Peter T. Hansen, *Mitigation: An Outline of Law, Method and Strategy*, CAP. DEF. DIG., Apr. 1992, at 29, 32.

279. John M. Fabian, *Death Penalty Mitigation and the Role of the Forensic Psychologist*, 27 LAW & PSYCHOL. REV. 73, 78 (2003) (quoting Russell Stetler, *Mental Disabilities and Mitigation*, 23 CHAMPION 49, 50 (1999)).

280. *Penry v. Lynaugh*, 492 U.S. 302, 319 (1989) (quoting *California v. Brown*, 479 U.S. 538, 545 (1987) (O’Connor, J., concurring)), *overruled in part by Atkins v. Virginia*, 536 U.S. 304, 316–19 (2002).

Fairly appraising the mitigating and aggravating factors relevant to a defendant's culpability involves not merely cold, rational analysis of the jurors. It is a calculus that includes emotional faculties as well—ranging from the capacity for righteous indignation, on the one hand, to the ability to empathize, on the other. For example, when considering aggravating factors, jurors are often asked to make judgments about the degree of moral depravity or brutality reflected by the crime. Consider, in this regard, some of the common statutory aggravating factors in this vein: "Desecration or Mutilation of Victim's Body, Sexual Abuse or Exploitation of a Child, Victim was a Child, Victim was Elderly or Disabled, Victim was a Family Member, and Victim was Pregnant."²⁸¹ Also, multiple jurisdictions include as an aggravating factor whether a murder was "especially heinous, atrocious, or cruel, manifesting exceptional depravity."²⁸² It would seem that an intact and well-ordered moral sensibility is necessary for the just assessment of this type of evidence.²⁸³

Similarly, a well-ordered sense of empathy is necessary to fairly appraise mitigating evidence. That is, to give fitting weight to mitigating evidence requires the capacity, in the words of Martha Nussbaum, to "see the other as a center of perception, emotion, and reason, rather than an inert object."²⁸⁴ The juror in this instance is called upon to discern whether taking into account the "diverse frailties of humankind"²⁸⁵ manifest in this particular defendant, a proportionate response is a sentence less than death. This process invariably requires the exercise of moral sentiment and placing oneself in the position of the other to be judged. It requires reflection on the character, background, extenuating circumstances, and remorse of the defendant. Conversely, the feeling and expression of remorse by the defendant—part and parcel of an authentic and

281. Jeffrey L. Kirchmeier, *Casting a Wider Net: Another Decade of Legislative Expansion of the Death Penalty in the United States*, 34 PEPP. L. REV. 1, 18–25 (2006).

282. CAL. PENAL CODE § 190.3 (2008). For similar formulations, see, e.g., ALA. CODE § 13A–5–49 (LexisNexis 2005); ARIZ. REV. STAT. ANN. § 13–751 (2010); ARK. CODE ANN. § 5–4–604 (2006); COLO. REV. STAT. ANN. § 18–1.3–1201 (2010); CONN. GEN. STAT. ANN. § 53A–46A (West 2007); FLA. STAT. ANN. § 921.141 (West 2006); HAW. REV. STAT. ANN. § 706–657 (LexisNexis 2007); IDAHO CODE ANN. § 19–2515 (2004); KAN. CRIM. CODE ANN. § 21–4625 (West 2007); MISS. CODE ANN. § 99–19–101 (2000); N.J. STAT. ANN. § 2C:44–1 (West 2005); N.C. GEN. STAT. § 14–17 (2009).

283. Obviously, fleshing out the contours of such a well-ordered moral sensibility is a deeply complicated question, well beyond the scope of this Article.

284. MARTHA NUSSBAUM, FROM DISGUST TO HUMANITY: SEXUAL ORIENTATION AND CONSTITUTIONAL LAW xix (2010).

285. *Woodson v. North Carolina*, 428 U.S. 280, 304 (1976).

effective mitigation claim—requires moral sensitivity and empathy for the victim.

In short, retributive justice requires that the punishment track culpability in a proportionate measure. Measuring culpability turns on clear-eyed assessment of the harms wrought as well as the defendant's character and state of mind, taken as whole. All of these appraisals require the capacity for indignation and empathy.

So, how does remembering fitly and truly bear on harmonizing punishment and culpability? More specifically, how might neurobiological memory modification frustrate this aspiration? To illustrate the potential challenges in this context, it is useful to consider several hypothetical cases.

Case 1: Unmediated Memory

In the first case, consider a defendant who robs a convenience store. After taking the contents of the cash register, he impetuously kills the clerk, in an effort to eliminate eye witnesses to the crime. He is apprehended and convicted of capital murder. During the sentencing phase of the capital trial, the defendant reflects on his background: his broken childhood, marked by unspeakable abuse and neglect; years of drug and alcohol use; a spotty and unstable employment history; and a history of using violence to impose his will and pursue his interests. Based on this reflection, he is able, with the aid of his lawyer, to construct a mitigation case rooted in this narrative. In addition to reflecting on his own past, the defendant considers the effect that his actions have had on the victim, his family, and the community in which the crime occurred. With the aid of a therapist, he is finally able to see himself in the people whose lives he violated and destroyed. He comes to deeply regret his misdeed and expresses his remorse to the jury.

For their part, the jurors appraise both the aggravating and mitigating evidence. They remember and reflect on the facts as presented several weeks before during the guilt phase of the trial: the barbaric nature of the crime, the helplessness of the victim, and the atrocious indifference of the defendant to human life. They reflect on their own attachments, loved ones, and communities (past and present), and feel fitting moral indignation. But they also consider the circumstances of the defendant's background and experiences. Some of them consider their own life's narrative (including past mistakes and regrets), and try to imagine what *they* would do if subjected to the deprivations and abuse that characterize the defendant's personal history. They reflect on his remorse, and they judge it to be genuine. They feel appropriate empathy and sympathy for the defendant.

Case 2: Memory Erasure in the Defendant

Consider the same scenario described above, but imagine that, prior to committing the robbery, the defendant takes a dose of Rohypnol to induce anterograde amnesia—effectively wiping out any memories of the crime itself. He is apprehended, found competent (despite his amnesia, he is able to understand the nature and object of the proceedings and assist in his own defense),²⁸⁶ and is convicted of capital murder.

Alternatively, imagine the same defendant commits the crime without the influence of drugs and is arrested and charged. But during the pendency of his case, undergoes extensive electroconvulsive therapy (ECT) to treat intractable depression. As a result, his memory of the crime and much of his past is erased.

In both instances, when trying to construct a mitigation case, the defendant finds it difficult to reflect on the details of the crime to generate a sense of empathy in himself for the victim, and, by extension, remorse. In the alternative ECT scenario, he is unable to fully access his past in a way to articulate the narrative of extraordinary deprivation and hardship that contributed to his disastrous conduct.

Case 3: Memory Dampening in the Defendant

In this case, imagine that the defendant takes an adequate dose of propranolol in advance of his crime to prevent the shameful and painful memories of the horrific acts he then commits. Alternatively, in the weeks following the crime, he pursues a strategy of reconsolidation blockade with propranolol, dampening the pain and shame of the memories after the fact.

During the sentencing phase of the trial he can only remember the murder as a neutral event. The memory is not infused with any meaningful or appropriate affective content. He is not able to feel authentic empathy or regret. Thus, his mitigation claim lacks a truly felt element of regret.

286. See 2 PAUL H. ROBINSON ET AL., CRIMINAL LAW DEFENSES § 207 (1984) (describing the jurisprudence of amnesia, and explaining that amnesia, standing alone, is rarely sufficient to support a claim of incompetence or that the trial is rendered fundamentally unfair); see also Jonathan M. Purver, Annotation, *Amnesia as Affecting Capacity to Commit Crime or Stand Trial*, 46 A.L.R.3d 544, § 2(a) (1972) (noting that generally amnesia per se is not a defense unless the accused did not know the nature of the act and that the act was wrong); James E. Tyesse & Thomas L. Hafemeister, *Amnesia and the Determination of Competency to Stand Trial*, 25 DEV. MENTAL HEALTH L. 65, 65–66 (2006) (noting that American courts have been unanimous in refusing to equate amnesia with incompetency).

Case 4: Memory Enhancement in the Defendant

Imagine that the defendant, just before the crime, takes a drug sufficient to *amplify* the stress and emotion that attend the encoded memory. Or, imagine that it is possible to amplify the emotional content of the memory after the fact by reconsolidation accompanied by an injection of a suitable excitatory agent. His memory of the crime itself may very well be more clear and durable. Additionally, the drugs effectively up-regulate the emotional content of the memories. He is plagued by the emotional pain of the memories—constantly reliving the events with all of their stress, fear, and emotion. He is tortured by the memories and racked with guilt. He experiences profound remorse. This is all conveyed to the jurors in his mitigation case.

Case 5: Memory Dampening of Jurors

Turning from the defendant to the jurors, imagine one or more jurors take propranolol in anticipation of seeing and hearing horrific evidence of the murder. Sufficient time passes between the presentation of the evidence and the jury's sentencing deliberations such that the facts of the crime are remembered as neutral. Those jurors under the influence of propranolol are unable to access the fitting emotions of revulsion and indignation that the murder narrative would normally provoke.

Consider the possibility that some jurors took propranolol in anticipation of hearing the horrific account of the defendant's past, presented as part of his mitigation claim. Over time, the defendant's narrative of deprivation of abuse would be recalled as emotionally neutral by such jurors. The defendant's story would perhaps not inspire in the jurors a substantial empathetic reaction.

Imagine alternatively that there are several jurors who have been taking propranolol on a regular basis to dull the sting of painful and shameful memories of their own past conduct. As a result, when they hear the facts put forth by the defendant in his mitigation claim, the narrative of hardship, terrible choices, and disastrous behavior does not resonate with them. They are not reminded by analogy of the pain and shame of their own failings and missteps.

Case 6: Memory Enhancement of Jurors

Imagine, finally, that certain jurors decide to take psychopharmacological agents that will *enhance* the memory and/or the stress and pain of the memories encoded when they hear the details of the defendant's crime. They take such drugs to preserve their memory of the crime itself in a measure beyond the normal capacities of the average person. Perhaps they also do not want to dull the sting of the horror of the crime itself. To the contrary, they want to

"burn it into their minds" in order to do justice to the victim's suffering. As a result, these jurors experience a powerful, persistent sense of moral indignation and revulsion for the crime, and by extension, for the defendant. The human costs of the crime are foremost in their consideration when weighing both aggravating and mitigating factors. Their visceral disgust for the crime itself crowds out other thoughts, including those relating to the background, character, and experiences of the defendant set forth in his mitigation claim.

Alternatively, such memory enhancement of the details of the mitigation claim by the jurors could prompt a similarly asymmetrical response to the defendant's history of deprivation and abuse, in contrast with the horror of crime itself. That is, artificially amplifying the memory of the mitigating evidence while leaving the memory of the details of the crime itself unenhanced could lead jurors to pay undue emphasis to the former at the expense of the latter.

What Do the Cases Show?

Obviously, the above cases are fanciful. But the fanciful exaggerations are intended to underscore an abiding truth, namely, that there is a connection between retributive justice and memory. Moreover, disrupting the latter can lead to serious complications for the project of modulating punishment according to culpability: the chief animating goal of retributive justice. Why is this so? There are several reasons.

Take first the question of *who* may be punished consistent with just deserts. Recall that this distributive principle forbids punishment of those individuals who have done no wrong. Case 1 poses no such problem. Case 2, involving memory erasure (particularly involving retrograde amnesia caused by ECT) raises a nontrivial question of *personal identity* that must be addressed. Rebecca Dresser, in discussing the work of Derek Parfit on punishment and identity, has noted that:

[D]esert claims can only be sustained if a person is an entity who is . . . stable over time. For punishment to be fair, the person punished must be the same person who previously disobeyed the law. If not, an innocent person unjustly pays the price for another's wrongdoing, an outcome which retributivists universally denounce.²⁸⁷

Similarly, Joel Feinberg has agreed that "all of our ordinary notions of responsibility . . . presuppose a continuity of personal identity between earlier and later stages" of the same individual's life.²⁸⁸ John Locke

287. Dresser, *supra* note 2, at 421–22 (internal citations omitted).

288. *Id.* (quoting JOEL FEINBERG, HARM TO SELF 83–84 (1986)).

likewise raised the concern about punishing the amnesiac.²⁸⁹ The retrograde amnesia caused by the ECT raises a question about the psychological continuity between the defendant before and after his forgetting. The amnesia induced by Rohypnol raises similar questions, though thornier, since the defendant intentionally induced the forgetting. It is unlikely that the psychological discontinuity forced by the amnesia in either case would be sufficient to raise a serious question of personal identity. As noted above, the modern jurisprudence of amnesia is skeptical of such claims. But, nevertheless, "to justify retributive desert, it is necessary to determine whether there is a morally relevant psychological connection between an offender and a person subject to punishment."²⁹⁰ True memory is a key constituent of this psychological connection. At the very least, the memory erasure in Case 2 interferes with the defendant's true recall of his own past, which is integral to constructing a mitigation narrative grounded in the truth. Accordingly, the jury will be inhibited in acquiring facts crucial to harmonizing punishment with desert.

The greater challenge memory modification poses for retributive justice, as illustrated by the above cases, arises with the up- or down-regulation of affective content in memory. In Case 3, it is clear that the down-regulation of the affective content of the defendant's memory prevents a *fitting* memory of his own crime. Without such a fitting memory, the defendant is unable to grasp fully the horror of his own acts. This poses an obstacle to empathy, and thus remorse. This complicates the task of punishing in a way that tracks culpability. Does it matter that the failure to encode the emotional valence of the crime was intentional? Would it matter if it were not? Should the jury punish the defendant as they would a sociopath, who cares nothing for the harms on others he inflicts? Or should they be more lenient, depending on how they judge his motives in taking the drug?

What do just deserts require for the defendant in Case 4 who has up-regulated his memory of his crime? Should the jury consider

289. See *id.* at 428 (quoting John Locke, *Of Identity and Diversity*, in 1 AN ESSAY CONCERNING HUMAN UNDERSTANDING 439, 464 (A. Fraser ed., 1959) (1690)). Some arguments for clemency or pardons likewise rest on a different claim of personal discontinuity, namely, that the convict in question has been rehabilitated and is no longer the person who committed the original crime. High profile cases involving these arguments include the matters of Stanley "Tookie" Williams and Karla Fay Tucker. See, e.g., Evan J. Mandery, *Commentary: Mercy and Contrition*, 42 CRIM. L. BULL. 339 (2006) (discussing Williams' case); Mary Sigler, *Mercy, Clemency, and the Case of Karla Fay Tucker*, 4 OHIO ST. J. CRIM. L. 455, 456 (2007) (discussing Tucker's case).

290. Dresser, *supra* note 2, at 427.

his amplified remorse and self-torment in appraising what he deserves? Again, does it matter that his remorse is, by design, chemically induced (exogenously)? At the very least, finding a punishment that fits culpability is complicated by memory modification in this case.

What about the jurors in Case 5? Down-regulating their emotions to prevent the encoding the memory of the crimes as described in court may mute their capacity for indignation and revulsion in the face of this particular human atrocity. Will this failure to remember *fitly* impair their ability to take on board the horror of the crime, and thus culpability of the defendant? The same could be asked of those jurors who down-regulate their memories of the defendant's life narrative (presented in mitigation). Might they be compromised in their efforts to ascribe adequate weight to his history of pain and suffering? If so, the project of fashioning a punishment that suits the defendant's moral responsibility is likewise compromised. And what about the jurors who are in the habit of down-regulating the shameful or painful memories of *their own* misconduct? Might this not impair their capacity for empathy, which is also integral to discerning culpability in service of finding a fitting punishment according to just deserts?

Finally, what about the jurors in Case 6 who have intentionally amplified their memory of the defendant's crime (and perhaps its affective content)? This is also a departure from remembering *fitly*. These jurors have an artificially induced volume of indignation and revulsion disproportionate to that associated with an unmodulated memory. It would seem that the emotions that suffuse the jurors' memory are likely to interfere with a fair appraisal of the facts and circumstances that mitigate the defendant's culpability. This has deleterious consequences for the project of harmonizing punishment with responsibility, as required by just deserts. The same could be said of those jurors who have artificially amplified their memories of the defendant's troubled past. Weighing culpability in this instance might be difficult (to the unfair benefit of the defendant), considering the weaker memory of the crime itself.

In conclusion, as the cases above demonstrate, the central task of retributive justice—harmonizing punishment and desert—depends in crucial ways on remembering *truly* and *fitly*. Modifying memory neurobiologically seriously complicates this goal by preventing access to accurate accounts of the crime, or by preventing authentic emotions (felt in the appropriate degree) integral to appraising culpability, such

as indignation (in response to aggravating factors) or empathy (in response to mitigating factors).²⁹¹

2. Remembering Fitly and Truly Is Essential to Effective Deterrence

Albeit in less dramatic fashion, memory likewise plays a significant role in the distributive justification for punishment traditionally referred to as *deterrence*. The aims of deterrence are twofold. First, under the doctrine of specific deterrence (also referred to as “particular deterrence” or even “intimidation”), the purpose is “to deter the criminal himself (rather than to deter others) from committing further crimes, by giving him an unpleasant experience he will not want to endure again.”²⁹² Second, for general deterrence (sometimes called “general prevention”), punishing the criminal is intended to deter others from committing similar crimes in the future, so as to avoid the same negative consequences.²⁹³ For both aspects of deterrence, the chief aim is to reduce the overall incidence of crime. This is accomplished by appealing to the rational self-interest of the relevant actors—the defendant (in the case of specific deterrence) and the broader society (in the case of general deterrence). The distributive considerations of *whom* and *how much* to punish, are thus calibrated to effectuate this consequentialist goal.²⁹⁴ For both types of deterrence

291. There remain a few related issues beyond the scope of the current inquiry but nevertheless are worth flagging for future consideration. First, might a serious disruption in memory wrought by neurobiological interventions foreclose the execution of a convicted defendant on the grounds that he is not able to “comprehend[] the meaning and purpose of the punishment” as discussed in *Panetti v. Quarterman*, 551 U.S. 930, 960 (2007)? How great a disruption would this require? Second, what limits should be imposed on the state’s use of neurobiological interventions as an adjunct to punishment—perhaps to induce remorse? See *Washington v. Harper*, 494 U.S. 210, 221–24 (1990) (discussing the framework for involuntary medication of prisoners). What if the defendant requests such an intervention?

292. LAFAVE, *supra* note 262, § 1.5(a)(1).

293. See *id.* § 1.5(a)(4) (“[T]he sufferings of the criminal for the crime he has committed are supposed to deter other from committing future crimes, lest they suffer the same unfortunate fate.”)

294. Are there any internal limits on the amount of punishment that may be meted out in the name of deterrence? Extremely harsh punishments for minor crimes would certainly serve as effective deterrents. The reason for restraint in this regard is a controversial and much-discussed topic among scholars and commentators. For a discussion of this question, see, for example, Richard S. Frase, *Excessive Prison Sentences, Punishment Goals, and the Eighth Amendment: “Proportionality” Relative To What?*, 89 MINN. L. REV. 571, 575–76 (2005), and Snead, *supra* note 259, at 1270 n.18. See also R. A. Duff, *Penal Communications: Recent Work in the Philosophy of Punishment*, 20 CRIME & JUST. 1, 87 (1996) (“I have argued that the strictly consequentialist accounts of the aims of punishment (whether or not our pursuit of such aims is to be constrained by independent requirements of justice) are open to serious and, I think, conclusive moral

to work, convicted criminals, jurors, and the broader society must all remember *fitly* and *truly*. To understand why this is so, and the related challenges that memory modification may pose to effective deterrence, consider again the hypothetical cases outlined above.

When deciding *whom* and *how much* to punish, a preliminary question for such calibration relates to the gravity and magnitude of the harms to be prevented. That is, the gravest harms—the worst crimes—demand maximal deterrence, and thus the harshest penalties. The sentencing jury's discernment on this question is structured and guided in a variety of ways, including by the enumeration of aggravating factors (discussed above). But, as in the context of retributive justice, fully (and fairly) grasping the brutality of a crime requires well-ordered emotional sensibilities, including functional capacities for empathy and indignation. In a reasonable and emotionally healthy juror, the indignation and revulsion in the face of crime bears an important relation to the societal interest in preventing it. Thus, the examples of juror memory modification described in Cases 5 and 6 raise concerns for effective deterrence. In both instances, the failure to remember *fitly* threatens to compromise the appropriate assessment of the crime's gravity and thus the proper calibration of punishment in the name of deterrence. The jurors in Case 5, who recall the facts of the crime as emotionally neutral, may find it difficult to fairly appraise the harshness of the defendant's actions and thus choose a degree of punishment that does not track the harm to be avoided. Conversely, in Case 5, a superabundance of emotion and stress associated with the crime might lead the jurors to choose a degree of punishment that exceeds that quantity necessary for effective deterrence.

Regarding the defendant and the broader members of society who might be inclined to commit similar crimes, memory modification may likewise complicate the task of distributing punishment in the name of deterrence. Successful deterrence depends on rational behavior driven by self-interest: “[e]ven if potential criminals do not care enough about others to refrain from criminal behavior, they will refrain if they know that they themselves will suffer from their illegal actions.”²⁹⁵ But what if, as in the example of Case 2, through memory erasure, defendants (or other would-be criminals in society) can force a radical disruption in *personal identity*? That is, whether the defendant

objections, however sophisticated an account they offer of those aims: for they still remain open to some version of the charge that they cannot do justice to or respect the moral standing of the guilty.”).

295. Dresser, *supra* note 2, at 437.

(or similar would-be criminal) regards his unmemoried future self as a *different person*? As Rebecca Dresser has observed:

Without the further fact of personal identity—without knowing whether a future person will remain the present person, or become someone else—the present person has no more reason to prevent harm to that future person than to prevent harm to other present persons. If potential criminals do not mind exposing others to harm, then they will not mind exposing their future selves either. Thus, punishment cannot be justified on grounds that it produces either general or specific deterrence.²⁹⁶

The effectiveness of deterrence thus depends on the degree of psychological connectedness that the would-be offender feels for his future self. In most instances, unless the would-be criminal is willing to annihilate his personal identity through memory erasure, there will likely be such a feeling or sense of connection. Nevertheless, this kind of disruption, made possible by memory modification, must be taken into account in shaping punishment in the name of deterrence.

Finally, remembering crime and the punishment thereof *fitly* and *truly* is necessary to deter future criminals for an additional reason. As Martha Minow has powerfully argued, forgetting crimes and their consequences (or the failure to remember with adequate emotional content) risks their repetition in the future.²⁹⁷ Should effective and widespread memory erasure or dampening become routine, this aim of deterrence could be confounded.

3. Remembering Fitly and Truly Is Essential to Effective Rehabilitation

The distributive principle of punishment known as “Rehabilitation” (also called “Correction” or “Reformation”) aims to help the offender heal himself so that he will no longer wish to commit such crimes in the future.²⁹⁸ This intervention is undertaken both for the sake of itself (to help a fellow member of the polity) and for the consequentialist motive of preventing social harms in the future.²⁹⁹

296. *Id.* (discussing Parfit’s reductive theory of personal identity).

297. See Minow, *supra* note 246, at 430 (“The question is whether we can learn to remember atrocities so that we resolve always to prevent them . . .”).

298. LaFAVE, *supra* note 262, § 1.5(a)(3) (“[W]e ‘punish’ the convicted criminal by giving him appropriate treatment, in order to rehabilitate him and return him to society so reformed that he will not desire or need to commit further crimes.”). LaFave notes that rehabilitation is perhaps not rightly understood as punishment in the same way as the other traditional distributive theories, “as the emphasis is away from making him suffer and in the direction of making his life better and more pleasant.” *Id.*

299. See *id.* (highlighting both the rehabilitative and crime prevention functions of this approach); Dresser, *supra* note 2, at 443–44 (“The intent is to reduce the crime rate, enhance the

The defendant's memory is crucial to this project. More specifically, remembering his crime fitly and truly plays an important role in healing and becoming a better citizen and person. For example, appreciating the wrongfulness of his conduct—the gravity of his harm and the human costs to the victim and community—are necessary for understanding why he should change his life. This requires true memory, suffused with fitting shame and indignation. The defendant in Case 2—whose memory is erased by Rohypnol or ECT—may not have a true, accurate memory of his crime. The defendant in Case 3—whose memory is dampened by propranolol—may not have a visceral appreciation of the human costs of his actions sufficient to motivate a life change. In both Cases 2 and 3, owing to defects of memory, the defendant may not be able to locate the story of his crime within a *redemptive* narrative in his own life. He would not, in the words of the President's Council on Bioethics, "give new meaning to old happenings." The defendant in Case 4, who is tortured by recurring memories of his crime attended by a superabundance of stress and pain, may not be capable of forgiving himself for his past bad acts and moving forward—an important aspect of rehabilitation. Moreover, the society that receives the offender back into its fold after his incarceration and treatment must likewise remember the crime fitly and truly. Its members must remember enough to hold the offender to account, but not *too much* (i.e., with too much emotion), so as to not accept that he has paid for his crime and must be re-integrated. Memory modification (especially of the sort discussed in Case 6) might frustrate this process of successful re-entry.³⁰⁰

4. Remembering Fitly and Truly Is Essential to Effective Incapacitation

"Incapacitation" (also called "restraint," "isolation," or "disablement") has as its aim the direct protection of society from dangerous criminals.³⁰¹ Shaping punishment to meet this goal requires the relevant state actors to identify "those offenders most likely to persist in committing crimes, and to sentence such persons to

former criminal's opportunities for satisfaction, and thus produce important benefits for society.").

300. An interesting question, beyond the scope the present inquiry but worth noting for future consideration, is whether it should be permissible for the state to use memory modification—erasure, dampening, or enhancement—as a tool of rehabilitation.

301. LAFAYE, *supra* note 262, § 1.5(a)(2) ("[S]ociety may protect itself from persons deemed dangerous because of their past criminal conduct by isolating these persons from society.").

longer prison terms than others convicted of the same offense.”³⁰² The principal task of punishment under this theory is thus *prediction*—particularly regarding future dangerousness. Incapacitation is only effective insofar as it follows accurate prediction about future behavior. Under this theory, the distributive questions of *whom* to punish and *how much* punishment is due are thus driven by prediction.

Successful prediction—the *sine qua non* of effective incapacitation—depends on insights that touch and concern personal identity. Predicting how an individual will act in the future requires certainty that his relevant traits and behaviors will persist over time. Thus, prediction is grounded in key assumptions about the continuity of personal identity. Continuity in personal identity depends on memory, for reasons discussed at length above.³⁰³ Thus, when extreme forms of memory modification can disrupt personal identity, accurate prediction may become very difficult. If the memory modification works a substantial change in the defendant’s impulses and disposition, he may very well refrain from repeating prior bad acts. Or he may not. In any event, the stakes are high, as Rebecca Dresser has noted: “[s]harp discontinuity [in personality] . . . could also result in needlessly confining a presently nondangerous person.”³⁰⁴

Take, for example, the defendant in Case 2. Might the erasure of certain memories likewise erase cues and associations that prompt violent responses? Analogous strategies are being explored to treat addiction.³⁰⁵ How should the jurors at sentencing approach the question of prediction in this case? Memory modification, by confounding personal identity, likewise complicates this process.

5. Remembering Fitly and Truly Is Essential to the Moral Educative and Restorative Purposes of Punishment

Finally, memory (and, by extension, memory modification) has important implications for relatively newer distributive principles of punishment, namely the moral educative and restorative theories of punishment. Under the moral educative theory, punishment is shaped with the pedagogical purpose of communicating to the polity “the proper distinctions between good conduct and bad—distinctions

302. Dresser, *supra* note 2, at 442.

303. See *supra* Part III.1.

304. Dresser, *supra* note 2, at 443.

305. Mass. Gen. Hosp., *supra* note 132.

which, when known, most of society will observe.”³⁰⁶ R. A. Duff has applied this notion to the defendant herself, and argues that this form of punishment communicates society’s “condemnation or censure” and involves “a penitential process that aims to bring the offender to repent her crime and, through her repentance, to repair those relationships that it damaged.”³⁰⁷ In this way, both as applied to the defendant and the broader community, punishment aims to shape behavior by moral formation.³⁰⁸

Closely related to this theory of punishment is “restorative justice” (or simply, “restoration”), which focuses on “making amends for the offending, particularly the harm caused to the victim, rather than inflicting pain on the offender.”³⁰⁹ Restorative justice is driven by the notion that crime works a serious disruption in the social relationships between offender and the victim and community that must be repaired.³¹⁰ Procedurally, it involves reuniting the victim and offender so that the former may express his personal suffering from the crime and the latter may acknowledge his wrongdoing and offer his remorse in return (and in some cases make restitution).³¹¹ In this way, restorative justice aims to mend the rift between them. To be successful, this project requires appropriate degrees of shame and remorse (on the part of the offender) along with controlled indignation, empathy, and something like forgiveness (on the part of the victim).

Another iteration of restorative justice involves reintegration of both offenders and victims into a society, often after a large-scale atrocity. This process involves restoring such individuals to what Martha Minow has referred to as “the community of humanity.”³¹² Restoration in this sense requires uncovering injustices and holding wrongdoers to account. It involves the work of moral witnesses—those who observed and suffered atrocity first hand—to testify to the injustices done and to preserve the memory of victims. It simultaneously involves a kind of remembrance and reconciliation, in order to avoid fanning the flames of vengeance.

306. LAFAVE, *supra* note 262, § 1.5(a)(5).

307. Duff, *supra* note 294, at 87–88.

308. See Alschuler, *supra* note 266, at 1 n.1 (noting that this theory of punishment “seeks to influence conduct through mechanisms other than the fear of punishment”).

309. LAFAVE, *supra* note 262, §1.5(a)(7) (Supp. 2010/2011) (quoting Erik Luna, *Introduction: The Utah Restorative Justice Conference*, 2003 UTAH L. REV. 1, 3).

310. *See id.*

311. *See id.*

312. *See* Minow, *supra* note 246, at 430.

Remembering fitly and truly is integral to all of these theories of punishment. The moral educative function requires the members of the community to remember the fact of the crime, and to regard it with a fitting emotional response. Without such memory, the punishment will seem either too harsh or too lenient and will not resonate with the moral sensibilities of the polity. Dampening, erasing, or enhancing the memory of the crime will confound the pedagogical aims of the punishment in this context.

On the micro level (between offender and victim), restoration requires a true and fitting memory of the crime. To express the human costs fully, the victim must remember the details of the crime as they occurred and must convey the fitting emotional response. Memory erasure, dampening, or enhancement might interfere with such a rendering. To take on board the enormity of one's crimes and feel authentic shame and remorse requires an intact memory (factually and affectively) of the crime. It likewise requires empathy—seeing oneself in the place of the victim by recalling instances in which one suffered injustice. This requires a similarly intact memory of one's past. Memory modification—erasure, dampening, and enhancement—is an obstacle to success in this regard.

On the macro level, the process of reintegrating victims and perpetrators of mass atrocity into the community requires a kind of true and fitting remembrance. As Martha Minow has observed, in such cases the aim is to hold wrongdoers to account without creating a new cycle of hatred and violence:

The task is to help the society—and the watching world—not merely recall but also remember, that is, to reconstitute a community of humanity against which there can be crimes (hence, “crimes against humanity”), and within which victims and survivors can be reclaimed as worthy members. Indeed, the task is to help avoid the castigation and exclusion of whole groups of people—labeled as co-nationalists or otherwise associated with perpetrators—from the sphere of common concern . . . For it is that fundamental humanity that entitles [those charged and eventually convicted of war crimes] to both procedural rights and to inclusion within the legally-framed sphere of human responsibility. Otherwise, they could simply be targets for retaliation and revenge.³¹³

Remembrance of such atrocities must be true and fitting—to do justice to victims (and survivors) and avoid their repetition. Accordingly, “[f]ailure to remember, collectively, injustice and cruelty is an ethical breach.”³¹⁴ But the affective content of such memories should not render it impossible to be fair and just to the perpetrators, nor should it lead to the scapegoating of those connected to the perpetrators who

313. *Id.* at 430–31.

314. MINOW, *supra* note 222, at 28.

bear no responsibility for the atrocities. Remembering truly and fitly in this case is a delicate balance. Memory modification may raise challenges for such a balance. Forgetting through erasure, dampening memory such that atrocities are remembered as emotionally neutral, or enhancing memory to keep the pain of injustice as a constant open wound crying out for vengeance, are all anathema to the kind of "remembering" that "re-affirm[s] the central insight of human rights: that all people share sufficient fundamental worth to be guaranteed membership within the group called humanity."³¹⁵

CONCLUSION

This Article has examined the deep connections between memory and the foundational distributive principles of punishment. It has argued that new neurobiological techniques for the modification of memory pose, in principle, serious challenges for the just and effective distribution of punishment under all of the dominant theoretical approaches. How (if at all) should the law respond to this insight? This is a question for future scholarship involving vexing normative questions relating to a panoply of issues, including (but certainly not limited to) privacy, autonomy, and justice as well as more concrete questions relating to the criminal process, the regulation for drug manufacture and advertising, and the governance of the practice of medicine. The Article has essayed to lay the necessary groundwork for such a broad, interdisciplinary dialogue to go forward.

315. Minow, *supra* note 246, at 431.