

**A Case for Memory Enhancement:
Ethical, Social, Legal, and Policy Implications for
Enhancing the Memory**

A thesis submitted to the University of Manchester for the
degree of

PhD in Bioethics and Medical Jurisprudence
in the Faculty of Humanities

2013

Paul Mũtuanyingĩ Mũrĩithi

Supervisors:

Prof. John Harris
Dr Catherine Stanton

iSEI/CSEP/School of Law

List of contents

List of contents	2
List of figures and tables	7
Abstract	8
Declaration	9
Copyright statement	9
Acknowledgements	10
Dedication	13
The author: Paul Mũtuanyingĩ Mũrĩithi	14
List of acronyms and abbreviations	17
<i>Part I: General introduction</i>	20
<i>Chapter 1</i>	20
1 Problem	20
<i>Chapter 2</i>	23
2 Research questions and detailed account of what is included in each chapter ..	23
2.1 What is the memory and why does is it matter?	23
2.2 Non-pharmacological memory enhancement: traditional, conventional, and technological means	24
2.3 Pharmacological means for memory enhancement.....	24
2.4 Ethical and social background to the memory enhancement debate.....	25
2.5 Arguments for and against human enhancements from a legal and policy issues perspective	25
2.6 Optimum memory: the ultimate prize for memory manipulation.....	25
2.7 Is there a duty to remember or an obligation not to forget?.....	26
2.8 What legal issues does the quest for an optimum memory raise?.....	26
2.9 What are the implications of optimum memory on eyewitness testimony?.....	27
2.10 Conclusion and future directions	27
2.11 Philosophical and legal approach.....	27
2.12 Conclusion	29
<i>Chapter 3</i>	31
3 What is the memory and why does is it matter?	31
3.1 Memory processes.....	32
3.1.1 Encoding/learning	32
3.1.2 Retention/consolidation/storage.....	32
3.1.3 Retrieval/remembering/recall.....	33
3.2 Types of memory	34
3.2.1 Short-term memory, primary memory, or working memory	35
3.2.2 Long-term memory, secondary memory, or reference memory	36

3.2.2.1	Declarative (explicit, relational) memory	36
3.2.2.2	Nondeclarative (implicit, procedural) memory	37
3.3	What is memory enhancement?	37
3.3.1	What is optimum memory?	37
3.4	Why is the memory important?	39
3.5	Conclusion	40
	<i>How do we enhance the memory?</i>	41
	<i>Chapter 4</i>	41
4	Non-pharmacological memory enhancement: traditional, conventional and technological means	41
4.1	Introduction	41
4.2	Traditional and conventional means for memory enhancement	43
4.2.1	Nutrition	43
4.2.1.1	Caffeine	43
4.2.1.2	Glucose	46
4.2.1.3	Omega-3 polyunsaturated fatty acids	47
4.2.1.4	Ginkgo biloba (EGb 761)	49
4.2.2	Physical exercise	51
4.2.3	Mnemonics	51
4.2.4	Music	53
4.2.5	Rituals and rites	54
4.2.6	Sleep	56
4.2.7	Yoga and meditation	57
4.3	Technological means for memory enhancement	58
4.3.1	Computers, internet and virtual social networking	58
4.3.2	Recording audio, photographic, lifelogging, and video devices	63
4.3.3	Brain Stimulation	66
4.3.3.1	Electroconvulsive therapy	66
4.3.3.2	Brain-machine interface or brain-computer interface	66
4.3.3.3	Transcranial magnetic stimulation and transcranial direct current stimulation	67
4.3.3.4	Deep brain stimulation	68
4.4	Conclusion	71
	<i>Chapter 5</i>	73
5	Pharmacological means for memory enhancement	73
5.1	Introduction	73
5.2	Pharmacological interventions that have been associated with memory improvement	73

5.2.1	Modafinil (Provigil)	73
5.2.2	Amphetamine (s)	76
5.2.2.1	D-amphetamine (Adderall)	77
5.2.3	Methylphenidate (Ritalin)	78
5.2.4	Donepezil (Aricept)	79
5.2.5	Rivastigmine (Exelon)	81
5.2.6	Galantamine (Razadyne)	82
5.2.7	Ampakines	82
5.2.8	Memantine	84
5.3	Pharmacological interventions that have been associated with memory dampening	84
5.3.1	Benzodiazepines	84
5.3.1.1	Propofol	85
5.3.1.2	Midazolam	86
5.3.1.3	Diazepam	87
5.3.1.4	Propranolol	87
5.3.1.5	Glucocorticoids	90
5.4	Conclusion	91
<i>Part II: Ethical, Social, Legal, and Policy Background to the Memory Enhancement Debate</i>		92
<i>Chapter 6</i>		92
6	Ethical and social background to the memory enhancement debate	92
6.1	What human enhancement is or is not: contrasting therapy and enhancement	92
6.2	Arguments for enhancements from an ethical and social perspective	96
6.2.1	Consistency	96
6.2.2	Enhancements are good for they make people's lives better	96
6.2.3	Enhancements are inevitable	97
6.2.4	Justice	98
6.3	Arguments against enhancements from an ethical and social perspective	100
6.3.1	The attitude of mastery and the openness to the unbidden	100
6.3.2	That to enhance is to use 'unnatural' means, and this is inauthentic	103
6.3.3	Should not enhance for health and safety reasons	105
6.3.4	Slippery slope, precautionary principle or precautionary approach arguments	107
6.3.5	Loss of human nature, loss of human dignity, loss of human diversity, change of personality and change of person identity arguments	108
6.3.6	Violation of sole authorship of one's life and equality	110

6.3.7	Other specific memory enhancement issues	112
6.3.7.1	Memory dampening results to loss of epistemic access	112
6.3.7.2	The presumption that the more of a good thing the better.....	113
6.3.7.3	Interests of the society in preserving memories for the greater good	113
6.3.7.4	Negative emotions play an important part in forming our identity	113
6.3.7.5	The problem of medicalization and drug mongering.....	114
<i>Chapter 7.....</i>		115
7	Arguments for and against human enhancements from a legal and policy issues perspective.....	115
7.1.1	Regulation	115
7.1.1.1	Prohibit entirely / moratorium	115
7.1.1.2	Means and methods	116
7.1.1.3	Allow different groups of people.....	117
7.1.1.4	Regulatory authorities / bodies	117
7.1.1.5	Gatekeepers.....	118
7.1.1.6	Therapeutic purposes only	119
7.1.1.7	Rules governing particular activities or establishments	120
7.1.1.8	Individual autonomy / laissez faire.....	121
7.1.2	Privacy and confidentiality	122
7.1.3	Coercion to use enhancing technologies	123
7.1.4	Discrimination of the unenhanced	124
7.1.5	Other specific legal issues.....	125
7.1.5.1	Consent and informed consent issues	125
7.1.5.2	Obstruction of justice/perverting the course of justice issues.....	125
7.1.5.3	Mitigation of emotional distress damages	125
7.1.5.4	Negligence issues.....	126
7.1.5.5	Individual versus society interests	126
<i>Part III: Papers</i>		127
<i>Chapter 8.....</i>		127
8	Optimum memory: the ultimate prize for memory manipulation.....	127
8.1	Abstract	127
8.2	Introduction	127
8.3	Appealing to distinctions: enhancement/therapeutic, normal/non-normal, species-typical functioning.....	131
8.4	Memory dampening results in the loss of epistemic access.....	134

8.5	Memory dampening results in a change of personal identity and personality	137
8.6	The presumption that the more of a good thing the better!.....	141
8.7	Conclusion	144
	<i>Chapter 9</i>	145
9	Is there a duty to remember or an obligation not to forget?.....	145
9.1	Abstract	145
9.2	Introduction	145
9.3	What is it to remember?	148
9.3.1	What is the nature of the obligation to remember?	148
9.3.2	Is remembering voluntary or involuntary?.....	150
9.4	All change please!	152
9.5	What is it to forget?.....	153
9.6	Are we obligated to remember people, information, and events from the past?	155
9.7	A case for a duty to remember	157
9.7.1	Interests of society in preserving memories for the greater good	157
9.7.2	Living authentically – remembering fitly and truly	160
9.7.3	Appeal to empathy	162
9.7.4	Duty to remember versus issue of justice	163
9.8	A case against a case for a duty to remember	166
9.8.1	The wrong of a duty to remember.....	166
9.9	Conclusion	168
	<i>Chapter 10</i>	170
10	What legal issues does the quest of optimum memory raise?.....	170
10.1	Introduction	170
10.2	What legal issues does the quest for an optimum memory through the practice of memory dampening raise?	170
10.2.1	Consent and informed consent issues	170
10.3	Obstruction of justice / perverting the course of justice	182
10.3.1	How could one possibly pervert the course of justice in memory dampening cases?.....	183
10.4	Mitigation of emotional distress damages / duty to mitigate loss/damages.....	186
10.5	Negligence and other possible claims for failure to treat traumatic memories	187
10.6	Individual versus societies' interests.....	188
10.7	Conclusion	188
	<i>Chapter 11</i>	189

11	What are the implications of optimum memory on eyewitness testimony/evidence?	189
11.1	Abstract	189
11.2	Introduction	189
11.3	The role of memory in eyewitness testimony	190
11.4	What are the difficulties in eyewitness memory?	192
11.4.1	Malleability of memory.....	192
11.4.1.1	Memory processes	193
11.4.1.2	Encoding/learning	193
11.4.1.3	Retention/storage	195
11.4.1.4	Retrieval/remembering	196
11.4.2	Mistaken identifications/misidentification of witnesses	197
11.5	What are the problems with eyewitness evidence?	199
11.5.1	Wrongful convictions and wrongful acquittals	199
11.6	Can we enhance eyewitnesses' memory during memory processes?	200
11.6.1	Overcoming some hurdles.....	201
11.7	What would be the impact of an optimum memory on eyewitness testimony?	202
11.8	Conclusion	205
	<i>Part IV Conclusion and future directions</i>	207
	<i>Chapter 12</i>	207
12	Concluding comments.....	207
12.1	Limitations	216
12.2	Future directions.....	217
13	Bibliography.....	219
	List of Cases.....	248

List of figures and tables

Memory classification and potential brain structures that could be targets for memory enhancement 1	38
---	----

Word count of main texts including footnotes 78,948

Abstract

The University of Manchester

Paul Mũtuanyingĩ Mũrĩithi

PhD in Bioethics and Medical Jurisprudence

A Case for Memory Enhancement: Ethical, Social, Legal, and Policy Implications for Enhancing the Memory

October 2013

The desire to enhance and make ourselves better is not a new one and it has continued to intrigue throughout the ages. Individuals have continued to seek ways to improve and enhance their well-being for example through nutrition, physical exercise, education and so on. Crucial to this improvement of their well-being is improving their ability to remember. Hence, people interested in improving their well-being, are often interested in memory as well. The rationale being that memory is crucial to our well-being. The desire to improve one's memory then is almost certainly as old as the desire to improve one's well-being. Traditionally, people have used different means in an attempt to enhance their memories: for example in learning through storytelling, studying, and apprenticeship. In remembering through practices like mnemonics, repetition, singing, and drumming. In retaining, storing and consolidating memories through nutrition and stimulants like coffee to help keep awake; and by external aids like notepads and computers. In forgetting through rituals and rites.

Recent scientific advances in biotechnology, nanotechnology, molecular biology, neuroscience, and information technologies, present a wide variety of technologies to enhance many different aspects of human functioning. Thus, some commentators have identified human enhancement as central and one of the most fascinating subject in bioethics in the last two decades. Within, this period, most of the commentators have addressed the Ethical, Social, Legal and Policy (ESLP) issues in human enhancements as a whole as opposed to specific enhancements. However, this is problematic and recently various commentators have found this to be deficient and called for a contextualized case-by-case analysis to human enhancements for example genetic enhancement, moral enhancement, and in my case memory enhancement (ME). The rationale being that the reasons for accepting/rejecting a particular enhancement vary depending on the enhancement itself. Given this enormous variation, moral and legal generalizations about all enhancement processes and technologies are unwise and they should instead be evaluated individually.

Taking this as a point of departure, this research will focus specifically on making a case for ME and in doing so assessing the ESLP implications arising from ME. My analysis will draw on the already existing literature for and against enhancement, especially in part two of this thesis; but it will be novel in providing a much more in-depth analysis of ME. From this perspective, I will contribute to the ME debate through two reviews that address the question how we enhance the memory, and through four original papers discussed in part three of this thesis, where I examine and evaluate critically specific ESLP issues that arise with the use of ME. In the conclusion, I will amalgamate all my contribution to the ME debate and suggest the future direction for the ME debate.

Declaration

I declare that no portion of the work referred to in this thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning.

Copyright statement

- i. The author of this thesis (including any appendices and/or schedules to this thesis) owns any copyright in it (the “Copyright”) and he has given the University of Manchester the right to use such Copyright for any administrative, promotional, educational and/or teaching purposes.
- ii. Copies of this thesis, either in full or in extracts, may be made **only** in accordance with the regulations of the John Rylands University Library of Manchester. Details of these regulations may be obtained from the Librarian. This page must form part of any such copies made.
- iii. The ownership of any patents, designs, trademarks and any and all other intellectual property rights except for the Copyright (the “Intellectual Property Rights”) and any reproductions of copyrights works, for example graphs and tables (“Reproductions”), which may be described in this thesis, may not be owned by the author and may be owned by third parties. Such Intellectual Property Rights and Reproductions cannot and must not be made available for use without the prior written permission of the owner (s) of the relevant Intellectual Property Rights and/or Reproductions.
- iv. Further information on the conditions under which disclosure, publication and exploitation of this thesis, the Copyright and any Intellectual Property Rights and/or Reproductions described in it may take place is available from the Head of School of Law (or the Vice-President) and the Dean of the Faculty of Life Sciences, for Faculty of Life Sciences’ candidates.

October 2013

Paul Mũtuanyingĩ Mũĩĩthĩ

Acknowledgements

To complete this PhD, many people who have made various sacrifices ranging from moral support, ideas, insightful comments, financial, accommodation, and indeed supervision have supported me. I will endeavour to mention a few, as it is impossible to enlist everyone here. If you read this thesis, without seeing your name below, please know that I am grateful to you too.

First and foremost, I have benefited, enjoyed academic and moral support from two stellar supervisors. On the one hand Professor John Harris: his philosophical astuteness, writings, and humour, have shaped my arguments, and will be a constant example to me of how Philosophy and bioethics should be done. His unwavering believe in my academic ability, will continue to inspire me 'Beyond the PhD'. On the other hand, Dr Catherine Stanton: her flexibility, encouragement, and indeed her empathy have been holistic and simply the best. Without the enrichment and encouragement of these two distinguished supervisors, this thesis would not have been accomplished in its current form. Kudos to you two.

I joined the structured programme in Bioethics and Medical Jurisprudence (BMJ) as a part of a cohort. By the virtue of belonging to this group, I have benefited widely from my fellow BMJ PhD students and indeed from the faculty members of CSEP, ISEI, and School of Law. In the BMJ group, as opposed to writing in isolation, I have enjoyed meeting regularly with my fellow students, I have benefited from their ideas, comments, feedback to my papers and work in progress that I have presented throughout the course of writing this thesis. I have indeed enjoyed the company of my fellow cohort members 2010: Tech Chuan Voo, Yan Yan Leung, and Dr Jacques SinFat Tamin, who welcomed me warmly to the group despite joining them slightly late. A vote of thanks to many other PhD students (some who have already completed successfully their PhD) who showed an interest in my work and made constructive comments either during presentations or directly on my papers. They include Tech Chuan Voo, Simon Barnes, Malcolm Oswald, Dr Constantinos Kanaris, Dr Amy Ford, Sam Walker, Divine Ban Yubala, Anna Pacholczyk, and Dr Yonghui Ma. Special thanks to Dr Marleen Eijkholt and Dr Sheelagh McGuiness,

for it is through a Biolaw conference that they organized in the University of Manchester in 2008 that I came to know about BMJ.

I am grateful to Professor Søren Holm who accepted my application to join the BMJ while he was the director. Professor Holm's ideas and continued debates in my first year of the course, helped to shape the beginning of this thesis. I am indebted to Dr Rebecca Bennett the current director, for her incisive comments on some parts of my thesis and indeed for practical guidance about writing and submission of this thesis. I am thankful to Professor Margaret Brazier and Dr Sarah Devaneh for introducing me to Medical Jurisprudence literature and sharing their expertise during the course of this PhD. This thesis would be impoverished without the philosophical insights that I benefited from Dr Ian Brassington, Dr Charles Erin, Dr John Coggon, Dr Catherine Rhodes, Dr Simona Giordano, and Sarah Chan during iSEI Seminars while doing this PhD. I am thankful to everyone in the iSEI, CSEP, and other people associated in the School of Law for their kindness, welcoming attitude, and constant communication, in particular Jackie Boardman, Catherine Spanswick, Mary Platt, and Stephen Wadsworth.

I am indebted to my friend Dr Nicola Zapiain Creamer for some insightful comments on part II of this thesis. I am thankful to my long-time friend Fr. Peter Waweru, OFM Cap., for his diligence in proofreading this thesis. I take responsibility for any remaining errors.

I am indebted to Waltraud and Wilhelm Häfele, my parents in-law, who while my wife and I thought we could not cope any more financially; they came in and made our lives tolerable again. Without their continued financial support, it would have been impossible to complete this PhD. Thanks to my parents Martha Wanjĩra and Raphael Mũrĩithi, who made a sacrifice of leaving their homeland Kenya for nearly six months to spend their time caring for my daughter Neorah in England, so that I could have sufficient time to write this thesis. I am grateful to Dr Simona Giordano and Dr John Coggon for offering me some work to proofread their book on

'*Scientific Freedom*.'* Their generous pay for this work contributed positively in funding this PhD.

I benefited from the generosity of various people who through their unending hospitality accommodated me during my visits to Manchester to attend seminars, meetings, and conferences. They include Barbara Golick & Denis Ontiri Mogaka, Dr Isaac Nyakundi & family, Marcus Mormoh & family, and indeed my course mate Tech Chuan Voo.

I have enjoyed continued love and companionship from my family. My wife Verena Häfele has sacrificed so much to make this PhD possible. Verena's sacrifices cannot fully be enlisted on such a short acknowledgement page. However, to be precise, without Verena on my side, it would have been difficult to embark on this PhD, leave alone completing it. Much love, inspiration, and motivation has been derived from my two daughters Neorah and Neviah, who were both born during the course of doing this PhD.

Finally, I am thankful to Dr Guy Kahane and Dr Simona Giordano for examining this PhD thesis; for making the *viva voce* an enjoyable experience; and for providing me with insightful and constructive comments on how to continue the research in this thesis.

* GIORDANO, S., COGGON, J. & CAPPATO, M. 2012. *Scientific Freedom*, Bloomsbury Publishing.

Dedication

I dedicate this thesis to my daughters:

Neorah M̃tuanyingĩ Häfele

and

Neviah M̃tuanyingĩ Häfele

The author: Paul Mũtuanyingĩ Mũrĩithi

Prior to joining the structured PhD Programme in Bioethics and Medical Jurisprudence in Manchester, I worked for social services for Essex County Council and Manchester City Council respectively.

I obtained my MA Degree in Philosophy and Religion, from Heythrop College – University of London in 2004. Diploma in Philosophy and Religious Studies (BA Equivalent) from St. Bonaventure College, Lusaka, Zambia in 1999. I have also studied Theology, Religious Studies, and Social Communication in Tangaza College – Catholic University of Eastern Africa, Nairobi, Kenya in the academic year 1999-2000.

Published papers

‘Does the rejection of wrongful life claims rely on a conceptual error?’*

I have presented some earlier drafts of this thesis in the following seminars:

- Research questions and some part of the general introduction of this thesis, presented on 17th of May 2010 to BMJ Cohort Group.
- Optimum memory: the rationale for dampening both negative and positive memories, presented on 21st Oct 2010 to BMJ group.
- Optimum memory: the rationale for dampening both negative and positive memories, presented on 4th Nov 2010 to iSEI group.
- Is there a duty to remember or an obligation not to forget? Presented on the 17th March 2011 to iSEI group.
- What legal issues does the quest for an optimum memory raise? Presented on 19th April 2012 to BMJ group.
- A Case for Memory Enhancement: Ethical, Social, Legal, and Policy Implications of Enhancing the Memory, presented on 6th of Dec 2012 to BMJ Group.

Other recent research related engagements

* MŪRĪITHI, P. M. 2011. Does the rejection of wrongful life claims rely on a conceptual error? *Journal of Medical Ethics*, 37, 433-436.

- ❖ I presented a paper ‘Does the rejection of wrongful life claims rely on a conceptual error?’ in The 3rd Annual Postgraduate Conference in Bioethics: Challenges at the Interface of Biolaw & Bioethics, June 2008. My paper was judged the best among the ‘Ethics Papers’ and it was consequently published in the Journal of Medical Ethics.
- ❖ I studied an online course in Neuroethics organized by the University of Uppsala, 2011. In this course, I covered 11 units – various topics in Neuroethics, which were taught by distinguished commentators in the field from both Europe and the US.
- ❖ Is there a need for an international governance regime for stem cell research? I moderated the discussion of this paper on 17th of May 2010, in the BMJ Cohort Group.
- ❖ I attended the Post Graduate Conference in the University of Manchester, October 2011.
- ❖ I attended the conference ‘Medical Law and Ethics in the Media Spotlight’ on 8th and 9th November 2010, at the British Academy, London.
- ❖ I attended the 11th World Congress of Bioethics, Rotterdam, June 2012. I was a reviewer for this conference, and as a part of a team, I reviewed 50 abstracts and judged which abstracts could be presented as papers or posters during this conference.
- ❖ I attended a conference organized by iSEI in April 2010: ‘Beyond The Body? Perspectives on Enhancement’. I was one of the reviewers/note-takers for the papers presented in this conference. I reviewed six different presentations that were consequently published and are still available on iSEI website as of today 24th June 2013. These are presentations by:
 - Dr Jens Clausen, Institute for Ethics and History in Medicine, University of *Tübingen*. ‘Brain – machine interfacing (BMI) and human enhancement’, available at <http://www.isei.manchester.ac.uk/research/conferences/beyondthebody/brainmachineinterface/>
 - Professor Maartje Schermer, department of Medical Ethics and Philosophy of Medicine at the ErasmusMC in Rotterdam. ‘Botox for the Brain?’ available at

<http://www.isei.manchester.ac.uk/research/conferences/beyondthebody/botoxforthebrain/>

- Professor Sarah Cunningham-Burley, University of Edinburgh. ‘Engaging with neuroscience: examining neurological subjectivity and what this means for debates about enhancement technologies’, available at <http://www.isei.manchester.ac.uk/research/conferences/beyondthebody/engagingwithneuroscience/>
- Dr Anders Sandberg, Future of Humanity Institute – Oxford University. ‘Beyond the Skull: extended minds, neural interfaces and brain emulations’, available at <http://www.isei.manchester.ac.uk/research/conferences/beyondthebody/beyondtheskull/>
- Dr Susan Stuart, University of Glasgow. ‘Boundaries? There are only illusions’, available at <http://www.isei.manchester.ac.uk/research/conferences/beyondthebody/boundaries/>
- Dr James Hughes, Trinity College in Hartford Connecticut. ‘When is Enhancement like a Gun? Limits on Enhancement in a Liberal Democratic Society’, available at <http://www.isei.manchester.ac.uk/research/conferences/beyondthebody/likea gun/>

List of acronyms and abbreviations

AD	– Alzheimer’s disease
ADHD	– Attention Deficit Hyperactivity Disorder
ATM	– Automated Teller Machine or Automatic Teller Machine
BBC	– British Broadcasting Corporation
BCA	– British Coffee Association
BCI	– Brain-Computer Interface
BMA	– British Medical Association
BMI	– Brain-Machine Interface
BPS	– British Psychological Society
BZs	– Benzodiazepines
CCTV	– Closed-Circuit Television
CPS	– Criminal Prosecution
DBS	– Deep Brain Stimulation
DNA	– Deoxyribonucleic acid
ECHR	– European Convention on Human Rights
ECtHR	– The European Court of Human Rights
ECT	– Electroconvulsive Therapy
Ed	– Editor, Edition
Eds	– Editors
Eg	– [L. <i>exempli gratia</i>] for example
ESLP	– Ethical, Social, Legal, and Policy
Et al	– [L. <i>et alii</i>] and Others
Etc	– et cetera
EU	– European Union
EWCA	– England and Wales Court of Appeal
FDA	– Food and Drug Administration
FMRI	– Functional Magnetic Resonance Imaging
GPA	– Grade Point Average
GSL	– General Sales lists
HFEA	– Human Fertilisation Embryology Authority
HIV-AIDS	– Human immunodeficiency Virus, Acquired Immunodeficiency Syndrome

Ibid – [L. *ibidem*] used in footnotes and it means ‘in the same source’

IQ – Intelligence Quotient

LTD – Limited

LTM – Long-Term Memory

LTP – Long-Term Potentiation

MCA – Mental Capacity Act

MD – Memory Dampening

ME - Memory Enhancement

MG – Milligrams

MHRA – Medicine and Healthcare Products Regulatory Agency

MOL – Method of Loci

MS – Multiple Sclerosis

NCA – National Coffee Association (in the USA)

NHS – National Health Service

OCD – Obsessive-Compulsive Disorder

OCN – The Oxford Centre for Neuroethics

OP – Optimum Memory

Para – Paragraph

PCBE – The President Council on Bioethics

PD – Parkinson’s Disease

POM – Prescription Only Medicines

PTSD – Post Traumatic Stress Disorder

PUFAs – Polyunsaturated Fatty Acids

RACE – Regulatory Authority for Cognitive Enhancements

STOA – Science and Technology Options Assessment

TBI – Traumatic Brain Injury

TMS – Transcranial Magnetic Stimulation

TT – this thesis (It is used for cross-referencing in the thesis and it is followed by a heading number)

UK – United Kingdom

UKHL – United Kingdom House of Lords

UKPGA – United Kingdom Public General Acts

UN – United Nations

URL – Uniform Resource Locator also known as web address

US / USA – United States / United States of America

ZIP – Zeta Inhibitory Peptide

Part I: General introduction

Chapter 1

1 Problem

The desire to enhance and make ourselves better is not a new one and it has continued to intrigue throughout the ages. Individuals have continued to seek ways to improve and enhance their well-being for example through nutrition, physical exercise, education, etc.^{1 2 3 4} Crucial to this improvement of their well-being is improving their ability to remember. Hence, people interested in improving their well-being, are often interested in memory as well.⁵ The rationale being that memory is crucial to our well-being. The desire to improve one's memory then is almost certainly as old as the desire to improve one's well-being. Traditionally, people have used different means in an attempt to enhance their memories: for example in learning through storytelling, studying, and apprenticeship. In remembering through practices like mnemonics, repetition, singing, and drumming. In retaining, storing and consolidating memories through nutrition and stimulants like coffee to help keep awake; and by external aids like notepads and computers. In forgetting through rituals and rites.

Recent scientific advances in biotechnology, nanotechnology, molecular biology, neuroscience, and information technologies, present a wide variety of technologies to enhance many different aspects of human functioning.⁶ Thus, some commentators have identified human enhancement as central and one of the most fascinating

¹ HARRIS, J. 2007. *Enhancing evolution: the ethical case for making better people*, Princeton, N.J., Princeton University Press.

² HÄYRY, M. 2008. The Historical Idea of a Better Race. *Studies in Ethics, Law, and Technology*, 2:1:11, 1-28.

³ NAAM, R. 2005. *More than human: embracing the promise of biological enhancement*, New York, Broadway Books.

⁴ MEHLMAN, M. J. 2009b. *The price of perfection: individualism and society in the era of biomedical enhancement*, Baltimore, Md., Johns Hopkins University Press.

⁵ PCBE 2003. Beyond Therapy: Biotechnology and the Pursuit of Happiness. *The President's Council on Bioethics*. Washington, D.C.p.217.

⁶ SCHUIJFF, M., SMITS, M., COENEN, C., KLAASSEN, P., HENNEN, L., RADER, M. & WOLBRING, G. 2009. European Parliament Science and Technology Options Assessment (STOA) - Human Enhancement Study. Brussels: *European Parliament STOA*.

subject in bioethics in the last two decades.⁷ Within, this period, most of the commentators have addressed the Ethical, Social, Legal and Policy (ESLP) issues in human enhancements as a whole as opposed to specific enhancements.^{8 9 10 11 12 13} However, this is problematic and recently various commentators^{14 15 16 17} have found this to be deficient and called for a contextualized case-by-case analysis to human enhancements for example genetic enhancement, moral enhancement, and in my case ME. The rationale being that the reasons for accepting/rejecting a particular enhancement vary depending on the enhancement itself. Given this enormous variation, moral and legal generalizations about all enhancement processes and technologies are unwise and they should instead be evaluated individually.^{18 19}

Taking this as a point of departure, this research will focus specifically on making a case for ME and in doing so assessing the ESLP implications arising from ME. My analysis will draw on the already existing literature for and against enhancement, but it will be novel in providing a much more in-depth analysis of ME.

From this perspective, I will contribute to the ME debate through two reviews that address the question how we enhance the memory, and through four original papers,

⁷ HARRIS, J. 2011. MORAL ENHANCEMENT AND FREEDOM. *Bioethics*, 25, 102-111.

⁸ HARRIS, J. 2007. *Enhancing evolution: the ethical case for making better people*, Princeton, N.J., Princeton University Press.

⁹ GLOVER, J. 2007. *Choosing children: genes, disability, and design*, Oxford, Clarendon Press.

¹⁰ SANDEL, M. J. 2007. *The case against perfection: ethics in the age of genetic engineering*, Cambridge, Massachusetts, Belknap Press of Harvard University Press.

¹¹ BOSTROM, N. & ROACHE, B. R. 2007. Ethical Issues in Human Enhancement. In: RYBERG, J., PETERSEN, T. & WOLF, C. (eds.) *New Waves in Applied Ethics*. New York: Palgrave Macmillan.

¹² SAVULESCU, J. 2007. Genetic Interventions and the Ethics of Enhancement of Human Beings. In: STEINBOCK, B. (ed.) *The Oxford Handbook of Bioethics*. Oxford: Oxford University Press.

¹³ BUCHANAN, A. E., BROCK, D. W., DANIELS, N. & WIKLER, D. 2000. *From chance to choice: genetics and justice*, Cambridge, Cambridge University Press.

¹⁴ SELGELID, M. J. 2007. An Argument against Arguments for Enhancement. *Studies in Ethics, Law, and Technology*, 1:1:12.

¹⁵ OVERALL, C. 2009. Life Enhancement Technologies. In: SAVULESCU, J. & BOSTROM, N. (eds.) *Human Enhancements*. Oxford: Oxford University Press. p.238.

¹⁶ BOSTROM, N. & SAVULESCU, J. 2009. Human Enhancement Ethics: The State of the Debate. In: SAVULESCU, J. & BOSTROM, N. (eds.) *Human enhancement*. Oxford: Oxford University Press. p.17.

¹⁷ MEHLMAN, M. J. 2009a. Genetic Enhancement in Sport, Ethical, Legal and Policy Concerns. In: MURRAY, T. H., MASCHKE, K. J. & WASUNNA, A. A. (eds.) *Performance-enhancing technologies in sports: ethical, conceptual, and scientific issues*. Baltimore: Johns Hopkins University Press.

¹⁸ OVERALL, C. 2009. Life Enhancement Technologies. In: SAVULESCU, J. & BOSTROM, N. (eds.) *Human Enhancements*. Oxford: Oxford University Press.

¹⁹ SELGELID, M. J. 2007. An Argument against Arguments for Enhancement. *Studies in Ethics, Law, and Technology*, 1:1:12.

where I examine and evaluate critically specific ESLP issues that arise with the use of ME. In the conclusion, I will amalgamate all my contribution to the ME debate and suggests the future direction for the ME debate. In what follows, I outline briefly the four parts that make up this thesis.

Part one of this thesis consists of five chapters, which form the general introduction. In chapter one, I highlight the main problem that is addressed by this thesis. In chapter two, I outline the research questions and give a detailed account of what is included in each of the remaining chapters that make up this thesis. Additionally in this chapter, I briefly discuss my philosophical and legal approach to the human enhancement debate. In chapter three, I discuss what the memory is and why it is important. In chapters four and five, I address the non-pharmacological and pharmacological means for ME respectively. In addition, I explore how we enhance the memory, discuss different methods and means that have been, and continue to be used for ME.

Part two of this thesis consists of chapters six and seven, which discuss the general ESLP issues arising from ME. In these two chapters, I draw from the existing and emerging literature the overarching principles that would support a case for ME. This involves too a critical assessment of the objections that could be raised against ME, and consequently evaluating whether they would be sufficient to warrant the rejection of ME from an ESLP perspective.

Part three of this thesis is composed of four independent papers. In this part, I assess some particular ESLP issues that will further reinforce my ongoing case for ME that I will have commenced in part two of this thesis. At the same time, I examine some implications that would arise through ME, by assessing eyewitness testimony as an example. Central in these four papers are the ideas of optimum memory and memory dampening.

Finally, part four of this thesis, summarizes the main purposes of this thesis, recaps on the central arguments discussed for and against ME, reiterates my contribution to the ME debate and finally, suggests some future directions for the debate.

Chapter 2

2 Research questions and detailed account of what is included in each chapter

In this chapter, I will briefly introduce what is included in each of the remaining chapters in parts one, two, three, and four of this thesis; establish some of the research questions that will form the basis for my articles; and briefly discuss the philosophical and legal approach to the human enhancement debate. I begin with what is the memory and why does it matter.

2.1 What is the memory and why does it matter?

In this chapter, I will discuss what the memory is and elucidate why the memory is important. To understand the memory, one has to face head-on some fundamental facts about the memory. First, the memory refers not to static entities; it is not like any other recording such as videos or audio recordings. Memory is not a record of the events themselves but rather a record of people's experiences of events. Second, that memory is not a singular phenomenon or unitary system, neither is it mediated by a single biological or psychological system. Third, that memory is not stored in any single location in the brain as some researchers used to believe, but that different kinds of information are processed and stored in different parts of the brain. Fourth, that memory is constructive and reconstructive in nature – an array of interacting systems and a vast number of interrelated activities or processes each capable of encoding or registering information, storing it and making it available for retrieval.

Additionally, I will discuss the main memory processes, and the central types of memory. I will clarify my usage of the terms memory enhancement (ME), optimum memory, and memory dampening (MD). At the end of chapter three, I will discuss the importance of the memory. This is essential, for it answers the question why we would want to enhance the memory. I stress that the memory is vital in bridging the gap between the past, through the present to the future; and. I highlight some fundamental role of memory in our general health and well-being.

2.2 Non-pharmacological memory enhancement: traditional, conventional, and technological means

In this chapter, I will assess and review the traditional, conventional,¹ and technological means that people have used over the centuries in an attempt to enhance their memories. I refer to these means here as non-pharmacological to contrast them from pharmacological means that I discuss on the next chapter. As already proposed,² the desire to enhance and make ourselves better is not a new one and it has continued to intrigue throughout the ages. Individuals have always sought ways to improve and enhance their well-being.^{3 4} Crucial to this improvement of their well-being is improving their ability to remember. To establish the claim that people have been enhancing their memories for centuries, it is vital to demonstrate how they have indeed done so. At the same time, ‘while the current bioethical debate mainly concentrates on pharmaceuticals, according to the given characterization, cognitive enhancement also by non-pharmacological means has to be regarded as enhancement proper’.⁵

2.3 Pharmacological means for memory enhancement

Pharmacological enhancement of the memory is perhaps, on the one hand, the most controversial means from an ethical, social, legal, and policy (ESLP) perspective. On the other hand, there is a contention about the effectiveness of the current drugs as a means for enhancing the memory and treating memory-related injuries. In this chapter, I review some of the pharmaceutical means that are currently widely used for ME. While most of the drugs reviewed in this chapter were initially developed and licensed for a variety of treatments, researchers have found them to have some enhancing effects in one way or another on the memory systems and memory processes.

¹ I use the term ‘conventional’ here to contrast other non-pharmacological means for ME that would be considered unconventional. Thus, while coffee is conventional and non-pharmacological, Deep Brain Stimulation is not only unconventional and non-pharmacological, but also technological.

² See this thesis (TT) hereafter, TT, 1.

³ HARRIS, J. 2007. *Enhancing evolution: the ethical case for making better people*, Princeton, N.J., Princeton University Press.

⁴ HÄYRY, M. 2008. The Historical Idea of a Better Race. *Studies in Ethics, Law, and Technology*, 2:1:11, 1-28.

⁵ DRESLER, M., SANDBERG, A., OHLA, K., BUBLITZ, C., TRENADO, C., MROCZKO-WĄSOWICZ, A., KÜHN, S. & REPANTIS, D. 2013. Non-pharmacological cognitive enhancement. *Neuropharmacology*, 64, 529-543.

2.4 Ethical and social background to the memory enhancement debate

As highlighted above in chapter one, in the past, most of the commentators addressing the ESLP issues in human enhancements have addressed them as a whole. In this chapter, I will draw on some arguments put forward for and against human enhancement in the already existing literature, but in doing so I will be novel in providing a much more specific in-depth analysis of the ESLP in ME. Given that there are numerous arguments for and against human enhancements, I will limit myself to those arguments that would be relevant to my current discussion on ME. I will accomplish this in two parts. First, I will assess the ethical and social arguments that have been put forward in support of human enhancement. Second, I will assess the ethical and social arguments against human enhancement.

2.5 Arguments for and against human enhancements from a legal and policy issues perspective

The debate on human enhancement from a legal and policy issues perspective has over the last decade focused on the questions of regulation. Legal theorists have been questioning whether enhancements would be lawful, whether they need to be regulated and if so, why and what form would that regulation take. In grappling with the questions of regulation, some commentators have argued for total prohibition, others for total freedom, and even others for a middle position – against total prohibition and against unrestricted freedom. In this chapter, I will assess these and other relevant arguments.

2.6 Optimum memory: the ultimate prize for memory manipulation

This paper addresses specific ethical and social issues in relation to memory enhancement, optimum memory, and memory dampening. I explore among others what optimum memory is and is not. What is memory dampening? What do we mean by well-being in this paper? What are the arguments put forward against memory dampening? Whose memory is it anyway? Is memory a property, a body part, a bodily function, an ideal, or does it have its own domain? Is my memory my own or is it part of the fabric of the society? What is the purpose of knowledge? Is all knowledge worth keeping, no matter how harmful and inconsequential it is to the beholder? What value of knowledge (if any) would one find in a PTSD sufferer, if

the sufferings have already paralysed the knowledge? How do we resolve the claim that MD results in change of personality? How can individuals aim/strive or target optimum memory if your optimum memory is different from mine? What is the doctrine of the mean?

2.7 Is there a duty to remember or an obligation not to forget?

This paper is about particular ethical and legal concerns that relates to memory enhancement, optimum memory, and memory dampening. To facilitate the response and assessment of the above main question, I have analysed other significant questions, such as, what is it to remember? What is the nature of the obligation to remember? Is remembering voluntary or involuntary? Is remembering ‘something we do’ or ‘something that happens to us’? Are we obligated to remember people, information, and events from the past? What is it to forget? Can we see forgetting as a systems failure rather than failure of character? Should we have stronger and weaker moral obligations similar to a sliding scale when it comes to remembering? What are the reasons put forward by those who support a duty to remember? What is the wrong of a duty to remember?

2.8 What legal issues does the quest for an optimum memory raise?

This paper addresses the main legal issues that would arise through the practice of MD and expound some instances in which they are likely to occur. In answering the above main question, I also explore other questions such as what legal issues does the quest for an optimum memory through the practice of memory dampening raise? Are the cases of therapeutic forgetting in the same class, for example, with female circumcision? Are there any unlawful inflictions of actual or grievous bodily harm in memory dampening cases? Should we give memory dampening drugs to everyone or only to those with an observed susceptibility to PTSD, and, if the latter, how do we distinguish them? Should we consider giving memory-altering drugs to all the witnesses, in addition to those directly involved? How do we decide whether certain people are to undergo a particular treatment or not? Could one possibly pervert the course of justice in memory dampening cases? Are reasons of perverting the course of justice and misuse of memory dampening drugs successful objections to MD? Under what circumstances could a claimant be put to the choice of either dampening

painful memories or else forgoing compensation for the pain attached to those memories that could have been dampened? When could cases of negligence arise in memory dampening cases?

2.9 What are the implications of optimum memory on eyewitness testimony?

This paper explores some specific legal implications related to the pursuit of optimum memory on eyewitness testimony. In assessing the main question above, I look at other questions such as why should the law bother about memory? Why should it be interested in an optimum memory? What are the difficulties in eyewitness memory? What are the causes of mistaken identifications? What are the problems with eyewitness evidence? Can we enhance eyewitnesses' memory during memory processes? What would be the impact of an optimum memory on eyewitness testimony? What impact would MD have on the testimony given in courts by claimants, defendants, or witnesses? What impact could it have on the juries and the judges?

2.10 Conclusion and future directions

This final chapter summarizes the main purposes of this thesis, recaps on the central arguments discussed for and against ME, reiterates my contribution to the ME debate and finally, suggests some future directions for the ME debate.

Having introduced the remaining chapters in the thesis, in the next section, I will discuss briefly the philosophical and legal approach to the human enhancement debate.

2.11 Philosophical and legal approach

Various philosophical and legal approaches to human enhancement have been identified in the literature. Commentators have approached the human enhancement debate from all corners ranging from deontological, virtue ethics, consequentialist, and nonconsequentialist approaches. For example, the EU parliament Science and Technology Options Assessment (STOA) study discusses five approaches: total prohibition of human enhancement, a laissez-faire approach, a reasoned pro-

enhancement approach, a reasoned restrictive approach, and a case-by-case approach.⁶ The study outlines and discusses possible general strategies of how to deal with the topic of human enhancement and human enhancing technologies in a European context. They reject a total ban and a laissez-faire approach as inappropriate, and identify a reasoned pro-enhancement approach, a reasoned restrictive approach, and a systematic case-by-case approach as viable options for the EU.⁷ Altogether, with regard to the policy options, and taking into account the wide range of risks and opportunities, the study favours a case-by-case approach to human enhancements arguing that we should evaluate potential technologies on an individual basis, based on shared European values and beliefs and on the latest insights into technology, society, and philosophy.⁸

Farrelly discusses a virtue ethics approach as one that could enlighten the moral discourse on enhancements in a valuable and distinctive way.⁹ Agar identifies liberal eugenics as opposed to authoritarian eugenics in his approach and his defence of human enhancements.¹⁰ Harris and Savulescu in most of their works cited in this thesis have advanced the debate from a liberal consequentialist approach. Whereas, Bostrom has advanced the debate from a transhumanist perspective, albeit based on liberal consequentialist assumptions, whereby they promote an interdisciplinary approach for enhancing the human condition, in the hope that by responsible use of science, technology, and other rational means we shall eventually manage to become post-human, beings with vastly greater capacities than present human beings have.¹¹

Most of the above approaches and many others have been used in the past to address the human enhancement issues as a whole. However, as highlighted above, this is problematic and consequently various commentators have called for a contextualized case-by-case approach to human enhancements. The rationale behind being that the

⁶ SCHUIJFF, M., SMITS, M., COENEN, C., KLAASSEN, P., HENNEN, L., RADER, M. & WOLBRING, G. 2009. European Parliament Science and Technology Options Assessment (STOA) - Human Enhancement Study. Brussels: *European Parliament STOA*.pp.8, 144.

⁷ Ibid.pp.10, 144.

⁸ Ibid.pp.8, 144.

⁹ FARRELLY, C. 2007. Virtue Ethics and Prenatal Genetic Enhancement. *Studies in Ethics, Law, and Technology*, 1:1:4.

¹⁰ AGAR, N. 2004. *Liberal eugenics: in defence of human enhancement*, Oxford, Blackwell Publishing.

¹¹ BOSTROM, N. 2003b. Human Genetic Enhancements: A Transhumanist Perspective. *The Journal of Value Inquiry*, 37, 493-506.

reasons for accepting/rejecting a particular enhancement varies depending on the enhancement itself.¹² Taking this as a point of departure, I will advance the human enhancement debate by making a specific case-by-case approach on ME. I will make a case for ME and in doing so assess the ESLP implications arising from ME. My analysis will draw on the already existing literature for and against enhancement, but will be novel in providing a much more in-depth analysis of ME.

Overall, in my case for ME, I will adopt the ‘Harrisian’ definition of enhancement.¹³ From this perspective, ME will be clearly anything that makes a change, a difference for the better in the beholder’s memory. This could be either increment or some form of decrement in the memory, and at their best these instances of ME is what I refer as optimum memory.¹⁴ Thus, from this perspective, MD will be a typical example of ME. Unlike other forms of human enhancements where it is presumed that the more of a good thing the better, I will argue that what is at stake in the ME debate is not necessarily more memory but rather an optimum memory that would enable the beholder to lead a better life.¹⁵ This demands the beholder to engage in the inescapable responsibility of making choices about their optimum memory – what memories they ought to enhance, retain, recall, or dampen.

By arguing for ME and indeed for an optimum memory throughout the thesis, my underlying philosophical principle and legal assertion is that ME and indeed an optimum memory is better for us. Moreover, when properly used, optimum memory could make us better people, advance our well-being and that of our fellow beings in the world – consequently, making the world a better place. This principle is in line with Harrisian philosophy of making a world a better place.¹⁶

2.12 Conclusion

In this chapter, I have briefly introduced the content of each of the remaining chapters in parts two, three, and four of this thesis; established some of the research

¹² TT, 1.

¹³ TT, 6.2.2.

¹⁴ TT, 3.3.1.

¹⁵ TT, 8.

¹⁶ HARRIS, J. 2007. *Enhancing evolution: the ethical case for making better people*, Princeton, N.J., Princeton University Press.p.3.

questions that form the basis for my articles; and briefly discussed the philosophical and legal approach to the human enhancement debate. In what follows, I will explore answers to the question: what is the memory and why does it matter?

Chapter 3

3 What is the memory and why does it matter?

In any attempt to understand the human memory, one has to confront some simple but key facts about the memory. Firstly, that the memory refers not to static entities – memory is not like any other recording media such as videos or audio recordings. Memory is not a record of the events themselves but rather is a record of people's experiences of events.^{1 2} Secondly, that memory is not a singular phenomenon or unitary system, neither is it mediated by a single biological or psychological system.³ Thirdly, that memory is not stored in any single location in the brain as some researchers used to believe, but that different kinds of information are processed and stored in different parts of the brain.^{4 5} Fourthly, that memory is constructive⁶ and reconstructive in nature,⁷ it is an array of interacting systems and a vast number of interrelated activities or processes each capable of encoding or registering information, storing it and making it available for retrieval.^{8 9 10} Without this capability for information storage, we could not perceive adequately, learn from our past, understand the present, or plan the future.¹¹ For this retention and retrieval combines bits of information from the past with what we currently know and believe.¹² For us to be able to understand memory, we need to be aware of the

¹ BPS Revised April 2010. Guidelines on Memory and the Law: Recommendations from the Scientific Study of Human Memory. A Report from the Research Board, *The British Psychological Society*, Leicester.

² HUNTER, I. M. L. 1962. *Memory facts and fallacies*, Harmondsworth, Middlesex, Penguin.

³ SCHACTER, D. L. 1996. *Searching for memory: the brain, the mind, and the past*, New York, Basic Books.

⁴ Ibid.

⁵ SQUIRE, L. R. 1992. Declarative and Nondeclarative Memory: Multiple Brain Systems Supporting Learning and Memory. *Journal of Cognitive Neuroscience*, 4, 232-243.

⁶ BPS Revised April 2010. Guidelines on Memory and the Law: Recommendations from the Scientific Study of Human Memory. A Report from the Research Board, *The British Psychological Society*, Leicester.

⁷ LOFTUS, E. F. 1996. *Eyewitness Testimony: With a New Preface by the Author*, Harvard University Press.

⁸ SCHACTER, D. L. 1996. *Searching for memory: the brain, the mind, and the past*, New York, Basic Books.

⁹ BADDELEY, A. D. 1999. *Essentials of Human Memory*, Psychology Press.

¹⁰ HUNTER, I. M. L. 1962. *Memory facts and fallacies*, Harmondsworth, Middlesex, Penguin.

¹¹ Ibid.

¹² SCHACTER, D. 17/10/2002. *Session 4: Remembering and Forgetting: Psychological Aspects* [Online]. The President's Council on Bioethics. Available: <http://bioethics.georgetown.edu/pcbe/transcripts/oct02/session4.html> [Accessed 01/02/ 2010].

memory processes that are fundamental to its characterization, namely: learning or encoding, retention or storage and retrieval, recall or remembering.^{13 14} Additionally we also need to be aware that there are various types of memory and they are based in different memory systems/structures in the brain. In what follows below, I will explain briefly each of these memory processes and look at types of memory respectively.

3.1 Memory processes

3.1.1 Encoding/learning

This is the process of acquiring some knowledge or data.¹⁵ In the initial stages of encoding, information is perceived through one or more of the senses, subsequently processed, and prepared for storage in long-term memory.¹⁶ The better the information is encoded, the better will be the subsequent remembering and by inference the retaining.¹⁷ Encoding is not a passive but rather an active and a complex process whereby information is considerably transformed and in some cases distorted as well.¹⁸

3.1.2 Retention/consolidation/storage

In the domain of memory research and theory, consolidation refers to the process by which a fragile short-term memory (STM) trace is transferred and stabilized into long-term memory (LTM).^{19 20} During this process, the encoded information is

¹³ GHETTI, S., SCHAAF, J. M., QIN, J. & GOODMAN, G. S. 2004. Chapter 22 - Issues in Eyewitness Testimony. In: WILLIAM, T. O. D. & ERIC, R. L. (eds.) *Handbook of Forensic Psychology*. San Diego: Academic Press.

¹⁴ WAGENAAR, W. A. 2008. Enhancing Memory in the Criminal Trial Process. In: ZONNEVELD, L., DIJSTELBLOEM, H. & RINGOIR, D. (eds.) *Reshaping the human condition: exploring human enhancement*. The Hague: Rathenau Institute. pp.65-75.

¹⁵ HUNTER, I. M. L. 1962. *Memory facts and fallacies*, Harmondsworth, Middlesex, Penguin. p.15.

¹⁶ WAGENAAR, W. A. 2008. Enhancing Memory in the Criminal Trial Process. In: ZONNEVELD, L., DIJSTELBLOEM, H. & RINGOIR, D. (eds.) *Reshaping the human condition: exploring human enhancement*. The Hague: Rathenau Institute. pp.65-75.

¹⁷ HUNTER, I. M. L. 1962. *Memory facts and fallacies*, Harmondsworth, Middlesex, Penguin. p.40.

¹⁸ WAGENAAR, W. A. 2008. Enhancing Memory in the Criminal Trial Process. In: ZONNEVELD, L., DIJSTELBLOEM, H. & RINGOIR, D. (eds.) *Reshaping the human condition: exploring human enhancement*. The Hague: Rathenau Institute. pp.65-75.

¹⁹ DUDAI, Y. 2004. The Neurobiology of Consolidations, Or, How Stable is the Engram? *Annual Review of Psychology*, 55, 51-86.

²⁰ DE QUERVAIN, D. J. F., AERNI, A., SCHELLING, G. & ROOZENDAAL, B. 2009. Glucocorticoids and the regulation of memory in health and disease. *Frontiers in Neuroendocrinology*, 30, 358-370.

stored in the memory until it is needed for retrieval.²¹ Retention cannot occur in the absence of encoding, for without encoding, there would be nothing to store. Retention is also a necessary condition for retrieval, for you cannot retrieve what has not been successfully encoded and retained in the memory.^{22 23} During retention/consolidation, the memory is susceptible to a variety of influences, which could be both facilitating and impairing even several hours after the experience.²⁴ Memory consolidation does not therefore occur instantly but it is rather a time-dependent process.^{25 26} It is widely agreed that not all information is equally transferred into long-term storage. Evidence suggests that emotionally arousing experiences are stabilized in LTM and they are well remembered even after decades.²⁷

3.1.3 Retrieval/remembering/recall

Retrieval is the process by which information stored in memory is brought back to consciousness.²⁸ Recall is effectuated through the presentation of retrieval cues that are usually in form of questions, but it is also possible to retrieve information through the presentation of a line up of faces, objects, voices, or even by means of smells.²⁹ Even if information is safely stored and preserved in memory, retrieval will only succeed if we engage effective retrieval cues.³⁰ Reduced memory retrieval is not a priori a negative thing as it supports the process of retaining important information and in some circumstances the reduction of memory retrieval may aid to

²¹ WAGENAAR, W. A. 2008. Enhancing Memory in the Criminal Trial Process. In: ZONNEVELD, L., DIJSTELBLOEM, H. & RINGOIR, D. (eds.) *Reshaping the human condition: exploring human enhancement*. The Hague: Rathenau Institute.pp.65-75.

²² Ibid.pp.65-75.

²³ HUNTER, I. M. L. 1962. *Memory facts and fallacies*, Harmondsworth, Middlesex, Penguin.p.15.

²⁴ MCGAUGH, J. L. 1966. Time-dependent processes in memory storage. *Science*, 153, 1351-8.

²⁵ Ibid.

²⁶ MCGAUGH, J. L. 2000. Memory--a Century of Consolidation. Ibid.287, 248-251.

²⁷ DE QUERVAIN, D. J. F., AERNI, A., SCHELLING, G. & ROOZENDAAL, B. 2009. Glucocorticoids and the regulation of memory in health and disease. *Frontiers in Neuroendocrinology*, 30, 358-370.

²⁸ GHETTI, S., SCHAAF, J. M., QIN, J. & GOODMAN, G. S. 2004. Chapter 22 - Issues in Eyewitness Testimony. In: WILLIAM, T. O. D. & ERIC, R. L. (eds.) *Handbook of Forensic Psychology*. San Diego: Academic Press.

²⁹ WAGENAAR, W. A. 2008. Enhancing Memory in the Criminal Trial Process. In: ZONNEVELD, L., DIJSTELBLOEM, H. & RINGOIR, D. (eds.) *Reshaping the human condition: exploring human enhancement*. The Hague: Rathenau Institute.pp.65-75.

³⁰ Ibid.pp.65-75.

suppress behaviours that are no more relevant or even maladaptive.³¹ Remembering involves other processes such as learning, consolidation, retrieval, and reconsolidation of the memory.³²

3.2 Types of memory

The knowledge that memory can be fragmented into subcomponents is not a new one and has been there since the American psychologist William James proposed it in 1890³³ and distinguished between STM and LTM.³⁴ However, it was only in the 1970s that some form of distinction became widely accepted.³⁵ Henceforth, psychologists have identified and continue to distinguish many types of memory for example explicit and implicit memory; declarative and non-declarative memory; eidetic/photographic and time-bound memory; procedural memory, autobiographical memory, emotional memory, sensory or iconic memory, echoic memory, and many more. There are many types of memory that have been identified in literature, that any efforts to discuss in detail all of them in this thesis would end up being fruitless. Furthermore, human memory looks different when viewed from various human perspectives:

There is the vision of the novelist or artist, who attempts to capture descriptively and imaginatively the lived experience of memory; the vision of the philosopher or theologian, who seeks wisdom about the nature of memory and its relationship to human experience and the good life; the vision of the psychologist or clinician, who attempts to research, test, and discover how memory works and how to keep it intact; and the vision of the neuroscientist, who studies the workings of the brain itself: by dissecting and studying the brains of non-human animals, by conducting chemical tests on human patients, or by taking pictures of the human brain at work.³⁶

³¹ DE QUERVAIN, D. J. F., AERNI, A., SCHELLING, G. & ROOZENDAAL, B. 2009. Glucocorticoids and the regulation of memory in health and disease. *Frontiers in Neuroendocrinology*, 30, 358-370.

³² DUDAI, Y. 2004. The Neurobiology of Consolidations, Or, How Stable is the Engram? *Annual Review of Psychology*, 55, 51-86.

³³ BADDELEY, A. D. 1999. *Essentials of Human Memory*, Psychology Press.p.9.

³⁴ SQUIRE, L. R., KNOWLTON, B. & MUSEN, G. 1993. The structure and organization of memory. *Annual review of psychology*, 44, 453-495.

³⁵ BADDELEY, A. D. 1999. *Essentials of Human Memory*, Psychology Press.p.9.

³⁶ PCBE-STAFF. March 7, 2003. *Better Memories? The Promise and Perils of Pharmacological Interventions* [Online]. Washington DC: The President's Council on Bioethics. Available: <http://bioethics.georgetown.edu/pcbe/transcripts/march03/session4.html> [Accessed 02/07 2010].

While my study of the memory here is work in Bioethics and Medical Jurisprudence, I also refer to other academic disciplines such as psychology, neuroscience, pharmacology among many others, in order to capture clearly our understanding of memory and what it means when we talk of enhancing it. Given the many types of memory as highlighted above, I will limit myself here to the two main types of memory STM and LTM, with further sub-classifications of LTM into declarative and nondeclarative memory as will be shown in table one later below. These types of memory are widely accepted.³⁷ However, in chapters four and five of this thesis, there will be more discussion of other various types of memory.

It is also widely accepted that various types of memory are processed in different brain structures and these brain structures are potential targets for ME. In table one below I demonstrate and summarize some of these brain structures.³⁸

3.2.1 Short-term memory, primary memory, or working memory

This refers to the temporary storage of information that is necessary for the performance of many cognitive tasks for example comprehension or reasoning. It is the ability to store and manipulate information over short periods.³⁹ This is the memory that one requires for example to hold a telephone number in mind after looking it up in a directory and while dialling. To understand this sentence, you need to remember the beginning until you get to the end. Without this temporary storage for words and the order in which they occur, the sentence would be incomprehensible.⁴⁰ Hence, one requires a good deal of temporary storage that needs to be retrieved accurately and appropriately. STM or Working memory has a limited capacity.⁴¹ This limited capacity is what is referred to as memory span or reading span, and it is used to describe the maximum amount of material that can be grasped or recalled immediately after a single presentation.⁴²

³⁷ TULVING, E. 1985. How many memory systems are there? *American Psychologist*, 40, 385.

³⁸ HU, R., ESKANDAR, E. & WILLIAMS, Z. 2009. Role of deep brain stimulation in modulating memory formation and recall. *Neurosurg Focus*, 27, E3.

³⁹ BARCH, D. 2004. Pharmacological manipulation of human working memory. *Psychopharmacology*, 174, 126-135.

⁴⁰ BADDELEY, A. D. 1999. *Essentials of Human Memory*, Psychology Press.p.15.

⁴¹ Ibid.p.19.

⁴² HUNTER, I. M. L. 1962. *Memory facts and fallacies*, Harmondsworth, Middlesex, Penguin.p.45.

3.2.2 Long-term memory, secondary memory, or reference memory

LTM refers to the storage and encoding of information for longer periods of time. Unlike STM above, the capacity of LTM is unlimited and as some theorists claim, it can endure indefinitely.⁴³ Additionally, they claim that information in LTM never disappears, but simply becomes less and less accessible.⁴⁴ LTM is the kind of memory that you need to remember your name, how to speak, where you lived as a child, or where you were last year.⁴⁵ LTM is not a single entity but is composed of several different components, which are mediated by separate brain systems.⁴⁶ Within LTM, further distinctions are made between declarative (explicit, relational) memory and nondeclarative (implicit) memory.⁴⁷

3.2.2.1 Declarative (explicit, relational) memory

Declarative (explicit, relational) memory is a brain-systems construct, referring to memory that is dependent on the hippocampus, medial temporal lobe, and diencephalon.^{48 49} There are two main types of declarative memory: episodic and semantic memory. On the one hand episodic memory refers to the autobiographical memory, which is the capacity to recollect specific experiences, events, or episodes which are unique to time and place, for example remembering going swimming a month ago. On the other hand, semantic memory is concerned with the stored factual knowledge of the world, for example knowing the speed of light.^{50 51 52} Both episodic and semantic memory are declarative, in the sense that retrieval of information is carried out explicitly and subjects are aware that stored information is being accessed.⁵³

⁴³ BADDELEY, A. D. 1999. *Essentials of Human Memory*, Psychology Press.pp.19,128.

⁴⁴ Ibid.pp.19,128.

⁴⁵ Ibid.p.16.

⁴⁶ SQUIRE, L. R., KNOWLTON, B. & MUSEN, G. 1993. The structure and organization of memory. *Annual review of psychology*, 44, 453-495.

⁴⁷ Ibid.

⁴⁸ Ibid.

⁴⁹ KANDEL, E. R. 2009. The Biology of Memory: A Forty-Year Perspective. *The Journal of Neuroscience*, 29, 12748-12756.

⁵⁰ BADDELEY, A. D. 1999. *Essentials of Human Memory*, Psychology Press.p.17.

⁵¹ BUDSON, A. E. 2009. Understanding memory dysfunction. *Neurologist*. United States.

⁵² SQUIRE, L. R., KNOWLTON, B. & MUSEN, G. 1993. The structure and organization of memory. *Annual review of psychology*, 44, 453-495.

⁵³ Ibid.

3.2.2.2 Nondeclarative (implicit, procedural) memory

Nondeclarative (implicit, procedural) memory is a heterogeneous collection of separate memory abilities that can be additionally dissociated from each other. These include skills and habits, conditioned responses, priming,⁵⁴ and nonassociative learning.⁵⁵ These memory abilities depend on multiple brain systems: the cerebellum, the striatum, the amygdala, and in the most elementary instances, simple reflex pathways themselves.⁵⁶ The above types of memory can be summarized in table one below which also shows the brain structures, which could be potential targets for ME.^{57 58 59}

3.3 What is memory enhancement?

When we talk of ME, we refer to enhancement of any of the above memory processes, the various types of memory, and the brain systems that support them. ME in this thesis, encompasses both processes that would on the one hand either influence the memory positively for example by increasing our ability to remember or on the other hand influence the memory through some form of decrement for example by memory dampening (MD), thus inhibiting what and how much we can remember. Memory dampening is a form of ME. In this thesis, MD refers to the technological and pharmacological possibility of modifying what we remember and how we remember it.

3.3.1 What is optimum memory?

In this thesis, ‘optimum memory’ refers to the best possible memory that an individual can attain through the processes of ME. Optimum memory can be achieved either through increment or through some form of decrement in the memory, and at their best these instances of ME is what I will refer throughout the

⁵⁴ Priming refers to an improved facility for detecting or identifying perceptual stimuli based on recent experience with them.

⁵⁵ SQUIRE, L. R., KNOWLTON, B. & MUSEN, G. 1993. The structure and organization of memory. *Annual review of psychology*, 44, 453-495.

⁵⁶ KANDEL, E. R. 2009. The Biology of Memory: A Forty-Year Perspective. *The Journal of Neuroscience*, 29, 12748-12756.

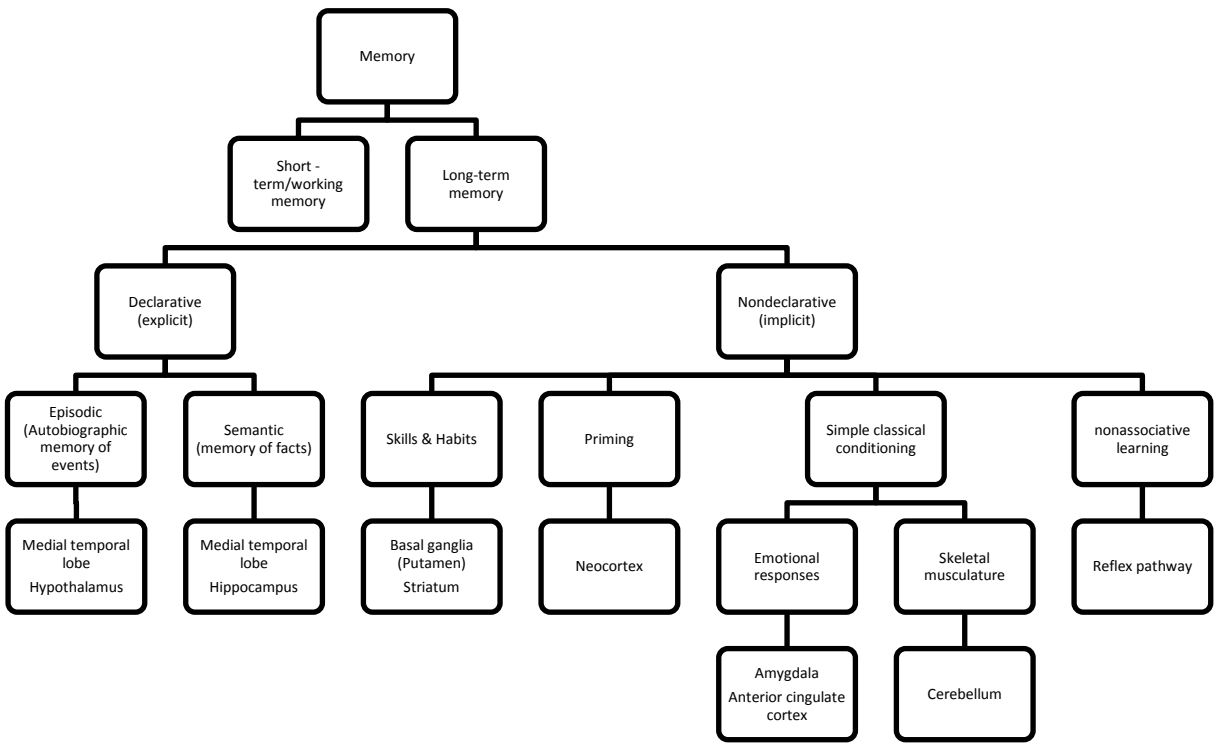
⁵⁷ SQUIRE, L. R. & ZOLA-MORGAN, S. 1991. The medial temporal lobe memory system. *Science*, 253, 1380-6.

⁵⁸ HU, R., ESKANDAR, E. & WILLIAMS, Z. 2009. Role of deep brain stimulation in modulating memory formation and recall. *Neurosurg Focus*, 27, E3.

⁵⁹ ROLDAN-VALADEZ, E., GARCÍA-LÁZARO, H., RAMIREZ-CARMONA, R. & LARA-ROMERO, R. 2012. Neuroanatomy of episodic and semantic memory in humans: A brief review of neuroimaging studies. *Neurology India*, 60, 613-617.

thesis as optimum memory. Thus, from this perspective, MD will be a typical example of ME. It is vital to understand this aspect of ME as I use it in the thesis, as it may appear paradoxical. We need to grasp that for the purposes of this thesis either memory increment or some form of decrement, could lead to optimum memory. Unlike other kinds of human enhancements where it is presumed that the more of a good thing the better, I will argue that what is at stake in the ME debate is not necessarily more memory but rather optimum memory that would enable the beholder to lead a better life.⁶⁰ This demands the beholder to engage in the inescapable responsibility of making choices about their optimum memory – what memories they ought to enhance, retain, recall, or dampen.

Table 1⁶¹
Memory classification and potential brain structures that could be targets for memory enhancement 1



⁶⁰ TT, 8.6.

⁶¹ This table is slightly modified from several other different tables. See SQUIRE, L. R. & ZOLA-MORGAN, S. 1991. The medial temporal lobe memory system. *Science*, 253, 1380-6. ROLDAN-VALADEZ, E., GARCÍA-LÁZARO, H., RAMIREZ-CARMONA, R. & LARA-ROMERO, R. 2012. Neuroanatomy of episodic and semantic memory in humans: A brief review of neuroimaging studies. *Neurology India*, 60, 613-617. HU, R., ESKANDAR, E. & WILLIAMS, Z. 2009. Role of deep brain stimulation in modulating memory formation and recall. *Neurosurg Focus*, 27, E3. And STICKGOLD, R. 2005. Sleep-dependent memory consolidation. *Nature*, 437, 1272-1278.

3.4 Why is the memory important?

Most of our everyday life is governed by the need to keep track of what we have done, what we are doing, and what we want to do in the near future. We are interested in knowing who we are, where we have come from, and where we are heading. To be at our best in keeping a track of whom we are and what we are doing, to be able to bridge our past doings with our current undertakings and our future endeavours demands the usage of our memory – indeed, as I will argue in this thesis, ‘optimum memory’. Memory is what enables us to remember, learn new things, and engage in relationships whether personal, social, or professional.⁶² The list on the significance of memory not only in our daily living tasks but also in our general health and well-being could be endless. I briefly highlight some central examples. First, memory plays an important role in the formation of one’s identity. Although there are disagreements philosophically on the extent that one would alter his memory and maintain his psychological identity,^{63 64 65} it suffices to highlight here that memory plays a crucial role in the formation of one’s identity. We need to remember who we are, where we are from, and where we are going. This ability to remember the past (retrospective memory) as well as the future intentions such as keeping an appointment, (prospective memory) is critical to enjoying any real quality of life.⁶⁶ Secondly, memory plays a fundamental role in the pursuit of our well-being (I will discuss further this claim in the thesis). Hence, people interested in happiness are often interested in memory as well.⁶⁷ Thirdly, because memory loss for example, through Alzheimer’s disease, dementia, traumatic injuries, and other age-related

⁶² HODGES, S., WILLIAMS, L., BERRY, E., IZADI, S., SRINIVASAN, J., BUTLER, A., SMYTH, G., KAPUR, N. & WOOD, K. 2006. SenseCam: A retrospective memory aid. *UbiComp 2006: Ubiquitous Computing*. Springer.

⁶³ Philosophers distinguish various types of identity; the most commonly identified being numerical identity (human or personal identity) versus narrative identity. Numerical identity refers to the relationship an entity has to itself over time in being one and the same entity. It provides criteria for an entity to continue to exist through change. For example, a human person undergoes immense changes over the years, yet a single individual may reflect on all of these changes as having occurred to him. Narrative identity refers to a person’s self-conception, what he considers most important to who he is, and the way he organises the story he tells himself about himself. See DEGRAZIA, D. 2005b. *Human Identity and Bioethics*, Cambridge University Press. pp.8,11-115.

⁶⁴ WASSERMAN, D. 2004. Making memory lose its sting. *Journal of Philosophy and Public Affairs Quarterly*, 24, 12-18.

⁶⁵ DEGRAZIA, D. 2005a. Enhancement technologies and human identity. *Journal of Medicine and Philosophy*, 30, 261-283.

⁶⁶ HODGES, S., WILLIAMS, L., BERRY, E., IZADI, S., SRINIVASAN, J., BUTLER, A., SMYTH, G., KAPUR, N. & WOOD, K. 2006. SenseCam: A retrospective memory aid. *UbiComp 2006: Ubiquitous Computing*. Springer.

⁶⁷ PCBE 2003. Beyond Therapy: Biotechnology and the Pursuit of Happiness. *The President's Council on Bioethics*. Washington, D.C.p.217.

memory impairments has devastating consequences on the individual as well as society,⁶⁸ it is vital to identify how such memory loss can be treated or prevented. Thus, individuals, patients groups, and non/governmental organizations are interested in treatments for such ailments. Fourthly, a competitive ‘edge’ – many benefits crucial to our success economically, socially, and even intellectually would come with an improved memory⁶⁹ and improved cognitive capacities.⁷⁰

3.5 Conclusion

In this chapter, I have clarified what the memory is and elucidated why the memory is important. I have also discussed the main memory processes and the central types of memory. In addition, I have clarified my usage of the terms ME and optimum memory.

Since any manipulation of memory, whether to obliterate unwelcome memory or reinforce fading ones has implications for who we are as individuals, as our ability to enhance the memory increases, we will need a rigorous ethical, social, legal and policy framework to ensure that such technology can be used in an appropriate and responsible manner.⁷¹ I will discuss these issues in chapters six and seven, however in what follows now, I explore answers to the question how do we enhance the memory? I begin by discussing the non-pharmacological means for ME.

⁶⁸ ROSE, S. P. R. 2002. 'Smart Drugs': Do they work? Are they ethical? Will they be legal? *Nature Reviews Neuroscience*, 3, 975-979.

⁶⁹ Ibid.

⁷⁰ SAVULESCU, J., SANDBERG, A. & KAHANE, G. 2011. Well-Being and Enhancement. In: SAVULESCU, J., MEULEN, R. & KAHANE, G. (eds.) *Enhancing Human Capacities*. Wiley. pp.3-18.

⁷¹ HU, R., ESKANDAR, E. & WILLIAMS, Z. 2009. Role of deep brain stimulation in modulating memory formation and recall. *Neurosurg Focus*, 27, E3.

How do we enhance the memory?

Chapter 4

4 Non-pharmacological memory enhancement: traditional, conventional and technological means

4.1 Introduction

In this chapter, I will assess and review the traditional, conventional,¹ and technological means that people have used over the centuries in an attempt to enhance their memories. I refer to these means here as non-pharmacological to contrast them from pharmacological means that I discuss in the next chapter. As already proposed elsewhere,² the desire to enhance and make ourselves better is not a new one and it has continued to intrigue throughout the ages. Individuals have always sought ways to improve and enhance their well-being.^{3 4} Crucial to this improvement of their well-being is improving their ability to remember. To establish the claim that people have been enhancing their memories for centuries, it is vital to demonstrate how they have indeed done so. At the same time, ‘while the current bioethical debate mainly concentrates on pharmaceuticals, according to the given characterization, cognitive enhancement also by non-pharmacological means has to be regarded as enhancement proper’.⁵

The traditional and conventional means used for ME may not be as controversial ethically, socially, legally or even from a policy perspective, as some technological and pharmacological enhancers that are currently available. This raises interesting questions about whether it is the end or the means that are objectionable or problematic and if so why. However, some of the traditional and conventional means

¹ I use the term ‘conventional’ here to contrast other non-pharmacological means for ME that would be considered unconventional. Thus, while coffee is conventional and non-pharmacological, Deep Brain Stimulation is not only unconventional and non-pharmacological, but also technological.

² TT, 1.

³ HARRIS, J. 2007. *Enhancing evolution: the ethical case for making better people*, Princeton, N.J., Princeton University Press.

⁴ HÄYRY, M. 2008. The Historical Idea of a Better Race. *Studies in Ethics, Law, and Technology*, 2:1:11, 1-28.

⁵ DRESLER, M., SANDBERG, A., OHLA, K., BUBLITZ, C., TRENADO, C., MROCZKO-WĄSOWICZ, A., KÜHN, S. & REPANTIS, D. 2013. Non-pharmacological cognitive enhancement. *Neuropharmacology*, 64, 529-543.

may have raised such controversies in their beginnings and during enculturation into new communities. Approaching the non-pharmacological means from this perspective, might illuminate the current debate on the controversies surrounding pharmacological and technological means for ME. Perhaps it is their newness as means for ME and the fact that they are still in experimental stages, which is responsible for their problematic status rather than any essential problem with them per se.⁶ As society accustoms itself to these pharmacological and technological means for ME, perhaps they will become absorbed into the ordinary category of human tools.⁷

As already discussed above (in chapter three), memory is an array of various systems and processes. It is widely accepted that memory consists of three main processes: encoding, retention and retrieval. Although, traditionally, people have attempted to enhance their memories through different means, these means do not fit in specifically with the current widely accepted memory processes, as the concept and our understanding of memory has evolved over time.

Some of the non-pharmacological means I discuss in this chapter have been widely used all over the world for ages, whereas others are recent and less known. It is only when you reflect about these methods that you realise they have been used as means and attempts to enhance the memory and other aspects of cognition. I write ‘attempts to enhance memories’ in the sense that the methods applied traditionally may not actually have had any memory enhancing potential, at least which could be backed by scientific data. However, some people believed and have continued to believe in their efficacy. Such would be the case, as we will see later with some herbs.

My usage of the terms ‘ME’ and indeed an ‘optimum memory’ implies any attempts to make it better by either improving and/or dampening the memory. Again, I write ‘attempts to forget’, because they may not have actually led to forgetting. In what follows, I will commence with the traditional and conventional means beginning with the most basic and widely used all over – nutrition.

⁶ BOSTROM, N. & SANDBERG, A. 2009. Cognitive enhancement: Methods, ethics, regulatory challenges. *Science and Engineering Ethics*, 15, 311-341.

⁷ Ibid.

4.2 Traditional and conventional means for memory enhancement

4.2.1 Nutrition

It has been widely reported that numerous food products, dietary supplements, and stimulants have claimed effects like ‘increase energy’ or ‘enhance memory’ even though there is scarce, controversial or an entire absence of scientific evidence.⁸ This is backed by sales of nutritional supplements that promise improved memory in middle age and beyond, reaching a billion dollars annually in the United States alone by the time of Farah et al’s, review in 2004.⁹ Attempts to enhance our cognitive abilities, including memory, through nutrition are widely discussed and some of them published in prestigious academic journals. However, results do often conflict. Individuals consume nutritional enhancers in everyday situations, intentionally targeting improving cognitive capacities, or unintentionally, when they take them just as a nutrient. In both cases, these nutritional enhancers can reduce fatigue and help maintain full cognitive capacities.¹⁰ In what follows below, I will review caffeine, glucose, omega-3 fatty acids, and ginkgo biloba respectively. All these have been considered to have some cognitive enhancing functions including that of ME.

4.2.1.1 Caffeine

Caffeine is naturally found in coffee beans, cacao beans, kola nuts, guarana berries, and tea leaves.¹¹ Soft drinks and energy drinks also often contain caffeine. Many people throughout the world consume caffeinated products every day, with coffee and tea being the primary sources.¹² Coffee is one of the most widely consumed beverages all over the world and it has been popular since its discovery over 1000 years ago. As the legend goes, Kaldi the goat herder discovered coffee in Ethiopia,

⁸ DRESLER, M., SANDBERG, A., OHLA, K., BUBLITZ, C., TRENADO, C., MROCZKO-WĄSOWICZ, A., KÜHN, S. & REPANTIS, D. 2013. Non-pharmacological cognitive enhancement. *Neuropharmacology*, 64, 529-543.

⁹ FARAH, M. J., ILLES, J., COOK-DEEGAN, R., GARDNER, H., KANDEL, E., KING, P., PARENS, E., SAHAKIAN, B. & WOLPE, P. R. 2004. Neurocognitive enhancement: What can we do and what should we do? *Nature Reviews Neuroscience*, 5, 421-425.

¹⁰ DRESLER, M., SANDBERG, A., OHLA, K., BUBLITZ, C., TRENADO, C., MROCZKO-WĄSOWICZ, A., KÜHN, S. & REPANTIS, D. 2013. Non-pharmacological cognitive enhancement. *Neuropharmacology*, 64, 529-543.

¹¹ HECKMAN, M. A., WEIL, J. & DE MEJIA, E. G. 2010. Caffeine (1, 3, 7-trimethylxanthine) in Foods: A Comprehensive Review on Consumption, Functionality, Safety, and Regulatory Matters. *Journal of Food Science*, 75, R77-R87.

¹² Ibid.

after noticing that his goats upon eating berries from a certain tree became so spirited that they did not want to sleep at night. With this news, the Abbot of the local monastery experimented on these berries and found that a brew of these ‘cherries’ could keep his brother monks awake through long hours of prayer.^{13 14} Coffee came to Europe in 1615 through the Venetian traders. People were very wary of drinking coffee and some called it the ‘bitter invention of Satan’.^{15 16} The local clergy in Italy condemned it! The controversy over coffee was so great, that Pope Clement VIII had to intervene. However, before making a decision, he tasted coffee for himself. He enjoyed it so much that he gave it Papal approval.^{17 18} In Britain, the first coffee house was opened in Oxford in 1651 and by 1700, there were 3,000 coffee houses in London.¹⁹ Afterwards, coffee consumption and growth rapidly spread all over the world.

Caffeine is an adenosine receptor antagonist that reduces inhibition of neural firing through an increased turnover of noradrenaline in the brain.^{20 21 22} Caffeine exerts its stimulating effects within less than an hour after consumption through altering the biochemistry of the brain.^{23 24} There is clear evidence from numerous studies^{25 26 27 28}

¹³ BCA. 2013. *Coffee Facts, Statistics & Coffee News - British Coffee Association* [Online]. Available: <http://www.britishcoffeeassociation.org/home-bca> [Accessed 01/02/ 2013].

¹⁴ NCA. 2013. *The History Of Coffee - National Coffee Association USA* [Online]. Available: <http://www.ncausa.org/i4a/pages/index.cfm?pageid=68> [Accessed 01/01/ 2013].

¹⁵ Ibid.

¹⁶ BCA. 2013. *Coffee Facts, Statistics & Coffee News - British Coffee Association* [Online]. Available: <http://www.britishcoffeeassociation.org/home-bca> [Accessed 01/02/ 2013].

¹⁷ Ibid.

¹⁸ NCA. 2013. *The History Of Coffee - National Coffee Association USA* [Online]. Available: <http://www.ncausa.org/i4a/pages/index.cfm?pageid=68> [Accessed 01/01/ 2013].

¹⁹ BCA. 2013. *Coffee Facts, Statistics & Coffee News - British Coffee Association* [Online]. Available: <http://www.britishcoffeeassociation.org/home-bca> [Accessed 01/02/ 2013].

²⁰ SMITH, A., BRICE, C., NASH, J., RICH, N. & NUTT, D. J. 2003. Caffeine and Central Noradrenaline: Effects on Mood, Cognitive Performance, Eye Movements and Cardiovascular Function. *Journal of Psychopharmacology*, 17, 283-292.

²¹ FERRÉ, S. 2008. An update on the mechanisms of the psychostimulant effects of caffeine. *Journal of Neurochemistry*, 105, 1067-1079.

²² DRESLER, M., SANDBERG, A., OHLA, K., BUBLITZ, C., TRENADO, C., MROCZKO-WĄSOWICZ, A., KÜHN, S. & REPANTIS, D. 2013. Non-pharmacological cognitive enhancement. *Neuropharmacology*, 64, 529-543.

²³ Ibid.

²⁴ EINÖTHER, S. J. L. & GIESBRECHT, T. 2013. Caffeine as an attention enhancer: Reviewing existing assumptions. *Psychopharmacology*, 225, 251-274.

²⁵ SMITH, A., BRICE, C., NASH, J., RICH, N. & NUTT, D. J. 2003. Caffeine and Central Noradrenaline: Effects on Mood, Cognitive Performance, Eye Movements and Cardiovascular Function. *Journal of Psychopharmacology*, 17, 283-292.

²⁶ SMITH, A. P. 2005. Caffeine at work. *Human Psychopharmacology: Clinical and Experimental*, 20, 441-445.

²⁹ that caffeine enhances cognitive performances: increasing mental alertness, concentration, wakefulness, and mood elevation. Other performance benefits attributed to caffeine include physical endurance, reduction of fatigue, and improvement of motor-skill performance on tasks that are impaired when arousal is low.^{30 31}

Evidence demonstrates that caffeine has clear beneficial effects on attention, improving performance on both simple and complex attention tasks.³² It improves executive control and potentially also orienting.³³ Caffeine yields similar effects when consumed in a coffee, tea, or as a capsule.³⁴

Although, there are disputes around the effects of caffeine on memory and learning,³⁵ some researchers have found that consumption of caffeine had clear effects on working memory in comparison to the placebo.^{36 37} However, because caffeine enhances alertness, wakefulness and attention, it is safer to assume that caffeine would also improve and enhance the memory, albeit indirectly. For by promoting alertness, wakefulness, and concentration, it creates a requisite environment in which learning and new memories are encoded.

²⁷ JARVIS, M. J. 1993. Does caffeine intake enhance absolute levels of cognitive performance? *Psychopharmacology*, 110, 45-52.

²⁸ HEWLETT, P. & SMITH, A. 2007. Effects of repeated doses of caffeine on performance and alertness: New data and secondary analyses. *Human Psychopharmacology*, 22, 339-350.

²⁹ HECKMAN, M. A., WEIL, J. & DE MEJIA, E. G. 2010. Caffeine (1, 3, 7-trimethylxanthine) in Foods: A Comprehensive Review on Consumption, Functionality, Safety, and Regulatory Matters. *Journal of Food Science*, 75, R77-R87.

³⁰ Ibid.

³¹ REYNER, L. A. & HORNE, J. A. 1997. Suppression of sleepiness in drivers: Combination of caffeine with a short nap. *Psychophysiology*, 34, 721-725.

³² EINÖTHER, S. J. L. & GIESBRECHT, T. 2013. Caffeine as an attention enhancer: Reviewing existing assumptions. *Psychopharmacology*, 225, 251-274.

³³ Ibid.

³⁴ BRICE, C. F. & SMITH, A. P. 2002. Effects of caffeine on mood and performance: A study of realistic consumption. Ibid. 164, 188-192.

³⁵ NEHLIG, A. 2010. Is caffeine a cognitive enhancer? *Journal of Alzheimer's Disease*, 20, S85-S94.

³⁶ KLAASSEN, E. B., DE GROOT, R. H. M., EVERS, E. A. T., SNEL, J., VEERMAN, E. C. I., LIGTENBERG, A. J. M., JOLLES, J. & VELTMAN, D. J. 2013. The effect of caffeine on working memory load-related brain activation in middle-aged males. *Neuropharmacology*, 64, 160-167.

³⁷ KOPPELSTAETTER, F., POEPEL, T. D., SIEDENTOPF, C. M., ISCHEBECK, A., VERIUS, M., HAALA, I., MOTTAGHY, F. M., RHOMBERG, P., GOLASZEWSKI, S., GOTWALD, T., LORENZ, I. H., KOLBITSCH, C., FELBER, S. & KRAUSE, B. J. 2008. Does caffeine modulate verbal working memory processes? An fMRI study. *NeuroImage*, 39, 492-499.

4.2.1.2 Glucose

There is clear evidence on the positive effects of glucose on memory. Existing studies demonstrate that glucose improves attention,^{38 39} processing speed,^{40 41} declarative memory,^{42 43} and working memory.^{44 45} Declarative memory refers to our ability to remember every day events and factual knowledge, whereas working memory refers to the short-term temporary storage system that underpins our capacity for coherent thought. Regardless of the time glucose is administered either immediately before or after learning and training; it has been found to improve the memory.^{46 47} Manning et al,⁴⁸ have assessed the effects of glucose at the time of memory tests and have examined the role of glucose on memory retrieval in healthy elderly people. They found that glucose facilitates memory in several populations of humans, including healthy elderly people.⁴⁹ According to them glucose enhances both memory storage and retrieval processes.⁵⁰ Other studies have found that glucose can enhance both encoding and consolidation memory processes in activities that require increased mental effort.^{51 52}

³⁸ BENTON, D., OWENS, D. S. & PARKER, P. Y. 1994. Blood glucose influences memory and attention in young adults. *Neuropsychologia*, 32, 595-607.

³⁹ JONES, E. K., SÜNRAM-LEA, S. I. & WESNES, K. A. 2012. Acute ingestion of different macronutrients differentially enhances aspects of memory and attention in healthy young adults. *Biological Psychology*, 89, 477-486.

⁴⁰ Ibid.

⁴¹ OWENS, D. S. & BENTON, D. 1994. The Impact of Raising Blood Glucose on Reaction Times. *Neuropsychobiology*, 30, 106-113.

⁴² SMITH, M. A., RIBY, L. M., EEKELEN, J. A. M. V. & FOSTER, J. K. 2011. Glucose enhancement of human memory: A comprehensive research review of the glucose memory facilitation effect. *Neuroscience & Biobehavioral Reviews*, 35, 770-783.

⁴³ MESSIER, C. 2004. Glucose improvement of memory: a review. *European Journal of Pharmacology*, 490, 33-57.

⁴⁴ OWEN, L., SCHOLEY, A., FINNEGAN, Y., HU, H. & SÜNRAM-LEA, S. 2012. The effect of glucose dose and fasting interval on cognitive function: a double-blind, placebo-controlled, six-way crossover study. *Psychopharmacology*, 220, 577-589.

⁴⁵ JONES, E. K., SÜNRAM-LEA, S. I. & WESNES, K. A. 2012. Acute ingestion of different macronutrients differentially enhances aspects of memory and attention in healthy young adults. *Biological Psychology*, 89, 477-486.

⁴⁶ SÜNRAM-LEA, S. I., FOSTER, J. K., DURLACH, P. & PEREZ, C. 2002. The effect of retrograde and anterograde glucose administration on memory performance in healthy young adults. *Behavioural Brain Research*, 134, 505-516.

⁴⁷ MANNING, C. A., STONE, W. S., KOROL, D. L. & GOLD, P. E. 1998. Glucose enhancement of 24-h memory retrieval in healthy elderly humans. *Behavioural brain research*, 93, 71-76.

⁴⁸ Ibid.

⁴⁹ Ibid.

⁵⁰ Ibid.

⁵¹ MEIKLE, A., RIBY, L. M. & STOLLERY, B. 2005. Memory processing and the glucose facilitation effect: The effects of stimulus difficulty and memory load. *Nutritional Neuroscience*, 8, 227-232.

4.2.1.3 Omega-3 polyunsaturated fatty acids

Omega-3 polyunsaturated fatty acids (PUFAs) are found in abundance in fish, as well as in some herbs, nuts, and plants.⁵³ Omega-3 PUFAs are important building blocks for neuronal cell membranes, and they have key roles in brain development, neuro-transmission, and modulation of ion channels, as well as possessing neuroprotective properties.⁵⁴

Many benefits have been attributed to omega-3 PUFAs such as reduced risks of stroke,⁵⁵ cardiovascular⁵⁶ and hypertension diseases,⁵⁷ blood pressure,⁵⁸ Alzheimer's disease, and schizophrenia.⁵⁹ Other beneficial effects of prenatal and early postnatal intakes of omega-3 PUFAs on cognitive development during infancy are well recognized.⁶⁰

Regarding positive effects on memory, the existing findings are quite conflicting. Some studies suggest that consumption of regular omega-3 PUFAs can reduce and/or prevent the risks of memory impairments like dementia,⁶¹ whereas others do

⁵² SMITH, M. A., RIBY, L. M., EEKELEN, J. A. M. V. & FOSTER, J. K. 2011. Glucose enhancement of human memory: A comprehensive research review of the glucose memory facilitation effect. *Neuroscience & Biobehavioral Reviews*, 35, 770-783.

⁵³ FOTUHL, M., MOHASSEL, P. & YAFFE, K. 2009. Fish consumption, long-chain omega-3 fatty acids and risk of cognitive decline or Alzheimer disease: a complex association. *NATURE CLINICAL PRACTICE NEUROLOGY*, 5.

⁵⁴ Ibid.

⁵⁵ HE, K., SONG, Y., DAVIGLUS, M. L., LIU, K., VAN HORN, L., DYER, A. R., GOLDBOURT, U. & GREENLAND, P. 2004. Fish Consumption and Incidence of Stroke A Meta-Analysis of Cohort Studies. *Stroke*, 35, 1538-1542.

⁵⁶ MOZAFFARIAN, D. & WU, J. H. Y. 2011. Omega-3 Fatty Acids and Cardiovascular Disease Effects on Risk Factors, Molecular Pathways, and Clinical Events. *Journal of the American College of Cardiology*, 58, 2047-2067.

⁵⁷ KRIS-ETHERTON, P. M., HARRIS, W. S., APPEL, L. J. & FOR THE NUTRITION, C. 2002. Fish Consumption, Fish Oil, Omega-3 Fatty Acids, and Cardiovascular Disease. *Circulation*, 106, 2747-2757.

⁵⁸ MORRIS, M. C., SACKS, F. & ROSNER, B. 1993. Does fish oil lower blood pressure? A meta-analysis of controlled trials. *Ibid.* 88, 523-533.

⁵⁹ ABAD, S. & TURON, X. 2012. Valorization of biodiesel derived glycerol as a carbon source to obtain added-value metabolites: Focus on polyunsaturated fatty acids. *Biotechnology Advances*, 30, 733-741.

⁶⁰ BOUCHER, O., BURDEN, M. J., MUCKLE, G., SAINT-AMOUR, D., AYOTTE, P., DEWAILLY, E., NELSON, C. A., JACOBSON, S. W. & JACOBSON, J. L. 2011. Neurophysiologic and neurobehavioral evidence of beneficial effects of prenatal omega-3 fatty acid intake on memory function at school age. *The American Journal of Clinical Nutrition*, 93, 1025-1037.

⁶¹ LIM, W., GAMMACK, J., VAN NIEKERK, J. & DANGOUR, A. 2006. Omega 3 fatty acid for the prevention of dementia.

not find such benefit on cognitive function, especially in healthy adults.⁶² Fotuhi et al,⁶³ did a systematic review on existing literature for observational and clinical studies and confirmed that there were conflicting results on whether omega 3 fatty acids offer such benefits as reduced risk or prevention of dementia and Alzheimer's disease. They concluded that while observational studies in the literature suggest omega-3 PUFAs provide a modest benefit with regard to slowing cognitive decline among elderly individuals without dementia, clinical trials conducted had not provided convincing evidence for the use of omega-3 PUFAs to treat any form of dementia or to prevent cognitive decline.⁶⁴ In one of the latest studies on the matter, Luchtman et al,⁶⁵ have observed that there were remarkably potent beneficial effects of omega-3 PUFAs on cognitive function across all age groups. Predominantly, the benefit was in the developing, the aged, and the cognitively impaired cohort. In cases where there were deficient PUFAs supply, which may lead to cognitive impairment, or in elderly, cognitively impaired individuals, Luchtman et al, found that omega-3 PUFAs supplementation may help to restore cognitive function.⁶⁶ However, they did not find convincing evidence to support cognition-enhancing effects by omega-3 PUFAs supplementation in healthy (young and adult) individuals with adequate omega-3 PUFAs intake.⁶⁷ Nevertheless, they recognized that this is less frequently studied. Therefore, further observational and clinical studies are required to ascertain benefits of omega-3 PUFAs on memory. Nevertheless, in the absence of curative treatment, even if it is difficult to change lifestyle habits, lifestyle factors such as diet, social engagement, cognitive stimulation, and physical exercise discussed in this chapter, seem to be the most realistic candidates for prevention of cognitive decline currently, in particular due to their safety.⁶⁸

⁶² SYDENHAM, E., DANGOUR, A. D. & LIM, W. S. 2012. Omega 3 fatty acid for the prevention of cognitive decline and dementia. *Cochrane Database of Systematic Reviews*.

⁶³ FOTUHI, M., MOHASSEL, P. & YAFFE, K. 2009. Fish consumption, long-chain omega-3 fatty acids and risk of cognitive decline or Alzheimer disease: a complex association. *NATURE CLINICAL PRACTICE NEUROLOGY*, 5.

⁶⁴ Ibid.

⁶⁵ LUCHTMAN, D. W. & SONG, C. 2013. Cognitive enhancement by omega-3 fatty acids from child-hood to old age: Findings from animal and clinical studies. *Neuropharmacology*, 64, 550-565.

⁶⁶ Ibid.

⁶⁷ Ibid.

⁶⁸ GILLETTE-GUYONNET, S., SECHER, M. & VELLAS, B. 2013. Nutrition and neurodegeneration: epidemiological evidence and challenges for future research. *British Journal of Clinical Pharmacology*, 75, 738-755.

4.2.1.4 Ginkgo biloba (EGb 761)

Ginkgo biloba is a product of the maidenhair tree. Ginkgo biloba is extracted and standardized in the West as EGb 761 and Dr Willmar Schwabe GmbH & Co. KG, Karlsruhe, manufactures it in Germany. In China, ginkgo biloba has been used as a traditional medicine for various disorders of health for a long time. It is widely used in the West for the treatment of a range of conditions including memory, concentration problems, confusion, depression, anxiety, dizziness, tinnitus, and headache.⁶⁹

Findings on the effects of ginkgo biloba on memory are very conflicting. A number of studies, reviews, and publications have concluded that ginkgo biloba has some positive effects on memory. This includes among others a meta-analysis of nine studies by Weinmann et al,⁷⁰ which concluded that there was significant advantage of ginkgo biloba compared to placebo in improving cognition for the whole group of patients with Alzheimer's disease, vascular or mixed dementia. A small clinical trial seems to have found similar results:⁷¹ that when EGb 761 was taken once daily at 240 mg, it was established to be significantly superior to placebo in the treatment of patients with dementia with neuropsychiatric symptoms.⁷² This was further supported by Kaschel's publication.^{73 74} Nevertheless, it is important to note that Dr Willmar Schwabe GmbH & Co. KG, Karlsruhe, the manufacturer of ginkgo biloba in Germany, funded both Weinmann et al and Kaschel studies.⁷⁵

⁶⁹ BIRKS, J. & GRIMLEY EVANS, J. 2009. Ginkgo biloba for cognitive impairment and dementia. *Cochrane Database Syst Rev*, 1.

⁷⁰ WEINMANN, S., ROLL, S., SCHWARZBACH, C., VAUTH, C. & WILlich, S. 2010. Effects of Ginkgo biloba in dementia: systematic review and meta-analysis. *BMC Geriatrics*, 10, 14.

⁷¹ IHL, R., BACHINSKAYA, N., KORCZYN, A. D., VAKHAPOVA, V., TRIBANEK, M., HOERR, R. & NAPRYEYENKO, O. 2011. Efficacy and safety of a once-daily formulation of Ginkgo biloba extract EGb 761 in dementia with neuropsychiatric features: a randomized controlled trial. *International Journal of Geriatric Psychiatry*, 26, 1186-1194.

⁷² Ibid.

⁷³ KASCHEL, R. 2011. Specific memory effects of Ginkgo biloba extract EGb 761 in middle-aged healthy volunteers. *Phytomedicine*, 18, 1202-1207.

⁷⁴ KASCHEL, R. 2009. Ginkgo biloba: specificity of neuropsychological improvement—a selective review in search of differential effects. *Human Psychopharmacology: Clinical and Experimental*, 24, 345-370.

⁷⁵ See disclosures – conflict of interest part on both publications.

However, in contrast to the above, others have found that ginkgo biloba does not have any effects on memory. Birks and Grimley's⁷⁶ review concluded that the evidence that ginkgo biloba has a predictable and clinically significant benefit for people with dementia or cognitive impairment is inconsistent and unreliable. Similarly, one of the longest independent clinical trials led by DeKosky et al,⁷⁷ found that ginkgo biloba administered at 120 mg twice a day was not effective in reducing either the overall incidence rate of dementia or Alzheimer's disease incidence in elderly individuals with normal cognition or those with mild cognitive impairment.⁷⁸ Laws et al,⁷⁹ systematic review and meta-analysis is one of the most recent to have assessed the effects of ginkgo biloba on memory. They have concluded that ginkgo biloba had no ascertainable positive effects on a range of targeted cognitive functions including memory in healthy individuals.⁸⁰ This is also supported by Hirsch et al.⁸¹ It seems most of the earlier publications had found continued positive effects on memory, whereas the most recent seem to suggest that ginkgo biloba's positive impact on memory is almost zero.

There are other nutraceuticals⁸² and herbs such as ginseng^{83 84 85} that have been studied in relation to cognitive enhancement and memory; but due to the scope and limitations of this paper, I have not addressed them here.

⁷⁶ BIRKS, J. & GRIMLEY EVANS, J. 2009. Ginkgo biloba for cognitive impairment and dementia. *Cochrane Database Syst Rev*, 1.

⁷⁷ DEKOSKY ST, W. J. D. F. A. L. & ET AL. 2008. Ginkgo biloba for prevention of dementia: A randomized controlled trial. *JAMA*, 300, 2253-2262.

⁷⁸ SNITZ BE, O. M. E. S. C. M. C. & ET AL. 2009. Ginkgo biloba for preventing cognitive decline in older adults: A randomized trial. *Ibid.* 302, 2663-2670.

⁷⁹ LAWS, K. R., SWEETNAM, H. & KONDEL, T. K. 2012. Is Ginkgo biloba a cognitive enhancer in healthy individuals? A meta-analysis. *Human Psychopharmacology: Clinical and Experimental*, 27, 527-533.

⁸⁰ *Ibid.*

⁸¹ HIRSCH, C. 2013. Ginkgo biloba extract did not reduce risk for Alzheimer disease in elderly patients with memory complaints. *Ann Intern Med*. United States.

⁸² SCHMITT, J. & FERRO, A. 2013. Nutraceuticals: is there good science behind the hype? *British Journal of Clinical Pharmacology*, 75, 585-587.

⁸³ NEALE, C., CAMFIELD, D., REAY, J., STOUGH, C. & SCHOLEY, A. *Ibid.* Cognitive effects of two nutraceuticals Ginseng and Bacopa benchmarked against modafinil: a review and comparison of effect sizes. 728-737.

⁸⁴ KENNEDY, D. O. & SCHOLEY, A. B. 2003. Ginseng: potential for the enhancement of cognitive performance and mood. *Pharmacology Biochemistry and Behavior*, 75, 687-700.

⁸⁵ COLEMAN, C. I., HEBERT, J. H. & REDDY, P. 2003. The effects of Panax ginseng on quality of life. *Journal of Clinical Pharmacy and Therapeutics*, 28, 5-15.

4.2.2 Physical exercise

There is strong evidence suggesting that regular physical exercise has beneficial effects on brain functioning, cognition, and improved long-term memory in young adults.^{86 87 88 89} Aerobic exercise training has been associated with improved attention, processing speed, executive function, and memory.^{90 91} Intense physical exercises are associated with enhanced learning speed in memorising tasks.⁹² Regular physical and cognitively stimulating exercises are also associated with lower risks for age-related cognitive impairments such as Alzheimer's disease and early onset dementia. There is converging observable evidence that physical exercise enhances cognitive function throughout the lifespan.⁹³

4.2.3 Mnemonics

The term *mnemonics* denotes internal cognitive strategies aimed at enhancing memory.⁹⁴ Since ancient times, people have used mnemonics in attempts to enhance memory. One famous and ancient mnemonics strategy is the *method of loci* (MOL), a technique used extensively by Greek and Roman orators.⁹⁵ Through this method, one associates the new information or items that he is learning and wishes to remember later with specific objects or landmarks within a well-known physical

⁸⁶ HILLMAN, C. H., ERICKSON, K. I. & KRAMER, A. F. 2008. Be smart, exercise your heart: exercise effects on brain and cognition. *Nat Rev Neurosci*, 9, 58-65.

⁸⁷ COLES, K. & TOMPOROWSKI, P. D. 2008. Effects of acute exercise on executive processing, short-term and long-term memory. *Journal of Sports Sciences*, 26, 333-344.

⁸⁸ STROTH, S., HILLE, K., SPITZER, M. & REINHARDT, R. 2009. Aerobic endurance exercise benefits memory and affect in young adults. *Neuropsychological Rehabilitation*, 19, 223-243.

⁸⁹ DRESLER, M., SANDBERG, A., OHLA, K., BUBLITZ, C., TRENADO, C., MROCZKO-WĄSOWICZ, A., KÜHN, S. & REPANTIS, D. 2013. Non-pharmacological cognitive enhancement. *Neuropharmacology*, 64, 529-543.

⁹⁰ SMITH, P. J., BLUMENTHAL, J. A., HOFFMAN, B. M., COOPER, H., STRAUMAN, T. A., WELSH-BOHMER, K., BROWNDYKE, J. N. & SHERWOOD, A. 2010. Aerobic Exercise and Neurocognitive Performance: A Meta-Analytic Review of Randomized Controlled Trials. *Psychosomatic Medicine*, 72, 239-252.

⁹¹ STROTH, S., HILLE, K., SPITZER, M. & REINHARDT, R. 2009. Aerobic endurance exercise benefits memory and affect in young adults. *Neuropsychological Rehabilitation*, 19, 223-243.

⁹² WINTER, B., BREITENSTEIN, C., MOOREN, F. C., VOELKER, K., FOBKER, M., LECHTERMANN, A., KRUEGER, K., FROMME, A., KORSUKEWITZ, C. & FLOEL, A. 2007. High impact running improves learning. *Neurobiology of Learning and Memory*, 87, 597-609.

⁹³ DRESLER, M., SANDBERG, A., OHLA, K., BUBLITZ, C., TRENADO, C., MROCZKO-WĄSOWICZ, A., KÜHN, S. & REPANTIS, D. 2013. Non-pharmacological cognitive enhancement. *Neuropharmacology*, 64, 529-543.

⁹⁴ Ibid.

⁹⁵ YATES, F. A. 2011. *The Art Of Memory*, Random House.

space.⁹⁶ In turn, this has to be mentally retraced during memory retrieval.⁹⁷ Scientific studies have shown that mnemonics strongly enhance memory capacity.⁹⁸ Data collected through functional magnetic resonance imaging (fMRI), during recitation and retrieval using the MOL, have revealed that those with superior memory use a spatial learning strategy and engage brain regions that are critical for spatial memory.^{99 100} They have pointed out that ‘the longevity and success of the MOL in particular may point to a natural human proclivity to use spatial context—and its instantiation in the right hippocampus—as one of the most effective means to learn and recall information.’¹⁰¹ Other well-known mnemonics methods include the *phonetic system* – which aid memorization of numbers and the *keyword method* – which enhances the acquisition of foreign vocabulary¹⁰² and scientific technology.¹⁰³ ¹⁰⁴ Mnemonic strategies have been for a long time. They continue to be strong and reliable enhancers, of learning and memory capacity.¹⁰⁵

Researchers have also demonstrated that repeated retrieval and repeated testing are powerful memory enhancers.^{106 107 108} From an educational setting, frequent testing

⁹⁶ RAZ, A., PACKARD, M. G., ALEXANDER, G. M., BUHLE, J. T., ZHU, H., YU, S. & PETERSON, B. S. 2009. A slice of π : An exploratory neuroimaging study of digit encoding and retrieval in a superior memorist. *Neurocase*, 15, 361-372.

⁹⁷ DRESLER, M., SANDBERG, A., OHLA, K., BUBLITZ, C., TRENADO, C., MROCZKO-WĄSOWICZ, A., KÜHN, S. & REPANTIS, D. 2013. Non-pharmacological cognitive enhancement. *Neuropharmacology*, 64, 529-543.

⁹⁸ WORTHEN, J. B. & HUNT, R. R. 2011. *Mnemonology: Mnemonics for the 21st Century*, Psychology Press.

⁹⁹ RAZ, A., PACKARD, M. G., ALEXANDER, G. M., BUHLE, J. T., ZHU, H., YU, S. & PETERSON, B. S. 2009. A slice of π : An exploratory neuroimaging study of digit encoding and retrieval in a superior memorist. *Neurocase*, 15, 361-372.

¹⁰⁰ MAGUIRE, E. A., VALENTINE, E. R., WILDING, J. M. & KAPUR, N. 2003. Routes to remembering: the brains behind superior memory. *Nat Neurosci*, 6, 90-95.

¹⁰¹ Ibid.

¹⁰² RAUGH, M. R. & ATKINSON, R. C. 1975. A Mnemonic Method for Learning a Second-Language Vocabulary. *Journal of Educational Psychology*, 67, 1-16.

¹⁰³ BALCH, W. R. 2005. Elaborations of Introductory Psychology Terms: Effects on Test Performance and Subjective Ratings. *Teaching of Psychology*, 32, 29-34.

¹⁰⁴ DRESLER, M., SANDBERG, A., OHLA, K., BUBLITZ, C., TRENADO, C., MROCZKO-WĄSOWICZ, A., KÜHN, S. & REPANTIS, D. 2013. Non-pharmacological cognitive enhancement. *Neuropharmacology*, 64, 529-543.

¹⁰⁵ Ibid.

¹⁰⁶ BUTLER, A. C. 2010. Repeated testing produces superior transfer of learning relative to repeated studying. *J Exp Psychol Learn Mem Cogn*, 36, 1118-33.

¹⁰⁷ ROEDIGER III, H. L. & BUTLER, A. C. 2011. The critical role of retrieval practice in long-term retention. *Trends in Cognitive Sciences*, 15, 20-27.

¹⁰⁸ MCDANIEL, M. A., ANDERSON, J. L., DERBISH, M. H. & MORRISETTE, N. 2007. Testing the testing effect in the classroom. *European Journal of Cognitive Psychology*, 19, 494-513.

produces substantial benefits to long-term retention, and studies have shown that students who use repeated retrieval practice had improved scores in college.¹⁰⁹

4.2.4 Music

Music has been present in all cultures and throughout history, whether vocal or instrumental, rhythmic or melodic, monodic (with one voice) or polyphonic.¹¹⁰ Most people interact with music in their daily life by listening, singing, dancing, or playing some form of instrument. Many value music especially for its capacity to evoke and regulate emotions, provide enjoyment and comfort, and relieve stress.¹¹¹ ¹¹² ¹¹³ Music has long been connected with general therapy and well-being of individuals.¹¹⁴ For example in two African contexts, on the one hand in South Africa,¹¹⁵ and on the other hand in Tunisia,¹¹⁶ music was combined with drama and dance, and within this cultural context it was integrated with therapy for mentally ill patients. Music was used as a vehicle to reach those who were isolated and withdrawn and it reintegrated them into social relationships.¹¹⁷ ¹¹⁸

After the psychodrama the now fully alerted group becomes involved in a discussion, and people whose suppressed memories have been stimulated by the group processes come forward and describe their personal experiences.¹¹⁹

As per memory, music has specifically been linked with improvement of memory in patients with AD.¹²⁰ ¹²¹ Researchers have found that music significantly enhances

¹⁰⁹ Ibid.

¹¹⁰ EL HAJ, M., POSTAL, V. & ALLAIN, P. 2011. Music Enhances Autobiographical Memory in Mild Alzheimer's Disease. *Educational Gerontology*, 38, 30-41.

¹¹¹ SÄRKÄMÖ, T. & SOTO, D. 2012. Music listening after stroke: beneficial effects and potential neural mechanisms. *Annals of the New York Academy of Sciences*, 1252, 266-281.

¹¹² SAARIKALLIO, S. 2011. Music as emotional self-regulation throughout adulthood. *Psychology of Music*, 39, 307-327.

¹¹³ JUSLIN, P. N. & LAUKKA, P. 2004. Expression, Perception, and Induction of Musical Emotions: A Review and a Questionnaire Study of Everyday Listening. *Journal of New Music Research*, 33, 217-238.

¹¹⁴ ALDRIDGE, D., FACHNER, J., DIJKSTRA, I., ERKKIL, J. & FROMMER, J. 2010. *Music Therapy and Addictions*, Jessica Kingsley Publishers.

¹¹⁵ BENJAMIN, B. 1983a. 'The singing hospital'--integrated group therapy in the Black mentally ill. *S Afr Med J*, 63, 897-9.

¹¹⁶ DEVISCH, R. & VERVAECK, B. 1986. Doors and thresholds: Jeddi's approach to psychiatric disorders. *Social Science & Medicine*, 22, 541-551.

¹¹⁷ Ibid.

¹¹⁸ BENJAMIN, B. 1983a. 'The singing hospital'--integrated group therapy in the Black mentally ill. *S Afr Med J*, 63, 897-9.

¹¹⁹ BENJAMIN, B. 1983b. 'The singing hospital'--integrated group therapy in the Black mentally ill. *South African medical journal= Suid-Afrikaanse tydskrif vir geneeskunde*, 63, 897.

¹²⁰ SIMMONS-STERN, N. R., BUDSON, A. E. & ALLY, B. A. 2010. Music as a memory enhancer in patients with Alzheimer's disease. *Neuropsychologia*, 48, 3164-3167.

autobiographical memories in patients with AD by promoting positive emotional memories.^{122 123} Music is allied with improvement of recognition memory¹²⁴ and attentional processes.¹²⁵ Other researchers have suggested that there is evidence that at least some forms of musical memory exists and may be differentially impaired by the degenerative effects of AD reflecting the pattern of neuropathological changes associated with the condition.¹²⁶ This is in line with a study that observed that a few notable individuals with semantic dementia had demonstrated clear preservation of knowledge of known melodies and famous people;¹²⁷ whereas a case study of a patient with AD illustrated that, her music ability had been spared from the disease.¹²⁸

4.2.5 Rituals and rites

Rituals and rites of passages have long been used to pass on knowledge and memories from one generation to the next. Any effective transmission of rituals from one generation to the next has demanded that at least some members should remember the procedures the rituals entail and at the same time must be motivated to continue carrying out these rituals.^{129 130} That is why ‘elders and ritual experts reproduce rituals because they are deeply convinced that they must preserve the

¹²¹ DEASON, R. G., SIMMONS-STERN, N. R., FRUSTACE, B. S., ALLY, B. A. & BUDSON, A. E. 2012. Music as a memory enhancer: Differences between healthy older adults and patients with Alzheimer's disease. *Psychomusicology: Music, Mind, and Brain*, 22, 175.

¹²² EL HAJ, M., POSTAL, V. & ALLAIN, P. 2011. Music Enhances Autobiographical Memory in Mild Alzheimer's Disease. *Educational Gerontology*, 38, 30-41.

¹²³ IRISH, M., CUNNINGHAM, C. J., WALSH, J. B., COAKLEY, D., LAWLOR, B. A., ROBERTSON, I. H. & COEN, R. F. 2006. Investigating the Enhancing Effect of Music on Autobiographical Memory in Mild Alzheimer's Disease. *Dementia and Geriatric Cognitive Disorders*, 22, 108-120.

¹²⁴ GREENE, C. M., BAHRI, P. & SOTO, D. 2010. Interplay between Affect and Arousal in Recognition Memory. *PLoS ONE*, 5, e11739.

¹²⁵ THOMPSON, R. G., MOULIN, C. J. A., HAYRE, S. & JONES, R. W. 2005. Music Enhances Category Fluency In Healthy Older Adults And Alzheimer's Disease Patients. *Experimental Aging Research*, 31, 91-99.

¹²⁶ BAIRD, A. & SAMSON, S. 2009. Memory for Music in Alzheimer's Disease: Unforgettable? *Neuropsychology review*, 19, 85-101.

¹²⁷ HSIEH, S., HORNBERGER, M., PIGUET, O. & HODGES, J. R. 2011. Neural basis of music knowledge: evidence from the dementias. *Brain*. England.

¹²⁸ CUDDY, L. L. & DUFFIN, J. 2005. Music, memory, and Alzheimer's disease: is music recognition spared in dementia, and how can it be assessed? *Medical Hypotheses*, 64, 229-235.

¹²⁹ WHITEHOUSE, H. 2005. Emotion, Memory and Religious Rituals: An Assessment of Two Theories. In: MILTON, K. & SVASEK, M. (eds.) *Mixed Emotions: Anthropological Studies of Feeling*. Bloomsbury Academic.p.91.

¹³⁰ MCCAULEY, R. N. & LAWSON, E. T. 2002. *Bringing Ritual to Mind: Psychological Foundations of Cultural Forms*, Cambridge University Press.p.i.

knowledge and insight gained by performing the ritual.¹³¹ Rituals are either frequent as witnessed in major world religions or are infrequent as in rites of passages like those of initiation. At the same time, the highly arousing emotional rituals, even when they are infrequent have been associated with enduring episodic or flashbulb memories.^{132 133 134 135}

For example in the Roman Catholic Church, the Eucharistic celebration during mass which could be viewed as a regular ritual, is taken to be a living memory of The Last Supper, whereby through transubstantiation the bread and wine becomes the Body and Blood of Christ that his followers eat in his remembrance.¹³⁶ Another example of another ritual in the Catholic Church, which could be viewed as having some influence on the memory, is the Sacrament of Conversion, Reconciliation, Penance, or Forgiveness.¹³⁷ Through this sacrament, the sinner confesses his sins through the priest, who offers the penitent some indulgences. After fulfilling the indulgences, the repentant ought to have been reconciled with God and his fellow men of whom he have sinned against. After the sacrament of reconciliation, then, the sinner is meant to forget the old sinful past and begin a new life.¹³⁸

¹³¹ RICHERT, R. A., WHITEHOUSE, H. & STEWART, E. 2005. Memory and analogical thinking in high-arousal rituals. *Mind and religion: Psychological and cognitive foundations of religiosity*, 127-145.

¹³² WHITEHOUSE, H. 2005. Emotion, Memory and Religious Rituals: An Assessment of Two Theories. In: MILTON, K. & SVASEK, M. (eds.) *Mixed Emotions: Anthropological Studies of Feeling*. Bloomsbury Academic.p.95.

¹³³ RICHERT, R. A., WHITEHOUSE, H. & STEWART, E. 2005. Memory and analogical thinking in high-arousal rituals. *Mind and religion: Psychological and cognitive foundations of religiosity*, 127-145.

¹³⁴ CZACHESZ, I. 2010. Long-term, explicit memory in rituals. *Journal of Cognition and Culture*, 10, 3-4.

¹³⁵ ROSSANO, M. J. 2009. Ritual behaviour and the origins of modern cognition. *Cambridge Archaeological Journal*, 19, 243-56.

¹³⁶ PAUL, J. 2003. Encyclical Letter Ecclesia de Eucharistia. 2012. Available: http://www.vatican.va/holy_father/special_features/encyclicals/documents/hf_jp-ii_enc_20030417_ecclesia_eucharistia_en.html.#2,54.

¹³⁷ *Catechism of the Catholic Church - PART 2 SECTION 2 CHAPTER 2 ARTICLE 4 THE SACRAMENT OF PENANCE AND RECONCILIATION* [Online]. Available: <http://www.scborromeo.org/ccc/p2s2c2a4.htm#1471> [Accessed 01/08/ 2013].

¹³⁸ Ibid.# 1473.

4.2.6 Sleep

The positive effects of sleep on memory consolidation have been known since Jenkins and Dallenbach¹³⁹ published their first empirical reports on the matter nearly a century ago. Jenkins and Dallenbach demonstrated that memory for nonsense syllables over retention periods including sleep was less prone to forgetting compared to an equivalent time of wakefulness.¹⁴⁰ Since their publication, many other studies have tested different memory systems and have confirmed the beneficial effects of sleep on memory consolidation.^{141 142 143 144} ‘Sleep has been identified as a state that optimizes the consolidation of newly acquired information in memory, depending on the specific conditions of learning and the timing of sleep.’¹⁴⁵¹⁴⁶ Many studies have confirmed the beneficial effect of sleep on declarative and procedural memory in various tasks.^{147 148 149} Even a nap, is sufficient to promote alertness and memory performance.^{150 151 152} Indeed, for some memory systems the gain of a daytime nap is as good as a whole night of sleep.¹⁵³ Overall, there is overarching evidence that sleep promotes different memory systems and practically no evidence for the opposite effect of sleep promoting forgetting.¹⁵⁴ The hypothetical claim in the beginning of this chapter and indeed in the thesis that individuals have

¹³⁹ JENKINS, J. G. & DALLENBACH, K. M. 1924. Obliviscence during Sleep and Waking. *The American Journal of Psychology*, 35, 605-612.

¹⁴⁰ Ibid.

¹⁴¹ BORN, J., RASCH, B. & GAIS, S. 2006. Sleep to remember. *Neuroscientist*, 12, 410-424.

¹⁴² DIEKELMANN, S. & BORN, J. 2010. The memory function of sleep. *Nat Rev Neurosci*, 11, 114-126.

¹⁴³ STICKGOLD, R. 2005. Sleep-dependent memory consolidation. *Nature*, 437, 1272-1278.

¹⁴⁴ WALKER, M. P. & STICKGOLD, R. 2004. Sleep-Dependent Learning and Memory Consolidation. *Neuron*, 44, 121-133.

¹⁴⁵ Ibid.

¹⁴⁶ BORN, J., RASCH, B. & GAIS, S. 2006. Sleep to remember. *Neuroscientist*, 12, 410-424.

¹⁴⁷ DIEKELMANN, S. & BORN, J. 2010. The memory function of sleep. *Nat Rev Neurosci*, 11, 114-126.

¹⁴⁸ MARSHALL, L. & BORN, J. 2007. The contribution of sleep to hippocampus-dependent memory consolidation. *Trends in Cognitive Sciences*, 11, 442-450.

¹⁴⁹ WALKER, M. P. & STICKGOLD, R. 2004. Sleep-Dependent Learning and Memory Consolidation. *Neuron*, 44, 121-133.

¹⁵⁰ DHAND, R. & SOHAL, H. 2006. Good sleep, bad sleep! The role of daytime naps in healthy adults. *Curr Opin Pulm Med*. United States.

¹⁵¹ LAHL, O., WISPEL, C., WILLIGENS, B. & PIETROWSKY, R. 2008. An ultra short episode of sleep is sufficient to promote declarative memory performance. *Journal of Sleep Research*, 17, 3-10.

¹⁵² DRESLER, M., SANDBERG, A., OHLA, K., BUBLITZ, C., TRENADO, C., MROCZKO-WĄSOWICZ, A., KÜHN, S. & REPANTIS, D. 2013. Non-pharmacological cognitive enhancement. *Neuropharmacology*, 64, 529-543.

¹⁵³ MEDNICK, S., NAKAYAMA, K. & STICKGOLD, R. 2003. Sleep-dependent learning: a nap is as good as a night. *Nat Neurosci*, 6, 697-698.

¹⁵⁴ DIEKELMANN, S. & BORN, J. 2010. The memory function of sleep. *Nat Rev Neurosci*, 11, 114-126.

been endeavouring to improve their memories throughout the ages, cannot be proven more than by the evidence of ME through sleep. For sleep is perhaps as old as the human person and as the claims go that we spend a third of our life sleeping,¹⁵⁵ this would tell the story of just how crucial sleep is.

4.2.7 Yoga and meditation

Meditation is a form of discipline that incorporates various emotional and attentional regular trainings developed for various ends, including the cultivation of mental well-being, emotional balance, and benefits to several cognitive capacities including that of memory.^{156 157} According to Lutz et al,¹⁵⁸ two styles of meditation are commonly studied. On the one hand, ‘focused attention meditation’ that entails the voluntary focusing of attention on a chosen object and on the other hand, ‘open monitoring meditation’, that involves an ongoing nonreactive monitoring of the content of experience. The practice of these styles of meditation could have a long-term impact on the brain and behaviour.¹⁵⁹

For instance, some researchers have observed that even brief sessions of mindfulness meditation lasting for four days significantly improved visuo-spatial processing, working memory, and executive functioning.¹⁶⁰ Here, mindfulness meditation describes special meditation techniques originating from Buddhist traditions such as Vipassana and Zen/Chan.¹⁶¹ Mindfulness meditation aims at developing the mental quality of mindfulness. Mindfulness refers to the ability to self-regulate attention encompassed with an awareness of one’s immediate experiences, while at the same time adopting an attitude of curiosity, openness, and acceptance.¹⁶² Similarly, other

¹⁵⁵ DRESLER, M., SANDBERG, A., OHLA, K., BUBLITZ, C., TRENADO, C., MROCZKO-WĄSOWICZ, A., KÜHN, S. & REPANTIS, D. 2013. Non-pharmacological cognitive enhancement. *Neuropharmacology*, 64, 529-543.

¹⁵⁶ Ibid.

¹⁵⁷ LUTZ, A., SLAGTER, H. A., DUNNE, J. D. & DAVIDSON, R. J. 2008. Attention regulation and monitoring in meditation. *Trends Cogn Sci*. England.

¹⁵⁸ Ibid.

¹⁵⁹ Ibid.

¹⁶⁰ ZEIDAN, F., JOHNSON, S. K., DIAMOND, B. J., DAVID, Z. & GOOLKASIAN, P. 2010. Mindfulness meditation improves cognition: evidence of brief mental training. *Conscious Cogn*. United States: 2010 Elsevier Inc.

¹⁶¹ EBERTH, J. & SEDLMEIER, P. 2012. The effects of mindfulness meditation: a meta-analysis. *Mindfulness*, 3, 174-189.

¹⁶² Ibid.

researchers have found that mindfulness meditation training enhances working memory capacity and some executive functions.¹⁶³

Like meditation above, yoga exercise has as well been associated with improved cognitive performance. Researchers have found that after yoga exercise/practice, subjects had significantly superior performance that included shorter reaction times and increased accuracy.¹⁶⁴ Similarly, others have concluded that yoga therapy/training can improve cognitive functions such as visual and verbal memory; attention and concentration; delayed and immediate recall; verbal retention and recognition tests, and even mental balance.^{165 166 167}

4.3 Technological means for memory enhancement

4.3.1 Computers, internet and virtual social networking

Recently there has been a lot of interest in non-pharmacological interventions to ameliorate memory difficulties in healthy older adults, as well as those with brain damage and neurodegenerative disorders.^{168 169 170 171} Computerized training programs have been in the forefront of this endeavour. In healthy elderly populations, cognitive training has centred on the enhancement of memory and speed of processing, with the goal of maximizing current function and reducing the risk of cognitive decline.^{172 173} Researchers suggest that computerized training programs can

¹⁶³ CHIESA, A., CALATI, R. & SERRETTI, A. 2011. Does mindfulness training improve cognitive abilities? A systematic review of neuropsychological findings. *Clinical psychology review*, 31, 449-464.

¹⁶⁴ GOTHE, N., PONTIFEX, M. B., HILLMAN, C. & MCAULEY, E. 2012. The Acute Effects of Yoga on Executive Function. *J Phys Act Health*.

¹⁶⁵ CHATTHA, R., NAGARATHNA, R., PADMALATHA, V. & NAGENDRA, H. R. 2008. Effect of yoga on cognitive functions in climacteric syndrome: a randomised control study. *BJOG*. England.

¹⁶⁶ RANGAN, R., NAGENDRA, H. & BHAT, G. R. 2009. Effect of yogic education system and modern education system on memory. *Int J Yoga*, 2, 55-61.

¹⁶⁷ SUBRAMANYA, P. & TELLES, S. 2009. Effect of two yoga-based relaxation techniques on memory scores and state anxiety. *Biopsychosoc Med*. England.

¹⁶⁸ COTELLI, M., MANENTI, R., ZANETTI, O. & MINIUSSI, C. 2012. Non-pharmacological intervention for memory decline. *Frontiers in human neuroscience*, 6.

¹⁶⁹ WILLIS, S. L., TENNSTEDT, S. L., MARSISKE, M., BALL, K., ELIAS, J., KOEPKE, K. M., MORRIS, J. N., REBOK, G. W., UNVERZAGT, F. W. & STODDARD, A. M. 2006. Long-term effects of cognitive training on everyday functional outcomes in older adults. *JAMA: the journal of the American Medical Association*, 296, 2805-2814.

¹⁷⁰ ACEVEDO, A. & LOEWENSTEIN, D. A. 2007. Nonpharmacological Cognitive Interventions in Aging and Dementia. *Journal of Geriatric Psychiatry and Neurology*, 20, 239-249.

¹⁷¹ DOUGLAS, S., JAMES, I. & BALLARD, C. 2004. Non-pharmacological interventions in dementia. *Advances in Psychiatric Treatment*, 10, 171-177.

¹⁷² ACEVEDO, A. & LOEWENSTEIN, D. A. 2007. Nonpharmacological Cognitive Interventions in Aging and Dementia. *Journal of Geriatric Psychiatry and Neurology*, 20, 239-249.

be used in older people to achieve long-term improvements in some important aspects of fluid intelligence^{174 175} and they could be employed more extensively to prevent and treat cognitive deficits in older people.¹⁷⁶ Computerized cognitive training programs have shown moderate improvements of memory,^{177 178} memory/attention,^{179 180} executive function, and processing speed.¹⁸¹ Other researchers have also identified that computerized cognitive training programs lead to improved working memory¹⁸² and episodic memory in young and older health adults, which is also transferable to fluid intelligence.^{183 184 185 186} However, some authors have recently disputed the evidence of transfer of working memory to fluid

¹⁷³ DOUGLAS, S., JAMES, I. & BALLARD, C. 2004. Non-pharmacological interventions in dementia. *Advances in Psychiatric Treatment*, 10, 171-177.

¹⁷⁴ JAEGGI, S. M., BUSCHKUEHL, M., JONIDES, J. & PERRIG, W. J. 2008. Improving fluid intelligence with training on working memory. *Proceedings of the National Academy of Sciences*, 105, 6829-6833.

¹⁷⁵ STERNBERG, R. J. Ibid. Increasing fluid intelligence is possible after all. 6791-6792.

¹⁷⁶ GÜNTHER, V. K., SCHÄFER, P., HOLZNER, B. J. & KEMMLER, G. W. 2003. Long-term improvements in cognitive performance through computer-assisted cognitive training: A pilot study in a residential home for older people. *Aging & Mental Health*, 7, 200-206.

¹⁷⁷ WILLIS, S. L., TENNSTEDT, S. L., MARSISKE, M., BALL, K., ELIAS, J., KOEPKE, K. M., MORRIS, J. N., REBOK, G. W., UNVERZAGT, F. W. & STODDARD, A. M. 2006. Long-term effects of cognitive training on everyday functional outcomes in older adults. *JAMA: the journal of the American Medical Association*, 296, 2805-2814.

¹⁷⁸ MAHNCKE, H. W., CONNOR, B. B., APPELMAN, J., AHSANUDDIN, O. N., HARDY, J. L., WOOD, R. A., JOYCE, N. M., BONISKE, T., ATKINS, S. M. & MERZENICH, M. M. 2006. Memory enhancement in healthy older adults using a brain plasticity-based training program: A randomized, controlled study. *Proceedings of the National Academy of Sciences*, 103, 12523-12528.

¹⁷⁹ SMITH, G. E., HOUSEN, P., YAFFE, K., RUFF, R., KENNISON, R. F., MAHNCKE, H. W. & ZELINSKI, E. M. 2009. A Cognitive Training Program Based on Principles of Brain Plasticity: Results from the Improvement in Memory with Plasticity-based Adaptive Cognitive Training (IMPACT) Study. *Journal of the American Geriatrics Society*, 57, 594-603.

¹⁸⁰ ZELINSKI, E. M., SPINA, L. M., YAFFE, K., RUFF, R., KENNISON, R. F., MAHNCKE, H. W. & SMITH, G. E. 2011. Improvement in Memory with Plasticity-Based Adaptive Cognitive Training: Results of the 3-Month Follow-Up. Ibid. 59, 258-265.

¹⁸¹ NOUCHI, R., TAKI, Y., TAKEUCHI, H., HASHIZUME, H., AKITSUKI, Y., SHIGEMUNE, Y., SEKIGUCHI, A., KOTOZAKI, Y., TSUKIURA, T., YOMOGIDA, Y. & KAWASHIMA, R. 2012. Brain Training Game Improves Executive Functions and Processing Speed in the Elderly: A Randomized Controlled Trial. *PLoS ONE*, 7, e29676.

¹⁸² ALLOWAY, T. P., BIBILE, V. & LAU, G. 2013a. Computerized working memory training: Can it lead to gains in cognitive skills in students? *Computers in Human Behavior*, 29, 632-638.

¹⁸³ JAEGGI, S. M., BUSCHKUEHL, M., JONIDES, J. & PERRIG, W. J. 2008. Improving fluid intelligence with training on working memory. *Proceedings of the National Academy of Sciences*, 105, 6829-6833.

¹⁸⁴ STERNBERG, R. J. Ibid. Increasing fluid intelligence is possible after all. 6791-6792.

¹⁸⁵ THORELL, L. B., LINDQVIST, S., BERGMAN NUTLEY, S., BOHLIN, G. & KLINGBERG, T. 2009. Training and transfer effects of executive functions in preschool children. *Developmental Science*, 12, 106-113.

¹⁸⁶ KLINGBERG, T. 2010. Training and plasticity of working memory. *Trends in Cognitive Sciences*, 14, 317-324.

intelligence.^{187 188 189} They contend that there is no convincing evidence to support the claim that these programmes improve working memory, but rather that they only improve on the specific task practiced.

Besides, computerized cognitive training programs, other related non-pharmacological ME are the internet and virtual social networking sites. Studies have demonstrated that social interactions facilitate cognitive performance not only in those with cognitive impairments but also in younger and healthier population.¹⁹⁰

191

For example, a simple exchange of views between two people requires that they pay attention to each other, maintain in memory the topic of the conversation and respective contributions, adapt to each other's perspective, infer each other's beliefs and desires, assess the situational constraints acting on them at the time, and inhibit irrelevant or inappropriate behaviour. Some of these processes are automatic, but others depend on limited-capacity cognitive resources often subsumed by the term executive functions, which include capacities such as attention, working memory and cognitive control.¹⁹²

While face-to-face social interactions have been dwindling of the past years,¹⁹³ virtual social interactions have been on the rise with some social networking sites

¹⁸⁷ SHIPSTEAD, Z., HICKS, K. L. & ENGLE, R. W. 2012a. Cogmed working memory training: Does the evidence support the claims? *Journal of Applied Research in Memory and Cognition*, 1, 185-193.

¹⁸⁸ SHIPSTEAD, Z., REDICK, T. S. & ENGLE, R. W. 2010. Does working memory training generalize? *Psychologica Belgica*, 50, 245-276.

¹⁸⁹ SHIPSTEAD, Z., REDICK, T. S. & ENGLE, R. W. 2012b. Is working memory training effective? *Psychological bulletin*, 138, 628-654.

¹⁹⁰ YBARRA, O., BURNSTEIN, E., WINKIELMAN, P., KELLER, M. C., MANIS, M., CHAN, E. & RODRIGUEZ, J. 2008. Mental Exercising Through Simple Socializing: Social Interaction Promotes General Cognitive Functioning. *Personality and Social Psychology Bulletin*, 34, 248-259.

¹⁹¹ YBARRA, O., WINKIELMAN, P., YEH, I., BURNSTEIN, E. & KAVANAGH, L. 2011. Friends (and Sometimes Enemies) With Cognitive Benefits: What Types of Social Interactions Boost Executive Functioning? *Social Psychological and Personality Science*, 2, 253-261.

¹⁹² YBARRA, O., BURNSTEIN, E., WINKIELMAN, P., KELLER, M. C., MANIS, M., CHAN, E. & RODRIGUEZ, J. 2008. Mental Exercising Through Simple Socializing: Social Interaction Promotes General Cognitive Functioning. *Personality and Social Psychology Bulletin*, 34, 248-259.

¹⁹³ PUTNAM, R. D. 2001. *Bowling Alone*, Simon & Schuster.

such as Facebook having more than 1 billion registered users¹⁹⁴ and at least 12 other networks with more than 100 million registered users.¹⁹⁵

Exploration of cognitive performance through virtual social network is quite novel, and still currently underexplored. However, a few studies suggest that the use of social virtual networking sites such as Facebook, Twitter, Skype, and Google to mention a few, whereby individuals and groups regularly communicate are also means of enhancing cognitive performance including that of memory.^{196 197}

The findings indicated that young people who had used Facebook (but not YouTube) for more than a year had higher scores in tests of verbal ability, working memory, and spelling, compared to their peers who had used it for a shorter time period.¹⁹⁸

The data suggest that some activities in Facebook and YouTube predicted higher scores in working memory performance. In particular, checking a friend's status updates in Facebook was the best predictor of both verbal and visuo-spatial working memory. Telling a friend to watch a video in YouTube was the best predictors of verbal working memory scores; while watching videos online best predicted visuo-spatial working memory.¹⁹⁹

However, previous studies that explored the impact of using social networking such as Facebook on academic performance for college students, had found a negative correlation.^{200 201} Kirschner et al, had found that Facebook registered users reported

¹⁹⁴ FACEBOOK-NEWSROOM. 2013. *Facebook's latest news, announcements and media resources* [Online]. Available: <http://newsroom.fb.com/Key-Facts> [Accessed 01/06/ 2013].

¹⁹⁵ ANONYMOUS. 2013. *List of virtual communities with more than 100 million active users - Wikipedia, the free encyclopedia* [Online]. Available: http://en.wikipedia.org/wiki/List_of_virtual_communities_with_more_than_100_million_users [Accessed 07/07/ 2013].

¹⁹⁶ ALLOWAY, T. P. & ALLOWAY, R. G. 2012. The impact of engagement with social networking sites (SNSs) on cognitive skills. *Computers in Human Behavior*, 28, 1748-1754.

¹⁹⁷ ALLOWAY, T. P., HORTON, J., ALLOWAY, R. G. & DAWSON, C. 2013b. Social networking sites and cognitive abilities: Do they make you smarter? *Computers & Education*, 63, 10-16.

¹⁹⁸ Ibid.

¹⁹⁹ ALLOWAY, T. P. & ALLOWAY, R. G. 2012. The impact of engagement with social networking sites (SNSs) on cognitive skills. *Computers in Human Behavior*, 28, 1748-1754.

²⁰⁰ KIRSCHNER, P. A. & KARPINSKI, A. C. 2010. Facebook® and academic performance. *Ibid.*26, 1237-1245.

²⁰¹ JUNCO, R. 2012. Too much face and not enough books: The relationship between multiple indices of Facebook use and academic performance. *Ibid.*28, 187-198.

having lower Grade Point Average (GPA) and spent fewer hours per week studying than non-users. Whereas, Junco reported that time spent on and checking Facebook had a negative rapport to overall GPA, while time spent on Facebook was slightly negatively related to time spent studying.²⁰² Therefore, currently the findings are still quite scant and further studies are required to establish whom, when and to what extent social networking sites would enhance cognition including memory.

However, it is worth noting that it is quite common for social networking sites for example Facebook to remind you about your friend's birthday, if he has entered the right birth date on his account, or to remind you about meetings, etc. As highlighted above, with some social networking sites users estimated in over a billion,^{203 204} the impact of these social networking sites on cognitive augmentation, including that of memory, is perhaps gigantic; and it is perhaps unlikely to be ignored by future scholarship. Moreover, unlike other forms of enhancements for example pharmaceutical and technological, (which are still at experimental stages at least from a clinical perspective, and which take a long time before they are accepted) computers, internet and virtual networking are already used by masses to enhance their cognition including that of memory as already highlighted. This makes the old methods of remembering facts and memorizing information redundant at least for those whom such technologies are available and they choose to make use of them for such purposes. With Google on your side, you will have all the facts and information at your fingertips.²⁰⁵ All these are in line with Bostrom and Sandberg's conclusions that to date it is progress in computing and information technology that has produced the most dramatic advances in the ability to process information.^{206 207} Closer to

²⁰² Ibid.

²⁰³ FACEBOOK-NEWSROOM. 2013. *Facebook's latest news, announcements and media resources* [Online]. Available: <http://newsroom.fb.com/Key-Facts> [Accessed 01/06/ 2013].

²⁰⁴ ANONYMOUS. 2013. *List of virtual communities with more than 100 million active users - Wikipedia, the free encyclopedia* [Online]. Available: http://en.wikipedia.org/wiki/List_of_virtual_communities_with_more_than_100_million_users [Accessed 07/07/ 2013].

²⁰⁵ ALLOWAY, T. P. & ALLOWAY, R. G. 2012. The impact of engagement with social networking sites (SNSs) on cognitive skills. *Computers in Human Behavior*, 28, 1748-1754.

²⁰⁶ BOSTROM, N. & SANDBERG, A. 2009. Cognitive enhancement: Methods, ethics, regulatory challenges. *Science and Engineering Ethics*, 15, 311-341.

²⁰⁷ BOSTROM, N. 2008a. Cognitive Enhancement in the Public Interest. In: ZONNEVELD, L., DIJSTELBLOEM, H. & RINGOIR, D. (eds.) *Reshaping the human condition: exploring human enhancement*. The Hague: Rathenau Institute, in collaboration with the British Embassy, Science and Innovation Network and the Parliamentary Office of Science & Technology.

computers and social networking enhancers are other external recording devices that I now address.

4.3.2 Recording audio, photographic, lifelogging, and video devices

A variety of external recording devices ranging from earlier audio recorders, video recorders, CCTVs, taking of photographs and recently lifelogging²⁰⁸ devices such as SenseCam,^{209 210} have been used in an attempt to maintain records and memories of various events both from an individual and collective perspective. Other widely used non-electronic aids that would serve a similar end in maintaining memories of events include pictures, calendars, diaries, paintings, illustrations, written notes, art and craft, etc. Similarly, other external electronic devices such as phones, alarm clocks, watches, fire alarms, timers, etc, affect functioning of our prospective memory.²¹¹ Prospective memory here refers to the functions that enable a person to carry out an intended action in the future.²¹² The impact of recording devices as forms of memory enhancers can be supported not only by individuals' use to record important events in their lives but also by their world wide application for example in criminal justice system, (whereby they are actively used in courts as form of evidence) in surveillance and in forensic science.^{213 214 215 216} Other usages for example in educational and learning settings, media, advertising, politics, etc, just demonstrate how these devices are ubiquitous. Given this, it is vital to establish how they influence cognition including memory systems and processes.

²⁰⁸ ALLEN, A. L. 2008. Dredging up the past: Lifelogging, Memory, and Surveillance. *The University of Chicago Law Review*, 75, 47-74.

²⁰⁹ HODGES, S., BERRY, E. & WOOD, K. 2011. SenseCam: a wearable camera that stimulates and rehabilitates autobiographical memory. *Memory*, 19, 685-96.

²¹⁰ HODGES, S., WILLIAMS, L., BERRY, E., IZADI, S., SRINIVASAN, J., BUTLER, A., SMYTH, G., KAPUR, N. & WOOD, K. 2006. SenseCam: A retrospective memory aid. *UbiComp 2006: Ubiquitous Computing*. Springer.

²¹¹ KAPUR, N., GLISKY, E. L. & WILSON, B. A. 2004. Technological memory aids for people with memory deficits. *Neuropsychological Rehabilitation*, 14, 41-60.

²¹² BURGESS, P. W., QUAYLE, A. & FRITH, C. D. 2001. Brain regions involved in prospective memory as determined by positron emission tomography. *Neuropsychologia*, 39, 545-555.

²¹³ WOOLNOUGH, P. S. & MACLEOD, M. D. 2001. Watching the birdie watching you: eyewitness memory for actions using CCTV recordings of actual crimes. *Applied Cognitive Psychology*, 15, 395-411.

²¹⁴ PORTER, G. 2009. CCTV images as evidence. *Australian Journal of Forensic Sciences*, 41, 11-25.

²¹⁵ PORTER, G. & KENNEDY, M. 2012. Photographic truth and evidence. *Ibid.* 44, 183-192.

²¹⁶ MNOOKIN, J. & WEST, N. 2001. Theaters of proof: Visual evidence and the law in Call Northside 777. *Yale Journal of Law & the Humanities*, Summer.

Studies have demonstrated that use of pictures influences memory cues from either a positive or a negative perspective, depending on the application.²¹⁷ From a positive perspective, a picture's ability to increase both comprehension and recall of a narrative is widely demonstrated. For example, Bransford and Johnson²¹⁸ observed subjects who heard a passage of a text in the absence of a context and others who heard same text, but accompanied by a picture related to the passage. They found that the former group, who just listened to the text, had low comprehension ratings and recall, whereas the latter group, who listened to text, accompanied by seeing the picture had high comprehension ratings and remembered more information. Bransford and Johnson concluded that the picture helped to create a context that enable subjects to understand the passage and provided more effective retrieval cues that increased the amount of information recalled.²¹⁹ Other researchers have recorded similar findings whereby pictures/illustrations accompanying auditory text in a narrative enhanced the memory especially during the retrieval/recall process and expanded the working memory.^{220 221 222} On a negative perspective, improper application of photographs and pictures for examples in news can distort the memory consolidation process and even lead to false memories.²²³

Like photographs/pictures above, video recordings and CCTVs' usage affects the memory both positively and negatively. On a positive side, the usage of video and CCTVs have supported witnesses' memory when it comes to identification in courts, and in other cases they have led to arrests, and even convictions of criminals.^{224 225} On a negative side, researchers have demonstrated that videos can be doctored and

²¹⁷ GARRY, M., STRANGE, D., BERNSTEIN, D. M. & KINZETT, T. 2007. Photographs can distort memory for the news. *Applied Cognitive Psychology*, 21, 995-1004.

²¹⁸ BRANSFORD, J. D. & JOHNSON, M. K. 1972. Contextual prerequisites for understanding: Some investigations of comprehension and recall. *Journal of verbal learning and verbal behavior*, 11, 717-726.

²¹⁹ Ibid.

²²⁰ WADDILL, P. J. & MCDANIEL, M. A. 1992. Pictorial enhancement of text memory: limitations imposed by picture type and comprehension skill. *Mem Cognit*, 20, 472-82.

²²¹ MAYER, R. E. & GALLINI, J. K. 1990. When Is an Illustration Worth Ten Thousand Words? *Journal of Educational Psychology*, 82.

²²² TINDALL-FORD, S., CHANDLER, P. & SWELLER, J. 1997. When two sensory modes are better than one. *Journal of Experimental Psychology: Applied*, 3, 257.

²²³ GARRY, M., STRANGE, D., BERNSTEIN, D. M. & KINZETT, T. 2007. Photographs can distort memory for the news. *Applied Cognitive Psychology*, 21, 995-1004.

²²⁴ WOOLNOUGH, P. S. & MACLEOD, M. D. 2001. Watching the birdie watching you: eyewitness memory for actions using CCTV recordings of actual crimes. *Ibid.* 15, 395-411.

²²⁵ PORTER, G. 2009. CCTV images as evidence. *Australian Journal of Forensic Sciences*, 41, 11-25.

lead to false autobiographical beliefs and memories. Nash et al,²²⁶ assessed the contributions of imagination and false evidence toward false belief and memory construction. In their study, subjects were exposed to false evidence that indicated the occurrence of some fictional events. They found that false evidence or imagination alone was often sufficient to cause belief and memory distortions.²²⁷

Lifelogging devices such as SenseCam have recently attracted academic debate on memory. A SenseCam is a wearable still camera that automatically (without any user's conscious effort/intervention), keeps a digital record of the events that a person experiences.^{228 229} 'The rationale behind SenseCam is that having captured a digital record of an event, it can subsequently be reviewed by the wearer in order to stimulate their memory.'²³⁰ While the impact of logging devices on cognition and memory are only on the early stages, initial tests on SenseCam from a clinical perspective have found positive benefits on a patient suffering from Amnesia.²³¹ The amnesic patient who used the SenseCam, showed a significantly improved recall of autobiographical memories which was maintained in the long-term – nearly a year after the occurrence of some of the events and without any review of those events for up to three months.^{232 233} Other studies on SenseCam have found similar benefits on autobiographic memory with secondary benefits for quality of life.^{234 235}

²²⁶ NASH, R. A., WADE, K. A. & LINDSAY, D. S. 2009. Digitally manipulating memory: Effects of doctored videos and imagination in distorting beliefs and memories. *Memory & cognition*, 37, 414-424.

²²⁷ Ibid.

²²⁸ HODGES, S., BERRY, E. & WOOD, K. 2011. SenseCam: a wearable camera that stimulates and rehabilitates autobiographical memory. *Memory*, 19, 685-96.

²²⁹ HODGES, S., WILLIAMS, L., BERRY, E., IZADI, S., SRINIVASAN, J., BUTLER, A., SMYTH, G., KAPUR, N. & WOOD, K. 2006. SenseCam: A retrospective memory aid. *UbiComp 2006: Ubiquitous Computing*. Springer.

²³⁰ Ibid.

²³¹ Ibid.

²³² Ibid.

²³³ BERRY, E., KAPUR, N., WILLIAMS, L., HODGES, S., WATSON, P., SMYTH, G., SRINIVASAN, J., SMITH, R., WILSON, B. & WOOD, K. 2007. The use of a wearable camera, SenseCam, as a pictorial diary to improve autobiographical memory in a patient with limbic encephalitis: a preliminary report. *Neuropsychol Rehabil*. England.

²³⁴ BROWNE, G., BERRY, E., KAPUR, N., HODGES, S., SMYTH, G., WATSON, P. & WOOD, K. 2011. SenseCam improves memory for recent events and quality of life in a patient with memory retrieval difficulties. *Memory*, 19, 713-22.

²³⁵ BRINDLEY, R., BATEMAN, A. & GRACEY, F. Ibid. Exploration of use of SenseCam to support autobiographical memory retrieval within a cognitive-behavioural therapeutic intervention following acquired brain injury. England.

4.3.3 Brain Stimulation

Various methods of brain stimulation that affect cognition and memory have been identified in literature. In what follows, I will assess briefly some forms of stimulation that are widely used and their effects on memory either positively or negatively. These are electroconvulsive therapy, brain-machine interfaces or brain-computer interfaces, deep brain stimulation, and transcranial magnetic stimulation.

4.3.3.1 Electroconvulsive therapy

Electroconvulsive therapy (ECT) is an old method of brain stimulation that was introduced in psychiatry treatments in the 1930s.²³⁶ ‘ECT involves the application of a brief electrical pulse directly to the scalp in order to induce brain seizures.’²³⁷ ECT has been used in the treatment of various psychiatric disorders such as mania, schizophrenia, catatonic states, and severe depression.²³⁸ However, ECT has been associated with severe cognitive impairments such as disorientation, anterograde amnesia (inability to form new memories) and retrograde amnesia (loss of past memories), and from a clinical perspective, it is only used as a ‘last resort.’²³⁹ ²⁴⁰ Moreover, ECT has a very high percentage of relapse – 47% in some cases.²⁴¹ Given the severe amnesiac effects on the memory, it is unlikely that healthy individuals would consent to the use of ECT in any voluntary attempts to enhance their memories and I will therefore not explore it here anymore.

4.3.3.2 Brain-machine interface or brain-computer interface

A brain-computer interface (BCI) is also sometimes referred to as a brain-machine interface (BMI). BCI is a communication and/or a control system that allows immediate interaction between the human brain and some external devices.²⁴²

²³⁶ HOY, K. E. & FITZGERALD, P. B. 2010. Brain stimulation in psychiatry and its effects on cognition. *Nat Rev Neurol*, 6, 267-275.

²³⁷ CARPENTER, L. L. 2006. Neurostimulation in resistant depression. *Journal of Psychopharmacology*, 20, 35-40.

²³⁸ Ibid.

²³⁹ FINK, M. 2001. Convulsive therapy: a review of the first 55 years. *Journal of Affective Disorders*, 63, 1-15.

²⁴⁰ LISANBY, S. H., MADDOX, J. H., PRUDIC, J., DEVANAND, D. P. & SACKEIM, H. A. 2000. The effects of electroconvulsive therapy on memory of autobiographical and public. *Arch Gen Psychiatry*, 57, 581-90.

²⁴¹ FINK, M. 2001. Convulsive therapy: a review of the first 55 years. *Journal of Affective Disorders*, 63, 1-15.

²⁴² MAK, J. N. & WOLPAW, J. R. 2009. Clinical Applications of Brain-Computer Interfaces: Current State and Future Prospects. *Biomedical Engineering, IEEE Reviews in*, 2, 187-199.

Through BCI, messages and control commands are delivered not by muscular contractions but rather by brain signals themselves.²⁴³ Currently, this technology is used in the treatment of deafness, Parkinson's disease, and depression.²⁴⁴ Among the most well established BMIs are the cochlear prostheses that are used to restore hearing in patients suffering from deafness. BMIs are considered promising future tools for the management of patients with neurological conditions, particularly those who are severely disabled.²⁴⁵

4.3.3.3 Transcranial magnetic stimulation and transcranial direct current stimulation

Transcranial magnetic stimulation (TMS) is a non-invasive procedure that produces a magnetic field to modulate the excitability of the brain cortex.²⁴⁶ TMS is used for the treatment of psychiatric diseases such as obsessive-compulsive disorder (OCD), chronic depression and recently minimally conscious state.²⁴⁷ TMS can selectively enhance the working verbal memory,²⁴⁸ and repetitive TMS has been associated with enhanced cognitive performance.²⁴⁹

Transcranial direct current stimulation (tDCS) is a technique that delivers low/weak direct electric currents to the scalp to modulate the resting membrane potentials of underlying neurons by either hyperpolarisation or partial depolarisation.²⁵⁰ ²⁵¹ Various studies have shown that tDCS of different cortical areas results in

²⁴³ Ibid.

²⁴⁴ BERGER, F., GEVERS, S., SIEP, L. & WELTRING, K. M. 2008. Ethical, legal and social aspects of brain-implants using nano-scale materials and techniques. *NanoEthics*, 2, 241-249.

²⁴⁵ AWAN, N. R., LOZANO, A. & HAMANI, C. 2009. Deep brain stimulation: current and future perspectives. *Neurosurgical Focus*, 27, E2.

²⁴⁶ SIRONI, V. A. 2011. Origin and evolution of deep brain stimulation. *Front Integr Neurosci*, 5, 42.

²⁴⁷ PICCIONE, F., CAVINATO, M., MANGANOTTI, P., FORMAGGIO, E., STORTI, S. F., BATTISTIN, L., CAGNIN, A., TONIN, P. & DAM, M. 2011. Behavioral and Neurophysiological Effects of Repetitive Transcranial Magnetic Stimulation on the Minimally Conscious State: A Case Study. *Neurorehabilitation and Neural Repair*, 25, 98-102.

²⁴⁸ DÜZEL, E., HUFNAGEL, A., HELMSTAEDTER, C. & ELGER, C. 1996. Verbal working memory components can be selectively influenced by transcranial magnetic stimulation in patients with left temporal lobe epilepsy. *Neuropsychologia*, 34, 775-783.

²⁴⁹ KLIMESCH, W., SAUSENG, P. & GERLOFF, C. 2003. Enhancing cognitive performance with repetitive transcranial magnetic stimulation at human individual alpha frequency. *Eur J Neurosci*. France.

²⁵⁰ IUCULANO, T. & COHEN KADOSH, R. 2013. The Mental Cost of Cognitive Enhancement. *The Journal of Neuroscience*, 33, 4482-4486.

²⁵¹ NITSCHKE, M. A., COHEN, L. G., WASSERMANN, E. M., PRIORI, A., LANG, N., ANTAL, A., PAULUS, W., HUMMEL, F., BOGGIO, P. S., FREGNI, F. & PASCUAL-LEONE, A. 2008. Transcranial direct current stimulation: State of the art 2008. *Brain Stimulation*, 1, 206-223.

modifications of perceptual, cognitive, and behavioural functions.^{252 253} Others have demonstrated that anodal tDCS of prefrontal cortex enhances working memory performance in patients with stroke²⁵⁴ and in healthy adults.²⁵⁵ It has also been demonstrated that tDCS in healthy volunteers improves declarative memory consolidation,²⁵⁶ verbal fluency,²⁵⁷ and visual memory.²⁵⁸

4.3.3.4 Deep brain stimulation

‘Deep brain stimulation (DBS) involves the direct implantation of electrodes into localized brain regions, with the aim of altering both local and connected brain activity via ongoing, generally high-frequency stimulation.’²⁵⁹ DBS has been used to treat Parkinson’s disease (PD),^{260 261} dystonia, and tremor disorders.²⁶² DBS has also been considered as a treatment for chronic pain, epilepsy, and a range of psychiatry disorders such as tourette’s syndrome, OCD, and depression.^{263 264 265 266} It has also

²⁵² Ibid.

²⁵³ KUO, M.-F. & NITSCHKE, M. A. 2012. Effects of Transcranial Electrical Stimulation on Cognition. *Clinical EEG and Neuroscience*, 43, 192-199.

²⁵⁴ JO, J. M., KIM, Y. H., KO, M. H., OHN, S. H., JOEN, B. & LEE, K. H. 2009. Enhancing the working memory of stroke patients using tDCS. *Am J Phys Med Rehabil*, 88, 404-9.

²⁵⁵ FREGNI, F., BOGGIO, P. S., NITSCHKE, M., BERMPOHL, F., ANTAL, A., FEREDOES, E., MARCOLIN, M. A., RIGONATTI, S. P., SILVA, M. T., PAULUS, W. & PASCUAL-LEONE, A. 2005. Anodal transcranial direct current stimulation of prefrontal cortex enhances. *Exp Brain Res*, 166, 23-30.

²⁵⁶ MARSHALL, L., MÖLLE, M., HALLSCHMID, M. & BORN, J. 2004. Transcranial Direct Current Stimulation during Sleep Improves Declarative Memory. *The Journal of Neuroscience*, 24, 9985-9992.

²⁵⁷ IYER, M. B., MATTU, U., GRAFMAN, J., LOMAREV, M., SATO, S. & WASSERMANN, E. M. 2005. Safety and cognitive effect of frontal DC brain polarization in healthy. *Neurology*, 64, 872-5.

²⁵⁸ CHI, R. P., FREGNI, F. & SNYDER, A. W. 2010. Visual memory improved by non-invasive brain stimulation. *Brain Res*, 1353, 168-75.

²⁵⁹ HOY, K. E. & FITZGERALD, P. B. 2010. Brain stimulation in psychiatry and its effects on cognition. *Nat Rev Neurol*, 6, 267-275.

²⁶⁰ WEAVER, F. M., FOLLETT, K. A., STERN, M., LUO, P., HARRIS, C. L., HUR, K., MARKS, W. J., JR., ROTHBLIND, J., SAGHER, O., MOY, C., PAHWA, R., BURCHIEL, K., HOGARTH, P., LAI, E. C., DUDA, J. E., HOLLOWAY, K., SAMII, A., HORN, S., BRONSTEIN, J. M., STONER, G., STARR, P. A., SIMPSON, R., BALTUCH, G., DE SALLES, A., HUANG, G. D. & REDA, D. J. 2012. Randomized trial of deep brain stimulation for Parkinson disease: thirty-six-month outcomes. *Neurology*. United States.

²⁶¹ PERLMUTTER, J. S. & MINK, J. W. 2006. Deep brain stimulation. *Annu Rev Neurosci*, 29, 229-57.

²⁶² AWAN, N. R., LOZANO, A. & HAMANI, C. 2009. Deep brain stimulation: current and future perspectives. *Neurosurgical Focus*, 27, E2.

²⁶³ Ibid.

²⁶⁴ WEAVER, F. M., FOLLETT, K. A., STERN, M., LUO, P., HARRIS, C. L., HUR, K., MARKS, W. J., JR., ROTHBLIND, J., SAGHER, O., MOY, C., PAHWA, R., BURCHIEL, K., HOGARTH, P., LAI, E. C., DUDA, J. E., HOLLOWAY, K., SAMII, A., HORN, S., BRONSTEIN, J. M., STONER, G., STARR, P. A., SIMPSON, R., BALTUCH, G., DE SALLES, A., HUANG, G. D. & REDA, D. J. 2012. Randomized trial of deep brain stimulation for Parkinson disease: thirty-six-month outcomes. *Neurology*. United States.

been identified that DBS of sub thalamic nucleus can reduce rigidity, braykinesia, and gait difficulties in people with PD.²⁶⁷

Some researchers have observed that DBS can improve overall social functioning and quality of life in patients with PD,²⁶⁸ while others have observed that DBS can help patients with chronic severe and treatment-resistant anorexia nervosa, achieve, as well as maintain improvements in their moods, anxiety and body weights.²⁶⁹

As far as cognitive and ME is concerned, some researchers have associated DBS with improved memory recall and formation.^{270 271} They have observed that DBS improved some autobiographical memories during treatment of a patient with morbid obesity.²⁷² This is what the researchers reported:

We used hypothalamic DBS in an investigational study to treat a patient with morbid obesity and observed, quite unexpectedly, that stimulation spontaneously evoked detailed autobiographical memory events. This striking phenomenon led us to investigate the anatomic substrates and

²⁶⁵ LYONS, M. K. 2011. Deep brain stimulation: current and future clinical applications. *Mayo Clin Proc.* United States.

²⁶⁶ PERLMUTTER, J. S. & MINK, J. W. 2006. Deep brain stimulation. *Annu Rev Neurosci*, 29, 229-57.

²⁶⁷ Ibid.

²⁶⁸ SCHUEPBACH, W. M. M., RAU, J., KNUDSEN, K., VOLKMANN, J., KRACK, P., TIMMERMANN, L., HÄLBIG, T. D., HESEKAMP, H., NAVARRO, S. M., MEIER, N., FALK, D., MEHDORN, M., PASCHEN, S., MAAROUF, M., BARBE, M. T., FINK, G. R., KUPSCH, A., GRUBER, D., SCHNEIDER, G. H., SEIGNEURET, E., KISTNER, A., CHAYNES, P., ORY-MAGNE, F., BREFEL COURBON, C., VESPER, J., SCHNITZLER, A., WOJTECKI, L., HOUETO, J. L., BATAILLE, B., MALTÊTE, D., DAMIER, P., RAOUL, S., SIXEL-DOERING, F., HELLWIG, D., GHARABAGHI, A., KRÜGER, R., PINSKER, M. O., AMTAGE, F., RÉGIS, J. M., WITJAS, T., THOBOIS, S., MERTENS, P., KLOSS, M., HARTMANN, A., OERTEL, W. H., POST, B., SPEELMAN, H., AGID, Y., SCHADE-BRITTINGER, C. & DEUSCHL, G. 2013. Neurostimulation for Parkinson's Disease with Early Motor Complications. *New England Journal of Medicine*, 368, 610-622.

²⁶⁹ LIPSMAN, N., WOODSIDE, D. B., GIACOBBE, P., HAMANI, C., CARTER, J. C., NORWOOD, S. J., SUTANDAR, K., STAAB, R., ELIAS, G., LYMAN, C. H., SMITH, G. S. & LOZANO, A. M. 2013. Subcallosal cingulate deep brain stimulation for treatment-refractory anorexia nervosa: a phase 1 pilot trial. *The Lancet*.

²⁷⁰ HU, R., ESKANDAR, E. & WILLIAMS, Z. 2009. Role of deep brain stimulation in modulating memory formation and recall. *Neurosurg Focus*, 27, E3.

²⁷¹ VIGNAL, J.-P., MAILLARD, L., MCGONIGAL, A. & CHAUVEL, P. 2007. The dreamy state: hallucinations of autobiographic memory evoked by temporal lobe stimulations and seizures. *Brain*, 130, 88-99.

²⁷² HAMANI, C., MCANDREWS, M. P., COHN, M., OH, M., ZUMSTEG, D., SHAPIRO, C. M., WENNERBERG, R. A. & LOZANO, A. M. 2008. Memory enhancement induced by hypothalamic/fornix deep brain stimulation. *Annals of Neurology*, 63, 119-123.

mechanism through which hypothalamic stimulation could drive this type of memory.²⁷³

Two months after hospital discharge, the researchers were able to induce autobiographical memory effects that were similar to those previously observed in the operating room through stimulation.²⁷⁴ They reported that ‘as the stimulation intensity was increased from 3.0 to 5.0 and 7.0 volts, the patient reported greater details in the scene and related that the memory became richer and more vivid.’²⁷⁵ Additionally, Suthana et al,²⁷⁶ have observed that stimulation of the entorhinal region enhances memory of spatial information when applied during learning. From a different perspective, Vedder and Klaming^{277 278} have argued that DBS as well as TMS (discussed above) can be used to enhance eyewitness memory for the common good.²⁷⁹

DBS is an invasive procedure and has been associated with some complications which could be procedure-related, device-related (technical problems), and undesired effects caused by stimulation or cessation of stimulation.²⁸⁰ Various studies have also associated DBS with some other long term (between 1-30 years) adverse events that include cognitive decline, speech difficulty, instability, gait disorders and depression.^{281 282 283 284 285}

²⁷³ Ibid.

²⁷⁴ Ibid.

²⁷⁵ Ibid.

²⁷⁶ SUTHANA, N., HANEEF, Z., STERN, J., MUKAMEL, R., BEHNKE, E., KNOWLTON, B. & FRIED, I. 2012. Memory Enhancement and Deep-Brain Stimulation of the Entorhinal Area. *New England Journal of Medicine*, 366, 502-510.

²⁷⁷ KLAMING, L. & VEDDER, A. 2009. Brushing Up our Memories: Can we use Neurotechnologies to Improve Eyewitness Memory? *Law, Innovation and Technology*, 1, 203-221.

²⁷⁸ VEDDER, A. & KLAMING, L. 2010. Human Enhancement for the Common Good—Using Neurotechnologies to Improve Eyewitness Memory. *AJOB Neuroscience*, 1, 22-33.

²⁷⁹ See TT, 11.

²⁸⁰ DE KONING, P. P., FIGEE, M., VAN DEN MUNCKHOF, P., SCHUURMAN, P. R. & DENYS, D. 2011. Current status of deep brain stimulation for obsessive-compulsive disorder: a clinical review of different targets. *Current psychiatry reports*, 13, 274-282.

²⁸¹ RODRIGUEZ-OROZ, M. C., OBESO, J. A., LANG, A. E., HOUETO, J. L., POLLAK, P., REHNCRONA, S., KULISEVSKY, J., ALBANESE, A., VOLKMANN, J., HARIZ, M. I., QUINN, N. P., SPEELMAN, J. D., GURIDI, J., ZAMARBIDE, I., GIRONELL, A., MOLET, J., PASCUAL-SEDANO, B., PIDOUX, B., BONNET, A. M., AGID, Y., XIE, J., BENABID, A. L., LOZANO, A. M., SAINT-CYR, J., ROMITO, L., CONTARINO, M. F., SCERRATI, M., FRAIX, V. & VAN BLERCOM, N. 2005. Bilateral deep brain stimulation in Parkinson's disease: a multicentre study with 4 years follow-up. *Brain*, 128, 2240-2249.

²⁸² PARSONS, T. D., ROGERS, S. A., BRAATEN, A. J., WOODS, S. P. & TRÖSTER, A. I. 2006. Cognitive sequelae of subthalamic nucleus deep brain stimulation in Parkinson's disease: a meta-analysis. *The Lancet Neurology*, 5, 578-588.

As the above studies have shown, there is wide conflicting information on the effects of DBS on cognition and the memory. More research is therefore required to ascertain the benefits of DBS on cognition and specifically for my purposes here – the memory.

4.4 Conclusion

In this chapter, I have assessed and reviewed some non-pharmacological means that individuals have used over the centuries as well as some emerging methods, in an attempt to enhance their memories. As already discussed, the desire to enhance and make ourselves better is not a new one and it has continued to intrigue throughout the ages; some of the traditional and conventional means for ME discussed in this chapter are evidence of this claim. Some means for example nutrition, sleep, and meditation are quite ancient. Their unending influence, including the current scientific interests on their effects on cognitive performance, is just a reminder that individuals have always, and will continue to look for ways to improve and enhance their well-being.

Unlike many other forms of ME such as use of drugs and brain stimulation that I have discussed in this thesis, some of the traditional and conventional means discussed in this chapter have been widely used since times immemorial to enhance an individual's general health, his mental well-being, and indeed his memory. Most of the people are also likely to use regularly some of the traditional and conventional non-pharmacological memory enhancers discussed in this chapter perhaps than any other means such as drugs and brain stimulation discussed in this thesis.

While most of the research has focussed on pharmacological and technological enhancement such as brain stimulation, it is vital to review traditional and

²⁸³ MEROLA, A., ZIBETTI, M., ANGRISANO, S., RIZZI, L., RICCHI, V., ARTUSI, C. A., LANOTTE, M., RIZZONE, M. G. & LOPIANO, L. 2011. Parkinson's disease progression at 30 years: a study of subthalamic deep brain-stimulated patients. *Brain*, 134, 2074-2084.

²⁸⁴ FREUND, H.-J. 2005. Long-term effects of Deep Brain Stimulation in Parkinson's Disease. *Ibid.* 128, 2222-2223.

²⁸⁵ ZAHODNE, L. B., OKUN, M. S., FOOTE, K. D., FERNANDEZ, H. H., RODRIGUEZ, R. L., KIRSCH-DARROW, L. & BOWERS, D. 2009. Cognitive declines one year after unilateral deep brain stimulation surgery in parkinson's disease: A controlled study using reliable change. *The Clinical Neuropsychologist*, 23, 385-405.

conventional means as well, assess their effectiveness and as already stated, to study them as enhancements proper. Other methods, external aids, and activities may have been used and may continue being used from a traditional and conventional perspective in attempts to enhance, improve, or inhibit the memory systems and processes.

While my discussion on this chapter contributes to the debate in informing on some of the non-pharmacological enhancers discussed above, it is limited, given the importance of memory and the vast multidisciplinary subjects addressing it. Given also, that memory is not only an academic issue but also a practical matter that individuals of all ages and cultural backgrounds have strived to enhance and make better, it is unlikely that any single study on non-pharmacological means will be exhaustive. Despite the conflicting findings about the effectiveness of some of the non-pharmacological means discussed in this chapter, there is nothing to suggest that their usage will decline, and therefore further studies to ascertain their benefits on memory would be essential.

Chapter 5

5 Pharmacological means for memory enhancement

5.1 Introduction

Pharmacological enhancement of the memory is perhaps on the one hand the most controversial means from an ethical, social, legal, and policy (ESLP) perspective. On the other hand, there is a contention about the effectiveness of the current drugs as a means for enhancing the memory and treating memory-related injuries. In this chapter, I review some of the pharmaceutical means that are currently widely used for the enhancement of memory. While most of the drugs reviewed in this chapter were initially developed and licensed for a variety of treatments, researchers have found them to have some enhancing effects in one way or another on the memory systems and memory processes.

Pharmacological enhancement of memory in this chapter implies three circumstances. First, when one takes drugs to improve or better his memory, as would be in the case of healthy people taking the drugs aiming at keeping awake, improving their cognition and ‘getting high’. Second, whenever one takes drugs in order to slow down the progression of memory decline, which would further lead for example to mild cognitive impairments, Alzheimer’s Disease (AD) and dementia. This is important given that AD is the most common single cause of dementia in our ageing society.¹ Third, it connotes to the process of MD whereby one takes beta blockers for example propranolol, aiming at relieving some traumatic memories. In what follows, I begin by reviewing some of the widely used psychoactive drugs that are associated with memory improvement.

5.2 Pharmacological interventions that have been associated with memory improvement

5.2.1 Modafinil (Provigil)

Modafinil is a wakefulness-promoting agent licensed by the Food and Drug Administration (FDA) in the US for the treatment of excessive daytime sleepiness associated with narcolepsy, obstructive sleep apnea/hypopnea syndrome, and shift

¹ MCGLEENON, DYNAN & PASSMORE 1999. Acetylcholinesterase inhibitors in Alzheimer’s disease. *British Journal of Clinical Pharmacology*, 48, 471-480.

work sleep disorder.^{2 3} However, modafinil has also been used as an off-label for many other clinical conditions including multiple sclerosis (MS), Attention deficit hyperactivity disorder (ADHD), Parkinson's disease (PD), mood disorders, traumatic brain injury (TBI), chronic fatigue syndrome, opiate, intoxication and recovery from general anaesthesia.⁴ For example, it has been observed that modafinil is effective in treating excessive daytime sleepiness for patients after traumatic brain injury in comparison to a placebo.⁵ Besides medical use, modafinil is also used for other cognitive enhancement purposes.⁶ From this perspective, in terms of cognitive and ME, modafinil has been shown to improve cognition in health adults^{7 8 9 10} but also in other specific groups like in adults with ADHD^{11 12} and high-dose cocaine users.¹³ Studies suggest that modafinil improves performance on working memory,^{14 15}

² FDA. 2013. *Provigil® (modafinil) Tablets [C-IV]* [Online]. Available: http://www.accessdata.fda.gov/drugsatfda_docs/label/2010/020717s030s034s0361bl.pdf [Accessed 01/01/ 2013].

³ VALENTINO, R. M. & FOLDVARY-SCHAEFER, N. 2007. Modafinil in the treatment of excessive daytime sleepiness. *Cleve Clin J Med*, 74, 561-6, 568-71.

⁴ Ibid.

⁵ KAISER, P. R., VALKO, P. O., WERTH, E., THOMANN, J., MEIER, J., STOCKER, R., BASSETTI, C. L. & BAUMANN, C. R. 2010. Modafinil ameliorates excessive daytime sleepiness after traumatic brain injury. *Neurology*, 75, 1780-1785.

⁶ REPANTIS, D., SCHLATTMANN, P., LAISNEY, O. & HEUSER, I. 2010. Modafinil and methylphenidate for neuroenhancement in healthy individuals: A systematic review. *Pharmacological Research*, 62, 187-206.

⁷ SUGDEN, C., HOUSDEN, C. R., AGGARWAL, R., SAHAKIAN, B. J. & DARZI, A. 2012. Effect of pharmacological enhancement on the cognitive and clinical psychomotor performance of sleep-deprived doctors: a randomized controlled trial. *Ann Surg*, 255, 222-7.

⁸ TURNER, D. C., CLARK, L., DOWSON, J., ROBBINS, T. W. & SAHAKIAN, B. J. 2004. Modafinil improves cognition and response inhibition in adult attention-deficit/hyperactivity disorder. *Biological Psychiatry*, 55, 1031-1040.

⁹ TURNER, D. C., ROBBINS, T. W., CLARK, L., ARON, A. R., DOWSON, J. & SAHAKIAN, B. J. 2003. Cognitive enhancing effects of modafinil in healthy volunteers. *Psychopharmacology*, 165, 260-269.

¹⁰ MÜLLER, U., ROWE, J. B., RITTMAN, T., LEWIS, C., ROBBINS, T. W. & SAHAKIAN, B. J. 2013. Effects of modafinil on non-verbal cognition, task enjoyment and creative thinking in healthy volunteers. *Neuropharmacology*, 64, 490-495.

¹¹ TURNER, D. C., CLARK, L., DOWSON, J., ROBBINS, T. W. & SAHAKIAN, B. J. 2004. Modafinil improves cognition and response inhibition in adult attention-deficit/hyperactivity disorder. *Biological Psychiatry*, 55, 1031-1040.

¹² LINDSAY, S. E., GUDELSKY, G. A. & HEATON, P. C. 2006. Use of Modafinil for the Treatment of Attention Deficit/Hyperactivity Disorder. *The Annals of Pharmacotherapy*, 40, 1829-1833.

¹³ KALECHSTEIN, A. D., MAHONEY III, J. J., YOON, J. H., BENNETT, R. & DE LA GARZA II, R. 2013. Modafinil, but not escitalopram, improves working memory and sustained attention in long-term, high-dose cocaine users. *Neuropharmacology*, 64, 472-478.

¹⁴ Ibid.

¹⁵ MINZENBERG, M. J. & CARTER, C. S. 2007. Modafinil: A Review of Neurochemical Actions and Effects on Cognition. *Neuropsychopharmacology*, 33, 1477-1502.

short-term memory span, visual memory, spatial planning, and stop-signal motor inhibition, increased accuracy and sustained attention.^{16 17 18}

Modafinil has been in use by healthy individuals and more specifically by some professionals. For example, military personnel use modafinil to sustain performance and offset fatigue after sleep deprivation while on continued or longer military operations.^{19 20} From this group of users, researchers have observed that modafinil reduces episodes of microsleeps and permits subjects to maintain normal mental states in comparison to a placebo.²¹ Statistical findings demonstrate that modafinil helps to maintain alertness, feelings of well-being, cognitive function, judgment, risk perception, and situation awareness of sleep-deprived aviators consistently better than placebo.^{22 23} Researchers suggest that students and academics are also regular users of stimulant drugs including modafinil in an attempt to maintain alertness, wakefulness, jetlag, and other academic challenges.^{24 25 26 27}

¹⁶ TURNER, D. C., CLARK, L., DOWSON, J., ROBBINS, T. W. & SAHAKIAN, B. J. 2004. Modafinil improves cognition and response inhibition in adult attention-deficit/hyperactivity disorder. *Biological Psychiatry*, 55, 1031-1040.

¹⁷ REPANTIS, D., SCHLATTMANN, P., LAISNEY, O. & HEUSER, I. 2010. Modafinil and methylphenidate for neuroenhancement in healthy individuals: A systematic review. *Pharmacological Research*, 62, 187-206.

¹⁸ RANDALL, D. C., SHNEERSON, J. M. & FILE, S. E. 2005. Cognitive effects of modafinil in student volunteers may depend on IQ. *Pharmacology Biochemistry and Behavior*, 82, 133-139.

¹⁹ CALDWELL, J. A. & CALDWELL, J. L. 2005. Fatigue in Military Aviation: An Overview of U.S. Military-Approved Pharmacological Countermeasures. *Aviation, Space, and Environmental Medicine*, 76, C39-C51.

²⁰ ELIYAHU, U., BERLIN, S., HADAD, E., HELED, Y. & MORAN, D. S. 2007. Psychostimulants and military operations. *Mil Med*, 172, 383-7.

²¹ LAGARDE, D. & BATEJAT, D. 1995. Disrupted Sleep-Wake Rhythm and Performance: Advantages of Modafinil. *Military Psychology*, 7, 165-191.

²² ESTRADA, A., KELLEY, A. M., WEBB, C. M., ATHY, J. R. & CROWLEY, J. S. 2012. Modafinil as a replacement for dextroamphetamine for sustaining alertness in military helicopter pilots. *Aviat Space Environ Med*, 83, 556-64.

²³ CALDWELL, J. A., JR., CALDWELL, J. L., SMYTHE, N. K., 3RD & HALL, K. K. 2000. A double-blind, placebo-controlled investigation of the efficacy of modafinil for sustaining the alertness and performance of aviators: a helicopter simulator study. *Psychopharmacology (Berl)*, 150, 272-82.

²⁴ TURNER, D. C. & SAHAKIAN, B. J. 2008. The Cognition-enhanced Classroom. In: ZONNEVELD, L., DIJSTELBLOEM, H. & RINGOIR, D. (eds.) *Reshaping the human condition: exploring human enhancement*. The Hague: Rathenau Institute, in collaboration with the British Embassy, Science and Innovation Network and the Parliamentary Office of Science & Technology.

²⁵ SAHAKIAN, B. & MOREIN-ZAMIR, S. 2007. Professor's little helper. *Nature*, 450, 1157-1159.

²⁶ QUIGLEY, M. 2008. Enhancing Me, Enhancing You: Academic Enhancement as a Moral Duty. *Expositions: Interdisciplinary Studies in the Humanities*, 2, 157-162.

²⁷ DIETZ, P., STRIEGEL, H., FRANKE, A. G., LIEB, K., SIMON, P. & ULRICH, R. 2013. Randomized Response Estimates for the 12-Month Prevalence of Cognitive-Enhancing Drug Use in University Students. *Pharmacotherapy: The Journal of Human Pharmacology and Drug Therapy*, 33, 44-50.

5.2.2 Amphetamine (s)

Amphetamine is a non-selective dopamine agonist that works by increasing the release of dopamine and blocking its reuptake.²⁸ It is a powerful central nervous system stimulant used in treating a number of disorders, including narcolepsy, ADHD, and obesity.^{29 30} Amphetamine and substituted amphetamines constitute of a group of psychostimulant drugs, which include methamphetamine (desoxyn), methylenedioxymethamphetamine (ecstasy),^{31 32} and *l*- and *d*-amphetamine (adderall),³³ which is also referred to in literature as mixed amphetamine salts.^{34 35} Both desoxyn and ecstasy are widely abused because of their effects on the users. On the one hand, desoxyn has the ability to increase wakefulness, physical activity, and decrease appetite,³⁶ whereas, on the other hand, ecstasy is used at least initially to attain mental stimulation, emotional warmth, enhanced sensory perception, and increase physical energy.³⁷ Ecstasy is illicitly manufactured and it is not contained in any medicinally used pharmaceutical.³⁸ Researchers suggest that amphetamines can exert profound effects on mental function and behaviour but can also lead to neurodegeneration and addiction.³⁹

²⁸ BARCH, D. 2004. Pharmacological manipulation of human working memory. *Psychopharmacology*, 174, 126-135.

²⁹ FLECKENSTEIN, A. E., VOLZ, T. J., RIDDLE, E. L., GIBB, J. W. & HANSON, G. R. 2007. New Insights into the Mechanism of Action of Amphetamines. *Annual Review of Pharmacology and Toxicology*, 47, 681-698.

³⁰ BERMAN, S. M., KUCZENSKI, R., MCCracken, J. T. & LONDON, E. D. 2008. Potential adverse effects of amphetamine treatment on brain and behavior: a review. *Mol Psychiatry*, 14, 123-142.

³¹ SULZER, D., SONNERS, M. S., POULSEN, N. W. & GALLI, A. 2005. Mechanisms of neurotransmitter release by amphetamines: A review. *Progress in Neurobiology*, 75, 406-433.

³² BERMAN, S. M., KUCZENSKI, R., MCCracken, J. T. & LONDON, E. D. 2008. Potential adverse effects of amphetamine treatment on brain and behavior: a review. *Mol Psychiatry*, 14, 123-142.

³³ Ibid.

³⁴ SMITH, M. E. & FARAH, M. J. 2011. Are prescription stimulants "smart pills"? The epidemiology and cognitive neuroscience of prescription stimulant use by normal healthy individuals. *Psychol Bull. United States: (PsycINFO Database Record 2011 APA, all rights reserved)*.

³⁵ ILIEVA, I., BOLAND, J. & FARAH, M. J. 2013. Objective and subjective cognitive enhancing effects of mixed amphetamine salts in healthy people. *Neuropharmacology*, 64, 496-505.

³⁶ BERMAN, S. M., KUCZENSKI, R., MCCracken, J. T. & LONDON, E. D. 2008. Potential adverse effects of amphetamine treatment on brain and behavior: a review. *Mol Psychiatry*, 14, 123-142.

³⁷ Ibid.

³⁸ Ibid.

³⁹ SULZER, D., SONNERS, M. S., POULSEN, N. W. & GALLI, A. 2005. Mechanisms of neurotransmitter release by amphetamines: A review. *Progress in Neurobiology*, 75, 406-433.

5.2.2.1 D-amphetamine (Adderall)

Some of the earlier research on *d*-amphetamine had found a clear positive influence of *d*-amphetamine in retention of symbolic material in long-term human memory.⁴⁰ They had observed that *d*-amphetamine administered to healthy subjects either before or after learning of word lists enhanced memory of the words.^{41 42 43 44} Researchers identify adderall as one of the most highly prescribed drugs,⁴⁵ and its usage is gaining popularity among young children and college students.^{46 47} Researchers suggest that adderall is widely used for cognitive enhancement by healthy young people.⁴⁸ However, contrary to some earlier research on *d*-amphetamine, recently Ilieva et al,⁴⁹ and Smith and Farah⁵⁰ viewed adderall as having no more than small effects on cognition in healthy young adults, although users may still perceive the drug as enhancing their cognition. Ilieva et al,⁵¹ concluded that they do not regard adderall as a powerful cognitive enhancer and if it does enhance cognition in healthy and adequately-rested young adults, the effects are likely to be small.⁵² They however identified some limitations in their studies that would have made them reach that conclusion, which included among others, lack of variation of the drug dose. Given this, they cannot know whether a higher or lower

⁴⁰ SOETENS, E., CASAER, S., DHOOGHE, R. & HUETING, J. E. 1995. EFFECT OF AMPHETAMINE ON LONG-TERM RETENTION OF VERBAL MATERIAL. *Psychopharmacology*, 119, 155-162.

⁴¹ Ibid.

⁴² ZEEUWS, I. & SOETENS, E. 2007. Verbal memory performance improved via an acute administration of D-amphetamine. *Human Psychopharmacology: Clinical and Experimental*, 22, 279-287.

⁴³ SOETENS, E., D'HOOGHE, R. & HUETING, J. E. 1993. Amphetamine enhances human-memory consolidation. *Neurosci Lett*. Ireland.

⁴⁴ ZEEUWS, I., DEROST, N. & SOETENS, E. 2010. Effect of an acute d-amphetamine administration on context information memory in healthy volunteers: evidence from a source memory task. *Hum Psychopharmacol*, 25, 326-34.

⁴⁵ VARGA, M. D. 2012. Adderall Abuse on College Campuses: A Comprehensive Literature Review. *Journal of Evidence-Based Social Work*, 9, 293-313.

⁴⁶ JIAO, X., VELEZ, S., RINGSTAD, J., EYMA, V., MILLER, D. & BLEIBERG, M. 2009. Myocardial infarction associated with adderall XR and alcohol use in a young man. *J Am Board Fam Med*. United States.

⁴⁷ HALL, K. M., IRWIN, M. M., BOWMAN, K. A., FRANKENBERGER, W. & JEWETT, D. C. 2005. Illicit use of prescribed stimulant medication among college students. *J Am Coll Health*, 53, 167-74.

⁴⁸ ILIEVA, I., BOLAND, J. & FARAH, M. J. 2013. Objective and subjective cognitive enhancing effects of mixed amphetamine salts in healthy people. *Neuropharmacology*, 64, 496-505.

⁴⁹ Ibid.

⁵⁰ SMITH, M. E. & FARAH, M. J. 2011. Are prescription stimulants "smart pills"? The epidemiology and cognitive neuroscience of prescription stimulant use by normal healthy individuals. *Psychol Bull*. United States: (PsycINFO Database Record 2011 APA, all rights reserved).

⁵¹ ILIEVA, I., BOLAND, J. & FARAH, M. J. 2013. Objective and subjective cognitive enhancing effects of mixed amphetamine salts in healthy people. *Neuropharmacology*, 64, 496-505.

⁵² Ibid.

dose of the drug might have produced different results. Desantis and Hane⁵³ study found that many users of ADHD drugs including adderall were convinced of the drugs' effectiveness and they gave various reasons to justify their usage of adderall. The students reported taking these stimulants including adderall as a 'study aid' to enhance their academic performances or help study; to aid concentration/alertness; for getting high and for experimentation.⁵⁴ Given the amphetamine popularity evidenced by studies above, they are likely to continue being used for cognitive and memory-related enhancements regardless of any conflicting conclusions on their effectiveness.

5.2.3 Methylphenidate (Ritalin)

Methylphenidate is a stimulant commonly used for the treatment of patients with ADHD and narcolepsy.⁵⁵ Data suggests that methylphenidate is extensively used as a stimulant for non-medical purposes especially by college students and academics as a 'study aid'^{56 57 58 59} aiming at improving concentration, enhancing alertness, and for 'getting high'.^{60 61} Methylphenidate has been associated with significantly increased interests and motivation for a particular task. A study by Volkow et al,⁶² found that healthy subjects who used methylphenidate described a mathematical task as being interesting, exciting, motivating, and less tiresome, whereas a placebo had no such effect. Researchers have observed that methylphenidate had significant

⁵³ DESANTIS, A. D. & HANE, A. C. 2010. "Adderall is definitely not a drug": justifications for the illegal use of ADHD stimulants. *Subst Use Misuse*, 45, 31-46.

⁵⁴ Ibid.

⁵⁵ FLECKENSTEIN, A. E., VOLZ, T. J., RIDDLE, E. L., GIBB, J. W. & HANSON, G. R. 2007. New Insights into the Mechanism of Action of Amphetamines. *Annual Review of Pharmacology and Toxicology*, 47, 681-698.

⁵⁶ MCCABE, S. E., KNIGHT, J. R., TETER, C. J. & WECHSLER, H. 2005. Non-medical use of prescription stimulants among US college students: prevalence and correlates from a national survey. *Addiction*, 100, 96-106.

⁵⁷ MAHER, B. 2008. Poll results: Look who's doping. *Nature*, 452, 674-675.

⁵⁸ BABCOCK, Q. & BYRNE, T. 2000. Student Perceptions of Methylphenidate Abuse at a Public Liberal Arts College. *Journal of American College Health*, 49, 143-145.

⁵⁹ DIETZ, P., STRIEGEL, H., FRANKE, A. G., LIEB, K., SIMON, P. & ULRICH, R. 2013. Randomized Response Estimates for the 12-Month Prevalence of Cognitive-Enhancing Drug Use in University Students. *Pharmacotherapy: The Journal of Human Pharmacology and Drug Therapy*, 33, 44-50.

⁶⁰ MAHER, B. 2008. Poll results: Look who's doping. *Nature*, 452, 674-675.

⁶¹ TETER, C. J., MCCABE, S. E., CRANFORD, J. A., BOYD, C. J. & GUTHRIE, S. K. 2005. Prevalence and motives for illicit use of prescription stimulants in an undergraduate student sample. *J Am Coll Health*, 53, 253-62.

⁶² VOLKOW, N. D., WANG, G. J., FOWLER, J. S., TELANG, F., MAYNARD, L., LOGAN, J., GATLEY, S. J., PAPPAS, N., WONG, C., VASKA, P., ZHU, W. & SWANSON, J. M. 2004. Evidence that methylphenidate enhances the saliency of a mathematical task by increasing dopamine in the human brain. *Am J Psychiatry*, 161, 1173-80.

effects on performance of the tests of spatial working memory and planning in healthy young adults.^{63 64} A systematic review by Repantis et al,⁶⁵ found that a single dose of methylphenidate had a distinguishable positive effect on memory. They found that in the reviews they analysed, the outcome of using methylphenidate comprised tests that measured changes in visual memory, working memory, spatial memory and learning capacities.⁶⁶

5.2.4 Donepezil (Aricept)

Donepezil is one of the drugs commonly used for the treatment of AD.⁶⁷ In the treatment of AD, the focus from a pharmacological perspective is the correction of the cholinergic deficiency within the central nervous system with the use of cholinesterase inhibitors.⁶⁸ Besides donepezil, other cholinesterase inhibitors recommended by clinicians include galantamine and rivastigmine.^{69 70} These drugs work by inhibiting the breakdown of acetylcholine, an important neurotransmitter associated with learning and memory, by blocking the enzyme acetylcholinesterase.⁷¹ Some researchers have observed that donepezil produces some modest improvements in cognitive functions including that of memory for those with traumatic brain injuries,⁷² while others have found that donepezil improved memory in multiple sclerosis patients with initial cognitive impairment.⁷³

⁶³ ELLIOTT, R., SAHAKIAN, B. J., MATTHEWS, K., BANNERJEA, A., RIMMER, J. & ROBBINS, T. W. 1997. Effects of methylphenidate on spatial working memory and planning in healthy young adults. *Psychopharmacology (Berl)*, 131, 196-206.

⁶⁴ MEHTA, M. A., OWEN, A. M., SAHAKIAN, B. J., MAVADDAT, N., PICKARD, J. D. & ROBBINS, T. W. 2000. Methylphenidate enhances working memory by modulating discrete frontal and parietal lobe regions in the human brain. *J Neurosci*, 20, RC65.

⁶⁵ REPANTIS, D., SCHLATTMANN, P., LAISNEY, O. & HEUSER, I. 2010. Modafinil and methylphenidate for neuroenhancement in healthy individuals: A systematic review. *Pharmacological Research*, 62, 187-206.

⁶⁶ Ibid.

⁶⁷ KADUSZKIEWICZ, H., ZIMMERMANN, T., BECK-BORNHOLDT, H.-P. & BUSSCHE, H. V. D. 2005. Cholinesterase Inhibitors For Patients With Alzheimer's Disease: Systematic Review Of Randomised Clinical Trials. *BMJ: British Medical Journal*, 331, 321-323.

⁶⁸ Ibid.

⁶⁹ Ibid.

⁷⁰ HANSEN, R. A., GARTLEHNER, G., WEBB, A. P., MORGAN, L. C., MOORE, C. G. & JONAS, D. E. 2008. Efficacy and safety of donepezil, galantamine, and rivastigmine for the treatment of Alzheimer's disease: a systematic review and meta-analysis. *Clin Interv Aging*, 3, 211-25.

⁷¹ BIRKS, J. 2006. Cholinesterase inhibitors for Alzheimer's disease. *Cochrane Database Syst Rev*, CD005593.

⁷² TAVERNI, J. P., SELIGER, G. & LICHTMAN, S. W. 1998. Donepezil mediated memory improvement in traumatic brain injury during post acute rehabilitation. *Brain Inj*, 12, 77-80.

⁷³ KRUPP, L. B., CHRISTODOULOU, C., MELVILLE, P., SCHERL, W. F., MACALLISTER, W. S. & ELKINS, L. E. 2004. Donepezil improved memory in multiple sclerosis in a randomized clinical trial. *Neurology*, 63, 1579-1585.

Patients with dementia taking donepezil experience benefits in cognitive function, activities of daily living, and behaviour.⁷⁴ A recent study by Howard et al,⁷⁵ investigated whether community-living patients with AD and who were already receiving donepezil benefited from continued treatment with donepezil. They found that there were modest cognition and functional benefits for those who continued taking donepezil for a year, in comparison to those who discontinued.⁷⁶ They also found similar findings for memantine (a drug discussed below), although the magnitude of the benefit was smaller than it was with donepezil.⁷⁷

In healthy volunteers, donepezil has been associated with enhanced performance and beneficial effects on retention. In a study of middle-aged pilots performing aviation simulation tasks, the group of pilots taking donepezil showed greater ability to retain the capacity to perform a set of complex simulator tasks than the placebo group.⁷⁸ In a study on cognitive performance in young and healthy subjects, Grön et al,⁷⁹ found that donepezil had significant drug effects that were specific to episodic memory in both the verbal and visual domain. Additionally, they found that donepezil significantly improved long-term visual episodic recall.⁸⁰ FitzGerald et al,⁸¹ found that donepezil improved verbal memory in healthy older adults. However, a few studies found negative impacts on the usage of donepezil in healthy volunteers. Balsters et al,⁸² found that donepezil impaired memory in healthy aged volunteers,⁸³

⁷⁴ BIRKS, J. & HARVEY, R. J. 2006. Donepezil for dementia due to Alzheimer's disease. *Cochrane Database Syst Rev*, CD001190.

⁷⁵ HOWARD, R., MCSHANE, R., LINDESAY, J., RITCHIE, C., BALDWIN, A., BARBER, R., BURNS, A., DENING, T., FINDLAY, D., HOLMES, C., HUGHES, A., JACOBY, R., JONES, R., JONES, R., MCKEITH, I., MACHAROUTHU, A., O'BRIEN, J., PASSMORE, P., SHEEHAN, B., JUSZCZAK, E., KATONA, C., HILLS, R., KNAPP, M., BALLARD, C., BROWN, R., BANERJEE, S., ONIONS, C., GRIFFIN, M., ADAMS, J., GRAY, R., JOHNSON, T., BENTHAM, P. & PHILLIPS, P. 2012. Donepezil and Memantine for Moderate-to-Severe Alzheimer's Disease. *New England Journal of Medicine*, 366, 893-903.

⁷⁶ Ibid.

⁷⁷ Ibid.

⁷⁸ YESAVAGE, J. A., MUMENTHALER, M. S., TAYLOR, J. L., FRIEDMAN, L., O'HARA, R., SHEIKH, J., TINKLENBERG, J. & WHITEHOUSE, P. J. 2002. Donepezil and flight simulator performance: Effects on retention of complex skills. *Neurology*, 59, 123-125.

⁷⁹ GRÖN, G., KIRSTEIN, M., THIELSCHER, A., RIEPE, M. & SPITZER, M. 2005. Cholinergic enhancement of episodic memory in healthy young adults. *Psychopharmacology*, 182, 170-179.

⁸⁰ Ibid.

⁸¹ FITZGERALD, D. B., CRUCIAN, G. P., MIELKE, J. B., SHENAL, B. V., BURKS, D., WOMACK, K. B., GHACIBEH, G., DRAGO, V., FOSTER, P. S., VALENSTEIN, E. & HEILMAN, K. M. 2008. Effects of Donepezil on Verbal Memory After Semantic Processing in Healthy Older Adults. *Cognitive and Behavioral Neurology*, 21.

⁸² BALSTERS, J. H., O'CONNELL, R. G., MARTIN, M. P., GALLI, A., CASSIDY, S. M., KILCULLEN, S. M., DELMONTE, S., BRENNAN, S., MEANEY, J. F., FAGAN, A. J., BOKDE, A.

Beglinger et al,^{84 85} found that donepezil group performed slightly but significantly worse on some tests of speed, attention and memory in comparison to the placebo group. Given such conflicting findings, further studies are required in order to establish the impact of donepezil on memory in healthy subjects.

5.2.5 Rivastigmine (Exelon)

Like donepezil above, this is one of cholinesterase inhibitors recommended for the treatment of AD.^{86 87} In a study assessing memory performance in patients with resistant schizophrenia often treated with electroconvulsive therapy (which is notable in leading to an adverse effect of memory loss), patients receiving rivastigmine during the electroconvulsive therapy (ECT) course, showed decreased cognitive subscale of the AD assessment scores, indicating cognitive improvement; whereas, subjects receiving placebo showed no significant change.⁸⁸ The researchers who lead the study suggested that coadministration of rivastigmine has beneficial effects of minimizing some of these ECT-induced cognitive impairments.⁸⁹ In a another study assessing treatment effects of rivastigmine on cognition, performance of daily living activities and behaviour in AD patients, subjects who continued rivastigmine for 6 months, showed modest effectiveness on cognition, functionality, and memory-associated behaviour compared with historical control patients.⁹⁰ Other researchers

L., UPTON, N., LAI, R., LARUELLE, M., LAWLOR, B. & ROBERTSON, I. H. 2011. Donepezil impairs memory in healthy older subjects: behavioural, EEG and simultaneous EEG/fMRI biomarkers. *PLoS One*. United States.

⁸³ Ibid.

⁸⁴ BEGLINGER, L. J., GAYDOS, B. L., KAREKEN, D. A., TANGPHAO-DANIELS, O., SIEMERS, E. R. & MOHS, R. C. 2004. Neuropsychological Test Performance in Healthy Volunteers Before and After Donepezil Administration. *Journal of Psychopharmacology*, 18, 102-108.

⁸⁵ BEGLINGER, L. J., TANGPHAO-DANIELS, O., KAREKEN, D. A., ZHANG, L., MOHS, R. & SIEMERS, E. R. 2005. Neuropsychological test performance in healthy elderly volunteers before and after donepezil administration: a randomized, controlled study. *J Clin Psychopharmacol*. United States.

⁸⁶ KADUSZKIEWICZ, H., ZIMMERMANN, T., BECK-BORNHOLDT, H.-P. & BUSSCHE, H. V. D. 2005. Cholinesterase Inhibitors For Patients With Alzheimer's Disease: Systematic Review Of Randomised Clinical Trials. *BMJ: British Medical Journal*, 331, 321-323.

⁸⁷ HANSEN, R. A., GARTLEHNER, G., WEBB, A. P., MORGAN, L. C., MOORE, C. G. & JONAS, D. E. 2008. Efficacy and safety of donepezil, galantamine, and rivastigmine for the treatment of Alzheimer's disease: a systematic review and meta-analysis. *Clin Interv Aging*, 3, 211-25.

⁸⁸ STRYJER, R., OPHIR, D., BAR, F., SPIVAK, B., WEIZMAN, A. & STROUS, R. D. 2012. Rivastigmine treatment for the prevention of electroconvulsive therapy-induced memory deficits in patients with schizophrenia. *Clin Neuropharmacol*, 35, 161-4.

⁸⁹ Ibid.

⁹⁰ FRANKFORT, S. V., APPELS, B. A., DE BOER, A., TULNER, L. R., VAN CAMPEN, J. P., KOKS, C. H. & BEIJNEN, J. H. 2006. Treatment effects of rivastigmine on cognition, performance of daily living activities and behaviour in Alzheimer's disease in an outpatient geriatric setting. *Int J Clin Pract*. England.

have found that rivastigmine may improve cognitive processing speed by enhancing compensatory brain activation in patients with MS.⁹¹

5.2.6 Galantamine (Razadyne)

Like donepezil and rivastigmine above, galantamine is also one of cholinesterase inhibitors recommended for the treatment of AD.^{92 93} Galantamine exhibits significant improvement of cognitive performances in patients with AD. In their studies of patients with AD in a clinical setting, Brodaty et al,⁹⁴ found that the patients treated with galantamine maintained their ratings of cognition, function, behaviour or global assessment over the 6-month period. Other researchers have found that galantamine improves cognitive functioning and sustained attention in chronic cocaine users, when compared to a placebo.⁹⁵ This is important especially given that long-term drug abuse is associated with a wide range of cognitive impairments that seem to be predictive of poorer treatment retention and outcome.⁹⁶

5.2.7 Ampakines

Unlike the cholinesterase inhibitors above that work on the cholinergic system, ampakines work on the glutamatergic system.⁹⁷ Glutamate is an important neurotransmitter in the mammalian central nervous system and it is linked to higher brain functions such as memory and learning.^{98 99 100} Drugs that facilitate

⁹¹ HUOLMAN, S., HAMALAINEN, P., VOROBYEV, V., RUUTIAINEN, J., PARKKOLA, R., LAINE, T. & HAMALAINEN, H. 2011. The effects of rivastigmine on processing speed and brain activation in patients with multiple sclerosis and subjective cognitive fatigue. *Mult Scler.* England.

⁹² HANSEN, R. A., GARTLEHNER, G., WEBB, A. P., MORGAN, L. C., MOORE, C. G. & JONAS, D. E. 2008. Efficacy and safety of donepezil, galantamine, and rivastigmine for the treatment of Alzheimer's disease: a systematic review and meta-analysis. *Clin Interv Aging*, 3, 211-25.

⁹³ KADUSZKIEWICZ, H., ZIMMERMANN, T., BECK-BORNHOLDT, H.-P. & BUSSCHE, H. V. D. 2005. Cholinesterase Inhibitors For Patients With Alzheimer's Disease: Systematic Review Of Randomised Clinical Trials. *BMJ: British Medical Journal*, 331, 321-323.

⁹⁴ BRODATY, H., WOODWARD, M., BOUNDY, K., BARNES, N. & ALLEN, G. 2006. A naturalistic study of galantamine for Alzheimer's disease. *CNS Drugs*. New Zealand.

⁹⁵ SOFUOGLU, M., WATERS, A. J., POLING, J. & CARROLL, K. M. 2011. Galantamine improves sustained attention in chronic cocaine users. *Exp Clin Psychopharmacol.* United States: 2011 APA, all rights reserved.

⁹⁶ SOFUOGLU, M., DEVITO, E. E., WATERS, A. J. & CARROLL, K. M. 2013. Cognitive enhancement as a treatment for drug addictions. *Neuropharmacology*, 64, 452-463.

⁹⁷ LYNCH, G., PALMER, L. C. & GALL, C. M. 2011. The likelihood of cognitive enhancement. *Pharmacology Biochemistry and Behavior*, 99, 116-129.

⁹⁸ RIEDEL, G., PLATT, B. & MICHEAU, J. 2003. Glutamate receptor function in learning and memory. *Behavioural Brain Research*, 140, 1-47.

⁹⁹ SHIMAMOTO, K. 2008. Glutamate transporter blockers for elucidation of the function of excitatory neurotransmission systems. *The Chemical Record*, 8, 182-199.

glutamatergic transmission within the cortex may both improve memory and modify complex network-level computations.¹⁰¹ Ampakines are centrally active drugs, which selectively improve performance of a number of behavioural task and increase AMPA receptor-gated currents.¹⁰² Ampakines improve communication in complex networks, potentially facilitating long-term potentiation (LTP),¹⁰³ which plays a critical role in the formation, retention and rapid recall of memories. Ampakines induce the expression of neurotrophic factors,¹⁰⁴ and cause cumulative enhancements of performance in tasks associated with spatial short-term memory in rats.¹⁰⁵ Studies in animal models have demonstrated that ampakines can accelerate learning, reduce age-related memory impairments, suppress symptoms in models of schizophrenia, ADHD, and depression.^{106 107} A small number of human studies have also produced positive results on ampakines effects on memory, where results of encoding were confirmed using tests of visual recognition, motor performance, and general intellectual functioning.^{108 109 110}

¹⁰⁰ MCENTEE, W. & CROOK, T. 1993. Glutamate: its role in learning, memory, and the aging brain. *Psychopharmacology*, 111, 391-401.

¹⁰¹ LYNCH, G., PALMER, L. C. & GALL, C. M. 2011. The likelihood of cognitive enhancement. *Pharmacology Biochemistry and Behavior*, 99, 116-129.

¹⁰² HAMPSON, R. E., ROGERS, G., LYNCH, G. & DEADWYLER, S. A. 1998. Facilitative effects of the ampakine CX516 on short-term memory in rats: enhancement of delayed-nonmatch-to-sample performance. *J Neurosci*, 18, 2740-7.

¹⁰³ LYNCH, G. & GALL, C. M. 2006. Ampakines and the threefold path to cognitive enhancement. *Trends in Neurosciences*, 29, 554-562.

¹⁰⁴ Ibid.

¹⁰⁵ HAMPSON, R. E., ROGERS, G., LYNCH, G. & DEADWYLER, S. A. 1998. Facilitative effects of the ampakine CX516 on short-term memory in rats: enhancement of delayed-nonmatch-to-sample performance. *J Neurosci*, 18, 2740-7.

¹⁰⁶ LYNCH, G. & GALL, C. M. 2006. Ampakines and the threefold path to cognitive enhancement. *Trends in Neurosciences*, 29, 554-562.

¹⁰⁷ HAMPSON, R. E., ROGERS, G., LYNCH, G. & DEADWYLER, S. A. 1998. Facilitative effects of the ampakine CX516 on short-term memory in rats: enhancement of delayed-nonmatch-to-sample performance. *J Neurosci*, 18, 2740-7.

¹⁰⁸ INGVAR, M., AMBROS-INGERSON, J., DAVIS, M., GRANGER, R., KESSLER, M., ROGERS, G. A., SCHEHR, R. S. & LYNCH, G. 1997. Enhancement by an ampakine of memory encoding in humans. *Exp Neurol*. United States.

¹⁰⁹ LYNCH, G., GRANGER, R., AMBROS-INGERSON, J., DAVIS, C. M., KESSLER, M. & SCHEHR, R. 1997. Evidence That a Positive Modulator of AMPA-Type Glutamate Receptors Improves Delayed Recall in Aged Humans. *Experimental Neurology*, 145, 89-92.

¹¹⁰ INGVAR, M., AMBROS-INGERSON, J., DAVIS, M., GRANGER, R., KESSLER, M., ROGERS, G. A., SCHEHR, R. S. & LYNCH, G. 1997. Enhancement by an ampakine of memory encoding in humans. *Exp Neurol*. United States.

5.2.8 Memantine

Memantine is licensed for the treatment of AD both in Europe and in the US.¹¹¹ A review of short-term clinical studies (≤ 28 weeks) has demonstrated that memantine has positive effects in aspects of cognition-language, memory, praxis, functional communication, and in activities of daily living.¹¹² Long-term follow-up studies (>1 year) have shown that the benefits of memantine are sustained and increase over time.¹¹³ Other clinical studies and meta-analyses have shown that treatment with memantine improves cognition, neuropsychiatric, and behavioural symptoms, as well as clinical global impression.^{114 115 116 117} Memantine is also associated with an ability to enhance long-term potentiation,¹¹⁸ attention, and information processing speed.¹¹⁹

5.3 Pharmacological interventions that have been associated with memory dampening

5.3.1 Benzodiazepines

Benzodiazepines (BZs) are widely used as psychotropic drugs. Some types of BZs such as Rohypnol (flunitrazepam), which now has the unfortunate label of a ‘prototypical date-rape’ drug,¹²⁰ and propofol have remarkable ability to wipe out episodic memory.¹²¹ Other popular BZs include midazolam, propofol, and diazepam. Studies suggest that chronic usage of BZs has some negative effects on the long-term

¹¹¹ RAMMES, G., DANYSZ, W. & PARSONS, C. 2008. Pharmacodynamics of memantine: an update. *Current neuropsychopharmacology*, 6, 55.

¹¹² WILKINSON, D. 2012. A review of the effects of memantine on clinical progression in Alzheimer's disease. *Int J Geriatr Psychiatry*, 27, 769-776.

¹¹³ Ibid.

¹¹⁴ TAYEB, H. O., YANG, H. D., PRICE, B. H. & TARAZI, F. I. 2012. Pharmacotherapies for Alzheimer's disease: Beyond cholinesterase inhibitors. *Pharmacology & Therapeutics*, 134, 8-25.

¹¹⁵ RAINA, P., SANTAGUIDA, P., ISMAILA, A., PATTERSON, C., COWAN, D., LEVINE, M., BOOKER, L. & OREMUS, M. 2008. Effectiveness of cholinesterase inhibitors and memantine for treating dementia: evidence review for a clinical practice guideline. *Ann Intern Med*. United States.

¹¹⁶ HERRMANN, N., CHAU, S. A., KIRCANSKI, I. & LANCTOT, K. L. 2011a. Current and emerging drug treatment options for Alzheimer's disease: a systematic review. *Drugs*. New Zealand.

¹¹⁷ HERRMANN, N., LI, A. & LANCTÔT, K. 2011b. Memantine in dementia: a review of the current evidence. *Expert Opinion on Pharmacotherapy*, 12, 787-800.

¹¹⁸ TAYEB, H. O., YANG, H. D., PRICE, B. H. & TARAZI, F. I. 2012. Pharmacotherapies for Alzheimer's disease: Beyond cholinesterase inhibitors. *Pharmacology & Therapeutics*, 134, 8-25.

¹¹⁹ FERRIS, S., SCHNEIDER, L., FARMER, M., KAY, G. & CROOK, T. 2007. A double-blind, placebo-controlled trial of memantine in age-associated memory impairment (memantine in AAMI). *Int J Geriatr Psychiatry*, 22, 448-55.

¹²⁰ SCHWARTZ, R. H., MILTEER, R. & LEBEAU, M. A. 2000. Drug-facilitated sexual assault ('date rape'). *Southern Medical Journal*, 93, 558-561.

¹²¹ VESELIS, R. A. 2006. The remarkable memory effects of propofol. *British Journal of Anaesthesia*, 96, 289-291.

cognitive functioning of elderly people in the community.¹²² A meta-analysis studying the long-term use of BZs, found that there were moderate-to-large effects for all cognitive domains; suggesting that long-term BZs users were significantly impaired, compared with controls, in all of the areas that the study assessed.¹²³ Among the cognitive dysfunctions that have been reported as impaired in patients taking BZs long term, are reduced / decreased visuospatial abilities, visuomotor abilities, IQ, motor coordination, psychomotor speed, speed of information processing, verbal learning, concentration, and delayed response time.¹²⁴ Other negative effects described are chronic effects of rebound anxiety, psychic drug dependence, an altered perception of the self, environment, and relationships.¹²⁵

5.3.1.1 Propofol

Propofol is a commonly used agent for general anaesthesia and for sedation in patients undergoing intensive care treatment.¹²⁶ Propofol has been associated with a prolonged retrograde amnesia following sedation in a 12-year-old boy.¹²⁷ According to Veselis et al,¹²⁸ propofol inhibits conscious memory processing and impairs the encoding of material into long-term memory. It affects LTM but not working memory.^{129 130} In rats, propofol administration induced amnesia of training on an inhibitory avoidance task.¹³¹ However, other researchers have identified propofol as

¹²² BIERMAN, E. J., COMIJS, H. C., GUNDY, C. M., SONNENBERG, C., JONKER, C. & BEEKMAN, A. T. 2007. The effect of chronic benzodiazepine use on cognitive functioning in older persons: good, bad or indifferent? *Int J Geriatr Psychiatry*, 22, 1194-200.

¹²³ BARKER, M. J., GREENWOOD, K. M., JACKSON, M. & CROWE, S. F. 2004. Cognitive effects of long-term benzodiazepine use: a meta-analysis. *CNS Drugs*. New Zealand.

¹²⁴ STEWART, S. A. 2005. The effects of benzodiazepines on cognition. *J Clin Psychiatry*, 66 Suppl 2, 9-13.

¹²⁵ Ibid.

¹²⁶ HAUER, D., RATANO, P., MORENA, M., SCACCIAOCE, S., BRIEGEL, I., PALMERY, M., CUOMO, V., ROOZENDAAL, B., SCHELLING, G. & CAMPOLONGO, P. 2011. Propofol Enhances Memory Formation via an Interaction with the Endocannabinoid System. *Anesthesiology*, 114.

¹²⁷ QURAISHI, S. A., GIRDHARRY, T. D., XU, S.-G. & ORKIN, F. K. 2007. Prolonged retrograde amnesia following sedation with propofol in a 12-year-old boy. *Pediatric Anesthesia*, 17, 375-379.

¹²⁸ VESELIS, R. A., PRYOR, K. O., REINSEL, R. A., LI, Y., MEHTA, M. & JOHNSON, R., JR. 2009. Propofol and Midazolam Inhibit Conscious Memory Processes Very Soon after Encoding: An Event-related Potential Study of Familiarity and Recollection in Volunteers. *Anesthesiology*, 110.

¹²⁹ Ibid.

¹³⁰ LEE, I. H., CULLEY, D. J., BAXTER, M. G., XIE, Z., TANZI, R. E. & CROSBY, G. 2008. Spatial memory is intact in aged rats after propofol anesthesia. *Anesth Analg*. United States.

¹³¹ ALKIRE, M. T., VAZDARJANOVA, A., DICKINSON-ANSON, H., WHITE, N. S. & CAHILL, L. 2001. Lesions of the Basolateral Amygdala Complex Block Propofol-induced Amnesia for Inhibitory Avoidance Learning in Rats. *Anesthesiology*, 95.

a memory-enhancing agent. According to a study by Hauer et al,¹³² propofol, in contrast to other commonly used sedatives, enhances emotional memory consolidation when administered immediately after a stressful event by enhancing endocannabinoid signaling.

5.3.1.2 Midazolom

Midazolam is a short acting water-soluble BZs popularly used as a sedative drug. Midazolam can impair short-term/working memory processes although these effects may not be as large as midazolam's effects on episodic memory processes.¹³³ In a study by Twersky et al,¹³⁴ of forty paediatric patients ranging between 4 and 10 years old, midazolam enhanced anterograde but not retrograde amnesia. On the one hand, the researchers found that compared to a placebo the patients who took midazolam experienced a significant postoperative reduction in ability to both recall and recognize cards shown subsequent to midazolam/placebo administration (anterograde amnesia). On the other hand, they observed that there was no difference between groups in postoperative ability to recall or recognize cards shown prior to midazolam/placebo administration (retrograde amnesia). In another study, midazolam produced significantly greater anterograde amnesia in comparison to diazepam given at a similar mean dosage.¹³⁵ Additionally, midazolam has also been associated with detrimental effect on immediate and delayed recall performance, significant decreased recognition performance of objects as compared to placebo, and impaired procedural learning.¹³⁶ In healthy volunteers, midazolam does not

¹³² HAUER, D., RATANO, P., MORENA, M., SCACCIAOCE, S., BRIEGEL, I., PALMERY, M., CUOMO, V., ROOZENDAAL, B., SCHELLING, G. & CAMPOLONGO, P. 2011. Propofol Enhances Memory Formation via an Interaction with the Endocannabinoid System. *Ibid.* 114.

¹³³ FISHER, J., HIRSHMAN, E., HENTHORN, T., ARNDT, J. & PASSANNANTE, A. 2006. Midazolam amnesia and short-term/working memory processes. *Consciousness and Cognition*, 15, 54-63.

¹³⁴ TWERSKY, R. S., HARTUNG, J., BERGER, B. J., MCCLAIN, J. & BEATON, C. 1993. Midazolam enhances anterograde but not retrograde amnesia in pediatric patients. *Anesthesiology*, 78, 51-5.

¹³⁵ HENNESSY, M., KIRKBY, K. & MONTGOMERY, I. 1991. Comparison of the amnesic effects of midazolam and diazepam. *Psychopharmacology*, 103, 545-550.

¹³⁶ RAMMSAYER, T. H., RODEWALD, S. & GROH, D. 2000. Dopamine-antagonistic, anticholinergic, and GABAergic effects on declarative and procedural memory functions. *Cognitive brain research*, 9, 61-71.

abolish implicit memory at a mild sedation level, but can abolish both explicit and implicit memories at a deep sedation level.¹³⁷

5.3.1.3 Diazepam

Diazepam is one of the BZs used as a sedative drug. Besides diazepam's well known amnesic and sedative effects, in a study of healthy volunteers, Deakin et al,¹³⁸ observed that 'diazepam can impair performance on reaction time tasks both by impairing sensitivity and by increasing the bias to respond.' Additionally, they found that diazepam impaired performance on tests of planning and risky decision making. Subjects who had taken diazepam made more risky choices on the risk-taking task. Subjects taking diazepam tended to get drowsier, calmer, and slower in response as the experiment progressed, in comparison with the subjects on placebo.¹³⁹ This is a replication of similar findings identified earlier in another study, whereby depending on the dose, diazepam impaired performance and rendered the subjects drowsy, calm, mentally slow, and clumsy.¹⁴⁰ However, contrary to the above, a recent study of healthy volunteers by Murphy et al,¹⁴¹ which aimed at elucidating whether there are direct effects of diazepam on emotional processing that are independent from the drug's sedative effect, concluded that 'diazepam significantly modulated attentional vigilance and notably decreased overall startle reactivity'. However, diazepam did not considerably affect mood, alertness, response times, facial expression recognition, or sustained attention.¹⁴²

5.3.1.4 Propranolol

Propranolol is a non-selective beta blocker used in the treatment of high blood pressure, abnormal heart rhythms, heart disease, and certain types of tremor. In

¹³⁷ TIAN, S. Y., ZOU, L., QUAN, X., ZHANG, Y., XUE, F. S. & YE, T. H. 2010. Effect of midazolam on memory: a study of process dissociation procedure and functional magnetic resonance imaging. *Anaesthesia*. England.

¹³⁸ DEAKIN, J. B., AITKEN, M. R. F., DOWSON, J. H., ROBBINS, T. W. & SAHAKIAN, B. J. 2004. Diazepam produces disinhibitory cognitive effects in male volunteers. *Psychopharmacology*, 173, 88-97.

¹³⁹ Ibid.

¹⁴⁰ MATTILA, M., SEPPALA, T. & MATTILA, M. J. 1986. Combined effects of buspirone and diazepam on objective and subjective tests of performance in healthy volunteers. *Clin. Pharm. Ther.*, 40, 620-626.

¹⁴¹ MURPHY, S. E., DOWNHAM, C., COWEN, P. J. & HARMER, C. J. 2008. Direct effects of diazepam on emotional processing in healthy volunteers. *Psychopharmacology (Berl)*, 199, 503-13.

¹⁴² Ibid.

healthy volunteers, doctors have used propranolol prior to surgery and found that it ‘significantly decreased tremor and anxiety in the surgeon without untoward effects to the surgeon and the patient.’¹⁴³ Regarding memory, propranolol usage and effects have been examined in three memory phases first, acquisition, formation, and encoding; secondly, emotional response and consolidation; and thirdly, retrieval and reconsolidation.¹⁴⁴ While earlier research focused on propranolol effects on acquisition and consolidation of memories, recent research focuses on memory reconsolidation and dissociation of emotion and fear from memories.¹⁴⁵ In one of the earliest studies on the effects of propranolol on memory, Cahill et al,¹⁴⁶ found that propranolol reduced memory for emotional events. They reported that:

Propranolol significantly impaired memory of the emotionally arousing story but did not affect memory of the emotionally neutral story. The impairing effect of propranolol on memory of the emotional story was not due either to reduced emotional responsiveness or to nonspecific sedative or attentional effects. The results support the hypothesis that enhanced memory associated with emotional experiences involves activation of the beta-adrenergic system.¹⁴⁷

Other researchers have done pilot studies on propranolol to determine its effectiveness on the prevention of post-traumatic stress disorder (PTSD). Vaiva et al,¹⁴⁸ observed that administering propranolol to young healthy individuals with tachycardia (abnormal rapid heart beating) was effective in mitigating PTSD symptoms and perhaps in preventing PTSD. They found that immediate treatment with propranolol decreased posttraumatic stress disorder two months after trauma. Their results were consistent with those of Pitman et al,¹⁴⁹ who in their study had

¹⁴³ ELMAN, M. J., SUGAR, J., FISCELLA, R., DEUTSCH, T. A., NOTH, J., NYBERG, M., PACKO, K. & ANDERSON, R. J. 1998. The effect of propranolol versus placebo on resident surgical performance. *Trans Am Ophthalmol Soc*, 96, 283-91; discussion 291-4.

¹⁴⁴ DONOVAN, E. 2010. Propranolol use in the prevention and treatment of posttraumatic stress disorder in military veterans: Forgetting therapy revisited. *Perspectives in Biology and Medicine*, 53, 61-74.

¹⁴⁵ Ibid.

¹⁴⁶ CAHILL, L., PRINS, B., WEBER, M. & MCGAUGH, J. L. 1994. Beta-adrenergic activation and memory for emotional events. *Nature*, 371, 702-4.

¹⁴⁷ Ibid.

¹⁴⁸ VAIVA, G., DUCROCQ, F., JEZEQUEL, K., AVERLAND, B., LESTAVEL, P., BRUNET, A. & MARMAR, C. R. 2003. Immediate treatment with propranolol decreases posttraumatic stress disorder two months after trauma. *Biological Psychiatry*, 54, 947-949.

¹⁴⁹ PITMAN, R. K., SANDERS, K. M., ZUSMAN, R. M., HEALY, A. R., CHEEMA, F., LASKO, N. B., CAHILL, L. & ORR, S. P. 2002. Pilot study of secondary prevention of posttraumatic stress disorder with propranolol. *Ibid.* 51, 189-192.

previously reported encouraging findings on the prevention of PTSD through propranolol. Propranolol acts by blocking the adrenaline-induced state of arousal, a factor that gives traumatic memory unique qualities, including immediacy and potency.^{150 151}

Recently, Brunet et al,¹⁵² have moved the research on propranolol further by testing its effect on PTSD prevention during the process of memory reconsolidation. They tested the effect of propranolol given after the retrieval of memories of past traumatic events, whereby individuals suffering from PTSD recalled and described detailed accounts of their traumatic experiences and received either propranolol or a placebo. A week later, these individuals listened to their accounts of trauma from the previous week, while their physiological indicators of stress like heart rate were recorded. Physiological responses in the group that received propranolol were significantly lower than for those on the placebo group. Brunet et al,¹⁵³ concluded that ‘propranolol given after reactivation of the memory of a past traumatic event reduces physiologic responding during subsequent recall of the event in a similar manner to propranolol given shortly after the occurrence of a traumatic event.’ Other subsequent studies have consistently demonstrated similar results on the propranolol’s ability to disrupt the process of memory reconsolidation; whereby, propranolol taken before memory reactivation erased expression of fear and prevented the return of fear 24 hours later,¹⁵⁴ a month later,¹⁵⁵ disrupted fear selectively in anxiety disorders,¹⁵⁶ and in an imagined threat.¹⁵⁷

¹⁵⁰ Ibid.

¹⁵¹ HENRY, M., FISHMAN, J. R. & YOUNGNER, S. J. 2007. Propranolol and the prevention of post-traumatic stress disorder: Is it wrong to erase the "sting" of bad memories? *American Journal of Bioethics*, 7, 12-20.

¹⁵² BRUNET, A., ORR, S. P., TREMBLAY, J., ROBERTSON, K., NADER, K. & PITMAN, R. K. 2008. Effect of post-retrieval propranolol on psychophysiologic responding during subsequent script-driven traumatic imagery in post-traumatic stress disorder. *Journal of Psychiatric Research*, 42, 503-506.

¹⁵³ Ibid.

¹⁵⁴ KINDT, M., SOETER, M. & VERVLIT, B. 2009. Beyond extinction: Erasing human fear responses and preventing the return of fear. *Nature Neuroscience*, 12, 256-258.

¹⁵⁵ SOETER, M. & KINDT, M. 2010. Dissociating response systems: Erasing fear from memory. *Neurobiology of Learning and Memory*, 94, 30-41.

¹⁵⁶ SOETER, M. & KINDT, M. 2011. Disrupting reconsolidation: pharmacological and behavioral manipulations. *Learn Mem.* United States.

¹⁵⁷ SOETER, M. & KINDT, M. 2012. Erasing fear for an imagined threat event. *Psychoneuroendocrinology*, 37, 1769-79.

5.3.1.5 Glucocorticoids

Glucocorticoids are the final products of the activated hypothalamus–pituitary–adrenal (HPA) axis, and are referred to as cortisol in humans and corticosterone in rodents.^{158 159} Researchers have suggested that glucocorticoid affects memory and learning processes through interactions with glutamatergic mechanisms.^{160 161} Glucocorticoid can acutely affect memory processes with both impairing and facilitating effects.¹⁶² Specifically, glucocorticoids enhance memory consolidation of emotionally arousing experiences, but impair memory retrieval and working memory during emotionally arousing test situations.^{163 164} It is from this perspective of studying the effects of glucocorticoid on emotionally arousing traumatic memories, that researchers suggest that glucocorticoid can reduce stress and PTSD symptoms.¹⁶⁵ Other researchers have reported that there is a decline in working and declarative memory, with cognitive and mood symptoms being dose-dependent during corticosteroid therapies.¹⁶⁶

Glucocorticoid hormones secreted by the adrenal cortex after a stressful event influence cognitive performance.¹⁶⁷ Usually, ‘glucocorticoid levels are generally elevated in learning situations and enter the brain, where they bind to specific

¹⁵⁸ DE QUERVAIN, D. J. F., AERNI, A., SCHELLING, G. & ROOZENDAAL, B. 2009. Glucocorticoids and the regulation of memory in health and disease. *Frontiers in Neuroendocrinology*, 30, 358-370.

¹⁵⁹ SANDI, C. 2011. Glucocorticoids act on glutamatergic pathways to affect memory processes. *Trends Neurosci.* England: 2011 Elsevier Ltd.

¹⁶⁰ Ibid.

¹⁶¹ SANDI, C. 1998. The role and mechanisms of action of glucocorticoid involvement in memory storage. *Neural Plast.*, 6, 41-52.

¹⁶² SANDI, C. 2011. Glucocorticoids act on glutamatergic pathways to affect memory processes. *Trends Neurosci.* England: 2011 Elsevier Ltd.

¹⁶³ DE QUERVAIN, D. J. F., AERNI, A., SCHELLING, G. & ROOZENDAAL, B. 2009. Glucocorticoids and the regulation of memory in health and disease. *Frontiers in Neuroendocrinology*, 30, 358-370.

¹⁶⁴ DE QUERVAIN, D. J. F., ROOZENDAAL, B., NITSCH, R. M., MCGAUGH, J. L. & HOCK, C. 2000. Acute cortisone administration impairs retrieval of long-term declarative memory in humans. *Nat Neurosci*, 3, 313-314.

¹⁶⁵ SCHELLING, G., ROOZENDAAL, B. & DE QUERVAIN, D. J. F. 2004. Can Posttraumatic Stress Disorder Be Prevented with Glucocorticoids? *Annals of the New York Academy of Sciences*, 1032, 158-166.

¹⁶⁶ BROWN, E. S. 2009. Effects of glucocorticoids on mood, memory, and the hippocampus. Treatment and preventive therapy. *Ann N Y Acad Sci.* United States.

¹⁶⁷ ROOZENDAAL, B. 2003. Systems mediating acute glucocorticoid effects on memory consolidation and retrieval. *Prog Neuropsychopharmacol Biol Psychiatry.* England.

receptors in brain regions, notably limbic structures and the cerebral cortex, that are involved in learning and memory.’¹⁶⁸

5.4 Conclusion

This chapter has reviewed briefly some of the drugs that are currently used in one way or another for enhancing the memory systems and memory processes. While the findings about the drugs’ effectiveness remain conflicting, additional problems are those of ethical, social, legal and policy (ESLP) implications that the use of drugs as memory enhancing agents raise. General ESLP questions arising from pharmaceutical, traditional, non-pharmacological and technological means for ME are addressed in part two of the thesis, whereas specific ESLP issues are addressed in part three. Despite some conflicting findings on the effectiveness of some of the pharmaceutical means for enhancing the memory, the popularity and usage of some of the above drugs is on the increase as evidenced by the data and studies already referred in the above review. This review is very limited, for the pharmaceutical means assessed in this chapter are only a scratch on the surface for the many widely available drugs discussed in the literature.

In the next part of this thesis, I will explore the ethical, social, legal, and social background to the memory enhancement debate.

¹⁶⁸ SANDI, C. 1998. The role and mechanisms of action of glucocorticoid involvement in memory storage. *Neural Plast*, 6, 41-52.

Part II: Ethical, Social, Legal, and Policy Background to the Memory Enhancement Debate

Chapter 6

6 Ethical and social background to the memory enhancement debate

As highlighted above, in the past, most of the commentators addressing the ESLP issues in human enhancements have addressed them as a whole. In what follows, I will draw on some arguments put forward for and against human enhancement in the already existing literature, but in doing so I will be novel in providing a much more specific in-depth analysis of the ESLP in ME. Given that there are numerous arguments for and against human enhancements, I will limit myself to those arguments that would be relevant to my current discussion on ME.

I will accomplish this in two parts. (i) I will assess the ethical and social arguments that have been put forward in support of human enhancement. (ii) I will assess the ethical and social arguments against human enhancement. However, before doing so, I will briefly explore the background on the distinction between therapy and enhancement.

6.1 What human enhancement is or is not: contrasting therapy and enhancement

The question of what enhancement is or is not has been central in the enhancement debate for the last decade, and has not shown signs of abating yet. Proponents and opponents of human enhancements have both relied on their definition to put forward their arguments for or against human enhancement respectively. Thus, any literature review on human enhancement over the last decade would be incomplete if it ignored the controversies that have evolved focusing on the definition of what human enhancement is or is not. To answer the question faithfully, it would only be fair then, to present views from both opponents and proponents of human enhancement, and therefore, this is my next task below.

The question of what enhancement is has received some huge attention in bioethical literature in contradistinction to therapy. On this distinction:

‘Therapy’ is the use of biotechnical power to treat individuals with known diseases, disabilities, or impairments, in an attempt to restore them to a normal state of health and fitness. By contrast, ‘Enhancement’ is the directed use of biotechnical power to alter, by direct intervention, not disease processes but the ‘normal’ workings of the human body and psyche, to augment or improve their native capacities and performances.^{1 2}

Those who introduced this distinction hoped to distinguish between the acceptable and unacceptable, permissible and impermissible, obligatory and non-obligatory uses of biomedical technology.^{3 4 5}

However, the above therapy-enhancement distinction has widely been disputed.^{6 7 8} In a seminal book on these matters, John Harris has rendered the most persuasive case for why we ought to let go of the enhancement/therapy distinction. Harris defines the term enhancement as ‘clearly anything that makes a change, a difference for the better’.⁹ Harris argues that you cannot plausibly define enhancements as relative to normalcy, to normal species functioning, nor to species-typical functioning. For Harris, the overwhelming moral imperative for both therapy and enhancement is to prevent harm and to confer benefit; and it is unimportant whether you classify the protection or benefit conferred as enhancement or improvement, protection or therapy. According to Harris, because the enhancement/therapy distinction fails to capture the moral purposes for which both therapy and

¹ PCBE 2003. Beyond Therapy: Biotechnology and the Pursuit of Happiness. *The President's Council on Bioethics*. Washington, D.C.p.13.

² KASS, L. Beyond Therapy: Biotechnology and the Pursuit of Human Improvement. Paper presented to *The President's Council on Bioethics*, 2003 Washington, DC.

³ Ibid.

⁴ PCBE 2003. Beyond Therapy: Biotechnology and the Pursuit of Happiness. *The President's Council on Bioethics*. Washington, D.C.

⁵ DANIELS, N. 2000. Normal Functioning and the Treatment-Enhancement. *Cambridge Quarterly of Healthcare Ethics*, 309-322.

⁶ BOSTROM, N. & ROACHE, B. R. 2007. Ethical Issues in Human Enhancement. In: RYBERG, J., PETERSEN, T. & WOLF, C. (eds.) *New Waves in Applied Ethics*. New York: Palgrave Macmillan.

⁷ HARRIS, J. 2009. Enhancements are a moral obligation. In: SAVULESCU, J. & BOSTROM, N. (eds.) *Human Enhancements*. Oxford: Oxford University Press.

⁸ HARRIS, J. 2007. *Enhancing evolution: the ethical case for making better people*, Princeton, N.J., Princeton University Press.

⁹ Ibid.p.36.

enhancement standardly and most appropriately are applied, nor does it serve to identify the permissibility/impermissibility of the interventions, we ought to let it go.

10 11

Similarly, Savulescu has maintained that the therapy-enhancement distinction is indefensible, arguing that what matters is human well-being, not only treatment and prevention of disease. According to Savulescu, because we already accept environmental interventions to improve ourselves through education, diet, and training, striving to become better people and increase our opportunities in life – to be consistent, we should also accept biological manipulations, for there is no moral difference between these interventions.¹²

Selgelid has attempted a rebuttal arguing that:

The fact that the treatment-enhancement distinction is hard to make does not mean that there are no important distinctions to be made. There is presumably no fine line to be drawn to separate those who are bald from those who are not bald, but this does not mean that there are no important distinctions to be made between the bald and the not bald... Though we cannot draw a line between the bald and the not bald, we can talk in a useful and meaningful way about baldness. We can distinguish the opposite ends of the spectrum; we can talk about degrees of baldness; and we can point out prototypical cases of baldness and prototypical cases of people who are not bald. Thus, rather than talking about the ethics of treatment versus enhancement as though these were categorically different things (and rather than abandoning the treatment-enhancement distinction altogether) it is most fruitful to talk about particular interventions and examine the ethics of these on a case-by-case basis.¹³

¹⁰ Ibid.p.58.

¹¹ HARRIS, J. 2009. Enhancements are a moral obligation. *In*: SAVULESCU, J. & BOSTROM, N. (eds.) *Human Enhancements*. Oxford: Oxford University Press.

¹² SAVULESCU, J. 2007. Genetic Interventions and the Ethics of Enhancement of Human Beings. *In*: STEINBOCK, B. (ed.) *The Oxford Handbook of Bioethics*. Oxford: Oxford University Press.

¹³ SELGELID, M. J. 2007. An Argument against Arguments for Enhancement. *Studies in Ethics, Law, and Technology*, 1:1:12.

The other versions of the same distinction of therapy versus enhancements are normal versus non-normal, healthy versus unhealthy, normal versus species typical function.¹⁴ Kamm advances such a distinction when she differentiates two types of enhancements. In the first, we increase above the norm so that more people are above the norm in ways that many people are already quite naturally. Whereas, in the second one, we introduce improvements that no human being has yet evidenced – for example, living healthily to be two hundred years old.¹⁵

While I accept that Harris, Savulescu, Bostrom and Roache¹⁶ have succeeded in convincingly rejecting the above therapy/enhancement distinction and demonstrating it cannot be coherently or consistently maintained, I also acknowledge that the debate on the distinction is still ‘live’ in some current ethical debates.^{17 18}

Having highlighted the controversies in the definition of enhancement, in what follows I will highlight the arguments put forward for human enhancements and the arguments against both from an ethical and social perspective. The ESLP issues / arguments discussed are not mutually exclusive, and therefore, they are sometimes intertwined and hence, it is not unusual to see one argument occurring in the ethical, social, legal as well as on the policy issues. Where that happens, I will leave it where it has widely been deliberated and cross-refer to it. At the same time, some arguments appeal to both proponents and opponents and they both use them to defend their own course, as in the case of therapy versus enhancement discussion above.

¹⁴ DANIELS, N. 1985. *Just Health Care*, Cambridge University Press.

¹⁵ KAMM, F. M. 2005. Is there a problem with enhancement? *American Journal of Bioethics*, 5, 5 – 14.

¹⁶ BOSTROM, N. & ROACHE, B. R. 2007. Ethical Issues in Human Enhancement. In: RYBERG, J., PETERSEN, T. & WOLF, C. (eds.) *New Waves in Applied Ethics*. New York: Palgrave Macmillan.

¹⁷ SPARROW, R. 2010. Better than men? Sex and the therapy/enhancement distinction. *Kennedy Inst Ethics J*, 20, 115-44.

¹⁸ SPARROW, R. 2012. Human enhancement and sexual dimorphism. *Bioethics*, 26, 464-75.

6.2 Arguments for enhancements from an ethical and social perspective

6.2.1 Consistency

Savulescu argues that since we already accept environmental interventions to improve our children, through education, diet and training, striving to make them better people and increase their opportunities in life – to be consistent, we should accept biological or genetic manipulations, for there is no moral difference between these interventions.¹⁹ Contra Savulescu, Sandel has argued that there are huge differences between the two, and that trying to manipulate children through genetic manipulation is reminiscent of eugenics.²⁰ Habermas has also argued that genetic manipulations are different because they are irreversible – they do not allow any ‘critical reappraisal.’ Genetic enhancements do not allow the person looking back on the prenatal intervention to engage in a revisionary learning process.²¹ However, Savulescu has made a rejoinder arguing that environmental interventions can equally be irreversible.²² The consistency argument as it stands is also successfully applicable to the ME debate. As I have discussed in part one of this thesis, there are numerous non-pharmacological memory enhancers, ranging from the traditional, conventional up to the current technological means. If we accept these means, other things being equal, we should also consistently accept biological and pharmacological means for ME.

6.2.2 Enhancements are good for they make people’s lives better

Harris defines enhancement as clearly anything that makes a change, a difference for the better.²³ Following this, Harris makes a strong case for human enhancement. He argues that enhancements are good for they make people’s lives better. If it is not good for you, then it is not an enhancement. Harris classifies wearing glasses, having hearing aid, vaccinations, and immunizations as enhancements. For Harris, these

¹⁹ SAVULESCU, J. 2007. Genetic Interventions and the Ethics of Enhancement of Human Beings. In: STEINBOCK, B. (ed.) *The Oxford Handbook of Bioethics*. Oxford: Oxford University Press.

²⁰ SANDEL, M. J. 2007. *The case against perfection: ethics in the age of genetic engineering*, Cambridge, Massachusetts, Belknap Press of Harvard University Press.p.51.

²¹ HABERMAS, J. R. 2003. *The future of human nature*, Cambridge, UK, Polity.p.62.

²² SAVULESCU, J. 2007. Genetic Interventions and the Ethics of Enhancement of Human Beings. In: STEINBOCK, B. (ed.) *The Oxford Handbook of Bioethics*. Oxford: Oxford University Press.

²³ HARRIS, J. 2007. *Enhancing evolution: the ethical case for making better people*, Princeton, N.J., Princeton University Press.p.36.

enhancements do not simply cure or ameliorate people's ills, but they make them better.

Better at experiencing the world through all the senses, better at assimilating and processing what we experience, better at remembering and understanding things, stronger, more competent, more of everything we want to be.²⁴

Harris does not fathom why the goal of enhanced intelligence, increased powers and capacities, and better health, should not be pursued through enhancement technologies or procedures, if it is safe to do so. For Harris, enhancements should not only be permissible but in some cases, it is a moral duty to enhance.²⁵ Harris sums up his philosophical work with a theme he claims that all moral agents share: 'an exploration of the responsibility to make the world a better place'.²⁶

6.2.3 Enhancements are inevitable

Some commentators have argued that some forms of enhancements like genetic and cognitive enhancements are inevitable and we should therefore just pursue them, for the costs of delays are colossal.^{27 28} Such costs would include loss of potential opportunities. The inevitability thesis advanced by Baylis and Robert²⁹ relies on several other issues and assumptions as well: (i) Liberal autonomy – it is wrong to prevent people from pursuing their goals if they are not harmful to others. (ii) Humans are naturally inquisitive and tinkering beings.³⁰ (iii) Humans are competitive beings, looking for new and challenging opportunities to maximise their personal, social, and economic advantage.³¹ (iv) Everything is constantly changing and therefore, the future is ours to shape.³² (v) Shared commitments to capitalism,

²⁴ Ibid.p.2.

²⁵ Ibid.pp.3,35.

²⁶ Ibid.p.3.

²⁷ BAYLIS, F. & ROBERT, J. S. 2004. The Inevitability of Genetic Enhancement Technologies. *Bioethics*, 18, 1-26.

²⁸ BOSTROM, N. 2003a. Astronomical Waste: The Opportunity Cost of Delayed Technological Development. *Utilitas*, 15, 308-314.

²⁹ BAYLIS, F. & ROBERT, J. S. 2004. The Inevitability of Genetic Enhancement Technologies. *Bioethics*, 18, 1-26.

³⁰ PCBE 2003. Beyond Therapy: Biotechnology and the Pursuit of Happiness. *The President's Council on Bioethics*. Washington, D.C.p.289.

³¹ BAYLIS, F. & ROBERT, J. S. 2004. The Inevitability of Genetic Enhancement Technologies. *Bioethics*, 18, 1-26.

³² Ibid.

privatization and a market driven global economy – eager to embrace bio-capitalism.³³

The challenge however, to the inevitability thesis, would be that inevitability is not similar to actualization. The fact that something will occur, does not mean we should do it now. For example, we do not argue that because we will die, then, that we should be killed or kill ourselves right away. Perhaps there are further reasons why we ought not to die now. Similarly, contra the inevitability thesis, there could be other reasons for holding on. Furthermore, if enhancements and indeed ME are inevitable as suggested, we still face the important questions of whether they should be regulated, and if so why and how? These are vital questions relevant to the ME debate and I will further address them on the legal and policy issues section later.

6.2.4 Justice

Justice issues on the enhancement debate come in many flavours. Both advocates and critics of human enhancement appeal to justice in support of their debate. Critics for example McKibben³⁴ argue that pursuing enhancements will create unfairness, exacerbating the disparities between the rich and the poor, in extreme cases leading to what they see as ‘Genrich’ versus the ‘Naturals’. For them enhancing technologies might lead to a two-class society of the enhanced and the unenhanced, where the latter, considered inferior, might suffer discrimination and many other disadvantages in life.³⁵ Mehlman has argued that pursuit of unregulated wealth-based enhancement will create intolerable risks for the society.³⁶ A number of commentators have responded to these objections. Savulescu has replied to McKibben arguing that:

We have free will and a sense of responsibility; it is up to us how we choose to use this technology and how we treat those who are not enhanced. Which laws and policies we form to protect the opportunities of the unenhanced is up to us. Whether someone is treated with concern and respect is completely independent of their biology – enhanced or unenhanced. It is a function of

³³ Ibid.

³⁴ MCKIBBEN, B. 2004. *Enough: genetic engineering and the end of human nature*, London, Bloomsbury.pp.39-40.

³⁵ Ibid.

³⁶ MEHLMAN, M. J. 2005. Genetic enhancement: plan now to act later. *Kennedy Inst Ethics J*, 15, 77-82.

our attitudes and motivation to treat others with concern and respect. Discrimination is our choice – not written into biology.³⁷

Similarly, other supporters have argued that natural lotteries are not fair either.³⁸ However, the objectors can still make a rejoinder that if widely practiced, enhancements could create more unfairness than the natural lottery already creates.³⁹ Furthermore, the fact that the natural lottery is unfair should not be an invitation for further exacerbation of this unfairness. Nonetheless, if enhancements occurred sporadically, it might be tolerable, perhaps viewed as simply another instance in which wealth gives advantage.⁴⁰

Commentators who are not against enhancements as such, argue that enhancing technologies may be pursued as a ‘morality of inclusion’ to create the basic cooperative framework or in other words to create the same level playing field.⁴¹ Additionally, advocates for enhancements have argued that it is not only morally laudable to enhance, but in some cases, it is morally obligatory to do so.^{42 43 44 45} Harris has argued that the claim of objecting to enhancements by appealing to justice or unfairness is mistaken: fairness does not require that I should not try to protect myself because others cannot; it does not require that we ‘do not provide benefits to any until they are available to all. It is doubtful ethics to deny palpable goods to some people because we cannot provide them for all’.⁴⁶ Farah et al, also share Harris response when they write:

³⁷ SAVULESCU, J. 2006. Justice, Fairness, and Enhancement. *Annals of the New York Academy of Sciences*, 1093, 321-338.

³⁸ SAUNDERS, B. 2008. The equality of lotteries. *Philosophy*, 83, 359-372.

³⁹ ROBERTSON, J. A. 1994. *Children of choice: freedom and the new reproductive technologies*, Princeton, Princeton University Press.p.166.

⁴⁰ Ibid.p.166.

⁴¹ BUCHANAN, A. E., BROCK, D. W., DANIELS, N. & WIKLER, D. 2000. *From chance to choice: genetics and justice*, Cambridge, Cambridge University Press.pp.20-21, 288-289.

⁴² HARRIS, J. 2007. *Enhancing evolution: the ethical case for making better people*, Princeton, N.J., Princeton University Press.

⁴³ HARRIS, J. 2009. Enhancements are a moral obligation. In: SAVULESCU, J. & BOSTROM, N. (eds.) *Human Enhancements*. Oxford: Oxford University Press.

⁴⁴ QUIGLEY, M. 2008. Enhancing Me, Enhancing You: Academic Enhancement as a Moral Duty. *Expositions: Interdisciplinary Studies in the Humanities*, 2, 157-162.

⁴⁵ SAVULESCU, J. 2005. New breeds of humans: The moral obligation to enhance. *Reproductive BioMedicine Online*, 10, 36-39.

⁴⁶ HARRIS, J. 2007. *Enhancing evolution: the ethical case for making better people*, Princeton, N.J., Princeton University Press.pp.28,62.

Unequal access is generally not grounds for prohibiting neurocognitive enhancement, any more than it is grounds for prohibiting other types of enhancement, such as private tutoring or cosmetic surgery, that are enjoyed mainly by the wealthy. Indeed, in principle there is no reason that neurocognitive enhancement could not help to equalize opportunity in our society. In comparison with other forms of enhancement that contribute to gaps in socioeconomic achievement, from good nutrition to high-quality schools, neurocognitive enhancement could prove easier to distribute equitably.⁴⁷

Furthermore, countless examples of unfair distribution of resources are ubiquitous and banning enhancements will not benefit anyone, whether individuals or society alike.⁴⁸ Kass disagrees:

Even if everyone had equal access to brain implants or genetic improvement of muscle strength or mind-enhancing drugs, a deeper disquiet would remain. The central matter is not just equality of access, but the goodness or badness of the thing offered.^{49 50}

Overall, the issues of justice and fairness will continue to inform the human enhancement debate and indeed my current discussion on ME.

6.3 Arguments against enhancements from an ethical and social perspective

6.3.1 The attitude of mastery and the openness to the unbidden

In his book '*The case against perfection*',⁵¹ Sandel argues against various forms of enhancement. He argues that the biggest problem with enhancements is not the drift to mechanism but the drive and the attitude to mastery. For him, what the drive to mastery misses, and may even destroy, is an appreciation of the gifted character of

⁴⁷ FARAH, M. J., ILLES, J., COOK-DEEGAN, R., GARDNER, H., KANDEL, E., KING, P., PARENS, E., SAHAKIAN, B. & WOLPE, P. R. 2004. Neurocognitive enhancement: What can we do and what should we do? *Nature Reviews Neuroscience*, 5, 421-425.

⁴⁸ BMA 2007. Boosting Your Brainpower: Ethical Aspects of Cognitive Enhancement. *British Medical Association*, London.p.20.

⁴⁹ KASS, L. Beyond Therapy: Biotechnology and the Pursuit of Human Improvement. Paper presented to *The President's Council on Bioethics*, 2003 Washington, DC.

⁵⁰ PCBE 2003. Beyond Therapy: Biotechnology and the Pursuit of Happiness. *The President's Council on Bioethics*. Washington, D.C.p.281.

⁵¹ SANDEL, M. J. 2007. *The case against perfection: ethics in the age of genetic engineering*, Cambridge, Massachusetts, Belknap Press of Harvard University Press.pp.27,61.

human powers and achievements.⁵² For Sandel, enhancements represent a kind of hyperagency – a promethean aspiration to remake nature, including human nature to serve our purposes and satisfy our desires.⁵³ Sandel gives the conspicuous examples of this trend in sports-crazed parents bent on making champions of their children, while another is the frenzied drive of overbearing parents to mould and manage their children’s academic careers.⁵⁴ According to Sandel, the problem with this hyperparenting familiar in our time is that it represents an anxious excess of mastery and dominion that misses the sense of life as a gift. This draws it disturbingly close to eugenics.⁵⁵ Having linked enhancements to eugenics, Sandel then proceeds to argue against eugenics. He writes ‘The problem with eugenics and genetic engineering is that they represent the one-sided triumph of wilfulness over giftedness, of dominion over reverence, of moulding over beholding.’⁵⁶ For Sandel, this triumph is mistaken – ‘for to believe that our talents and powers are wholly our own doing is to misunderstand our place in creation, to confuse our role with God’s.’⁵⁷ For Sandel, ‘if we allow genetic revolution to erode our appreciation for the gifted character of human powers and achievements, it would transform three key features of our moral landscape: humility, responsibility, and solidarity.’⁵⁸ ‘In a social world, that prizes mastery and control, parenthood is a school for humility. That we care deeply about our children and yet cannot choose the kind we want, teach parents to be open to the unbidden.’⁵⁹ Other similar claims of the same nature to Sandel’s are those of playing god,⁶⁰ hubris arguments, and preference of the status quo.⁶¹

However, a number of commentators^{62 63 64 65} have found some weaknesses with Sandel’s account. First, that the giftedness of nature also includes diseases, decline,

⁵² Ibid.pp.27,61.

⁵³ Ibid.pp.27,61.

⁵⁴ Ibid.p.52.

⁵⁵ Ibid.p.61.

⁵⁶ Ibid.p.85.

⁵⁷ Ibid.p.85.

⁵⁸ Ibid.p.86.

⁵⁹ Ibid.p.86.

⁶⁰ PETERS, T. 2003. *Playing God?: genetic determinism and human freedom*, New York, Routledge.

⁶¹ BOSTROM, N. & ORD, T. 2006. The reversal test: Eliminating status quo bias in applied ethics. *Ethics*, 116, 656-679.

⁶² Most of the responses are towards an earlier article that came before the book: SANDEL, M. J. 2004. The Case Against Perfection. *The Atlantic Monthly*, 293, 251-263.

and decay – for example, malaria, cancer, and Alzheimer’s disease.⁶⁶ Secondly, while modesty born of gratitude for the world’s ‘givenness’ may enable us to recognise that not everything in the world is open to any use we may desire or devise, it will not by itself teach us which things we can fiddle with and which we should leave inviolate.⁶⁷ ⁶⁸ In other words the mere ‘giftedness’ of things cannot tell us which gifts we need to accept, improve, or oppose.⁶⁹ Having pointed out the problem, Kass then sets out to improve it. For Kass:

The word ‘given’ has two relevant meanings, the second of which Sandel’s account omits ‘given,’ meaning ‘bestowed as a gift,’ and ‘given’... something ‘granted,’ definitely fixed and specified. Most of the given bestowals of nature have their given species-specified natures: they are each and all of a given sort. ...To turn a man into a cockroach ... would be dehumanizing. To try to turn a man into more than a man might be so as well.⁷⁰

Kamm has offered a detailed response of Sandel’s account against enhancement.⁷¹ Having responded to Sandel, Kamm then proceeds to give an analysis of what she sees as a deeper problem with the pursuit of enhancements. For Kamm, the deeper issue in human enhancement is the designers’ lack of imagination. That most people’s conception of the varieties of goods is very limited, and if they designed people, their improvements would likely conform to limited, predictable types.⁷² Kass shares this view when he confronts the problem of conformity and homogenization in his case against enhancements.⁷³

⁶³ KASS, L. Beyond Therapy: Biotechnology and the Pursuit of Human Improvement. Paper presented to *The President’s Council on Bioethics*, 2003 Washington, DC.

⁶⁴ HARRIS, J. 2007. *Enhancing evolution: the ethical case for making better people*, Princeton, N.J., Princeton University Press.

⁶⁵ KAHANE, G. U. Y. 2011. Mastery Without Mystery: Why there is no Promethean Sin in Enhancement. *Journal of Applied Philosophy*, 28, 355-368.

⁶⁶ PCBE 2003. Beyond Therapy: Biotechnology and the Pursuit of Happiness. *The President’s Council on Bioethics*. Washington, D.C.p.289.

⁶⁷ Ibid.p.289.

⁶⁸ KASS, L. Beyond Therapy: Biotechnology and the Pursuit of Human Improvement. Paper presented to *The President’s Council on Bioethics*, 2003 Washington, DC.

⁶⁹ Ibid.

⁷⁰ Ibid.

⁷¹ KAMM, F. M. 2005. Is there a problem with enhancement? *American Journal of Bioethics*, 5, 5 – 14.

⁷² Ibid.

⁷³ KASS, L. Beyond Therapy: Biotechnology and the Pursuit of Human Improvement. Paper presented to *The President’s Council on Bioethics*, 2003 Washington, DC.

Additionally, Harris has also rejected Sandel's account of enhancement. He questions like Kass and Kamm why we have to recognise and accept the gifted nature of normalcy but not the gifted nature of diseases.⁷⁴ Unlike Kass and Kamm, Harris locates the answer in the rationality of choice. If this is accepted, Harris continues, then, one has to acknowledge that the choosy if they are rational and fastidious do not choose based on giftedness.⁷⁵

Bostrom and Ord have similarly rejected other claims in favour of the status quo. They have argued that such claims are a result of a status quo bias, which they define as 'an inappropriate (irrational) preference for an option because it preserves the status quo.'⁷⁶ If we remove this bias, through the application of a method, they call 'the Reversal Test' many consequentialist objections to enhancements would be rendered as highly implausible.⁷⁷ In their own words, this is how they explain the Reversal Test:

If one considers the change of parameter in a certain direction to be undesirable then one should consider a change to the same parameter in the opposite direction away from the status quo. If this is undesirable too, then the onus is on those who reach these conclusions to explain why we cannot improve our position through changes to this parameter. If they are unable to do so, then we have reason to suspect that they suffer from status quo bias.⁷⁸

All these render Sandel argument on the attitude of mastery and the openness to the unbidden as implausible.

6.3.2 That to enhance is to use 'unnatural' means, and this is inauthentic

Although this argument occurs in various forms and for different enhancements, it is the account from Kass⁷⁹ that has been the most persuasive. Kass begins by pointing out that although traditionally the only means that we have acquired human excellence or perfected our natural gifts is through our own efforts and discipline,

⁷⁴ HARRIS, J. 2007. *Enhancing evolution: the ethical case for making better people*, Princeton, N.J., Princeton University Press.p.112.

⁷⁵ Ibid.p.112.

⁷⁶ BOSTROM, N. & ORD, T. 2006. The reversal test: Eliminating status quo bias in applied ethics. *Ethics*, 116, 656-679.

⁷⁷ Ibid.

⁷⁸ Ibid.

⁷⁹ KASS, L. Beyond Therapy: Biotechnology and the Pursuit of Human Improvement. Paper presented to *The President's Council on Bioethics*, 2003 Washington, DC.

this may not be the case anymore. For according to Kass, through biotechnology, we may be able to perfect our nature with less training or perhaps with no teaching at all.⁸⁰ Having drugs to improve our memory and our alertness could relieve the need for exertion to acquire these powers, leaving time and effort for better things.⁸¹ Some people will object to these means because they are artificial and unnatural.⁸² However, Kass analyses the objection that means alone cannot be the problem – for human beings have always used and continue looking for artful means and devices to improve themselves. So, it cannot be their unnaturalness alone that upsets us when they are used to make people ‘better than well’, he writes.⁸³

Nevertheless, for Kass, there is still a sense in which ‘naturalness’ of means matters – not in the fact that drugs and devices are artefacts, but in their relation to the nature of human activity.⁸⁴ According to Kass, use of these drugs deforms or violates the deep structure of natural human activity.⁸⁵ He asserts that while in ordinary practice, we sense the relation between our doings and the resulting improvement, between the means used and the end sought, contrary, the biomedical interventions act directly on the human body and mind to bring about their effects on a subject who is not merely passive but who plays no role at all.⁸⁶ One can at best *feel* their effects *without understanding their meaning in human terms*.⁸⁷ Therefore, for Kass, the major problem with biotechnical improvements is that they produce changes in us by disrupting the normal character of human being-at-work-in-the-world, which, when fine and full constitutes human flourishing.⁸⁸ Additionally, Kass continues, these biotechnical interventions skip the realm of intelligible meaning, and hence, we cannot really own the transformations nor experience them as genuinely ours, for we cannot attest whether the resulting conditions and activities – of our bodies and our minds are, in the fullest sense, our own as human.⁸⁹

⁸⁰ Ibid.

⁸¹ Ibid.

⁸² Ibid.

⁸³ Ibid.

⁸⁴ Ibid.

⁸⁵ Ibid.

⁸⁶ Ibid.

⁸⁷ Ibid.

⁸⁸ Ibid.

⁸⁹ Ibid.

Thomas Douglas, in his pioneering article on ‘*moral enhancement*’⁹⁰ has responded to the claim that we should not allow biomedical means to moral enhancement because they are unnatural. Although Douglas is writing specifically on moral enhancement, his analysis is quite relevant as well to other forms of enhancement.

According to Douglas, for this claim to succeed, it would have to establish an account of naturalness (or unnaturalness) that demonstrates [a] that using biomedical means to morally enhance oneself is unnatural, and [b] that this unnaturalness gives a person reason not to engage in such enhancement. However, finding such an account is problematic as Douglas demonstrates. Douglas analyses three different Humean concepts of nature: that which may be opposed to (i) ‘miracles’, (ii) ‘the rare and unusual’, and (iii) ‘artifice’. He equates respectively the three concepts of unnaturalness with (1) miraculousness (or supernaturalness), (2) rarity or unusualness, or (3) artificiality. He then considers whether any of these three concepts of naturalness renders both [a] and [b] plausible. In summary, Douglas analysis (of which the reader is referred to for a fully-fledged discussion) concludes that none of the three Humean concepts of unnaturalness renders both [a] and [b] plausible.⁹¹

Harris has also objected to the view held by Kass on unnatural means. Harris argues that what matters surely is the ethics of altering our nature, not the means that we adopt. For Harris, if it is right to alter our nature, we should choose the best and most reliable, not to mention the most efficient and economical, methods of so doing.⁹²

6.3.3 Should not enhance for health and safety reasons

One of the reasons for rejecting the pursuit of human enhancements is on the basis that they may cause bodily harm. Many people share the intuition that we ought to protect ourselves from dangerous people, defective products, unsafe work places, and poor-quality health care services.⁹³ These people see the government or the state as having a primary responsibility in protecting and promoting the populations’

⁹⁰ DOUGLAS, T. 2008. Moral Enhancement. *Journal of Applied Philosophy*, 25, 228-245.

⁹¹ Ibid.

⁹² HARRIS, J. 2007. *Enhancing evolution: the ethical case for making better people*, Princeton, N.J., Princeton University Press, p.125.

⁹³ GOSTIN, L. O. 2000. Public Health Law in a New Century. *JAMA: The Journal of the American Medical Association*, 283, 2837-2841.

health. However, they acknowledge that this protection is not possible without constraining a wide range of activities from individuals, groups, or corporate entities.⁹⁴ The pursuit of human enhancement according to the critics is one kind of those activities that should be limited for the risk of causing harm to individuals and to the society. For example, Kass⁹⁵ argues that no biological agent used for purposes of self-perfection will be entirely safe. For Kass anything powerful enough to enhance system A is likely to be powerful enough to harm system B. So, by trying to enhance the human person who is a highly complex yet an integrated whole, one intervenes partially only at one's peril.⁹⁶ However, Kass acknowledges that by itself that might not be a sufficient objection, for many good things in life are filled with risks, and free people, when properly informed often choose to run the risks involved hoping to acquire the foreseen benefits.⁹⁷

So, why should people not be free to pursue human enhancements? Moreover, what if all the technical hurdles, risks and barriers were resolved, and it is demonstrated that one could enhance without causing any bodily harm, would not this argument just collapse? Furthermore, safety issues are not limited to human enhancement and risks accompany almost every intervention, whether new or old.⁹⁸ For example, we widely accept ME through external aids like computers and mobile phones; yet, they are not exclusively safe, thus raising issues of privacy, confidentiality, and data protection. We widely accept education, and yet it can be quite unsafe, creating dogmatists, terrorists.⁹⁹

Kass¹⁰⁰ answers back that:

The big issues have nothing to do with safety, as in the case of cloning children, the real questions concern what to think about the perfected powers, assuming that they may be safely used. Conversely, the ethical issue of

⁹⁴ Ibid.

⁹⁵ KASS, L. *Beyond Therapy: Biotechnology and the Pursuit of Human Improvement*. Paper presented to *The President's Council on Bioethics*, 2003 Washington, DC.

⁹⁶ Ibid.

⁹⁷ Ibid.

⁹⁸ BOSTROM, N. & SANDBERG, A. 2009. Cognitive enhancement: Methods, ethics, regulatory challenges. *Science and Engineering Ethics*, 15, 311-341.

⁹⁹ Ibid.

¹⁰⁰ KASS, L. *Beyond Therapy: Biotechnology and the Pursuit of Human Improvement*. Paper presented to *The President's Council on Bioethics*, 2003 Washington, DC.

avoiding risk and bodily harm is independent of whether risky intervention aims at treating disease or at something beyond it.

However, as for now, there is a shared concern between most commentators who either support or oppose enhancements of whether we could alter the human person especially through genetic enhancements without making mistakes.^{101 102} Genetic enhancements could go awry. Other limitations like our understanding of the molecular biological detail of any proposed intervention, coupled with the financial incentives on the part of promoters of the technology, could have the potential to lead to grievous and potentially irremediable harms to many individuals as some authors claim.^{103 104} We therefore need to manage and identify a better balance between safety and benefit for use of human enhancement, and in my case ME.¹⁰⁵

6.3.4 Slippery slope, precautionary principle or precautionary approach arguments

Slippery slope arguments generally hold that we should resist a certain practice or policy, either on the ground that allowing it could lead us to allow another practice or policy that is clearly objectionable.^{106 107} Thus a companion to the slippery slope argument is the fear that if we allow any form of human enhancement now, even the most basic ones, this might open irreversibly the door to many other problematic and dangerous forms of enhancements. Those who oppose many forms of genetic manipulation, even for therapeutic purposes, often appeal to the slippery slope argument – that allowing genetic modification will open the door to genetic enhancements for non-therapeutic purposes. Similarly, through the precautionary principle or precautionary approach arguments, critics reject any forms of human enhancements maintaining that they could be detrimental to the society. They hold

¹⁰¹ KAMM, F. M. 2005. Is there a problem with enhancement? *American Journal of Bioethics*, 5, 5 – 14.

¹⁰² SANDEL, M. J. 2007. *The case against perfection: ethics in the age of genetic engineering*, Cambridge, Massachusetts, Belknap Press of Harvard University Press.

¹⁰³ ROBERTSON, J. A. 1994. *Children of choice: freedom and the new reproductive technologies*, Princeton, Princeton University Press.p.165.

¹⁰⁴ COORS, M. E. & HUNTER, L. 2005. Evaluation of genetic enhancement: Will human wisdom properly acknowledge the value of evolution? *American Journal of Bioethics*, 5, 21 – 22.

¹⁰⁵ BANJO, O. C., NADLER, R. & REINER, P. B. 2010. Physician attitudes towards pharmacological cognitive enhancement: safety concerns are paramount. *PLoS One*, 5, e14322.

¹⁰⁶ LODE, E. 1999. Slippery Slope Arguments and Legal Reasoning. *California Law Review*, 87, 1469-1543.

¹⁰⁷ VOLOKH, E. 2003. The Mechanisms of the Slippery Slope. *Harvard Law Review*, 116, 1026-1137.

that in the absence of scientific consensus about whether human enhancements would be harmful, the onus of proof lies on the supporters to demonstrate that they will not.

Harris has rejected these claims. He asserts that in the absence of reliable predictive knowledge as to how dangerous leaving things alone may prove, we have no rational basis for a precautionary approach, which prioritizes the status quo.¹⁰⁸ Bostrom and Ord also echo this.¹⁰⁹ Similarly, Robertson has offered several other grounds for rejecting the slippery slope and precautionary approach arguments: First, the fear that something will happen in the future is not by itself a sufficient reason to stop an otherwise acceptable action from occurring in the present.¹¹⁰ Secondly, there is no certainty that the predicted undesirable outcome will actually happen.¹¹¹ Thirdly, the feared extension may not be as undesirable as presently envisaged.¹¹² Fourthly, even if it is, there may be ways to prevent that use without foregoing beneficial uses. Fifthly, even if one met all the conditions, one would still have to show that future harms discounted by their probability of their occurrence outweigh present benefits.¹¹³ Finally, everything has a beginning and if we followed the precautionary approaches always, then we would never do anything for the first time.¹¹⁴

6.3.5 Loss of human nature, loss of human dignity, loss of human diversity, change of personality and change of person identity arguments

These arguments although presented with different tonalities, they all share one same principle underlying them – the ‘loss-of’ something we currently have. Due to the limitation of this thesis, I will only present one version of these arguments as

¹⁰⁸ HARRIS, J. 2007. *Enhancing evolution: the ethical case for making better people*, Princeton, N.J., Princeton University Press.p.34.

¹⁰⁹ BOSTROM, N. & ORD, T. 2006. The reversal test: Eliminating status quo bias in applied ethics. *Ethics*, 116, 656-679.

¹¹⁰ ROBERTSON, J. A. 1994. *Children of choice: freedom and the new reproductive technologies*, Princeton, Princeton University Press.p.156.

¹¹¹ Ibid.p.163.

¹¹² Ibid.p.163.

¹¹³ Ibid.pp.163-164.

¹¹⁴ HARRIS, J. 2007. *Enhancing evolution: the ethical case for making better people*, Princeton, N.J., Princeton University Press.p.34.

advanced by Fukuyama.¹¹⁵ Fukuyama challenges strongly the pursuit of human enhancements. First, he asks what it is that human essence might be in danger of losing. He answers that from a secular perspective, it would have to do with human nature: the species – typical characteristics shared by all human beings.¹¹⁶ This is what he calls factor X – the human essence, the most basic meaning of what it is to be human. According to Fukuyama, all human beings share this factor X universally. Therefore, if you strip all of a person's contingent and accidental characteristics away, there remains some essential human quality that is worthy of a certain minimal level of respect. For Fukuyama that is ultimately what is at stake in the biotech revolution.¹¹⁷ According to Fukuyama, biotechnology will cause us in some way to lose our humanity – an essential quality that has always underpinned our sense of who we are and where we are going despite all the changes that have taken place throughout human history.¹¹⁸

Fukuyama's appeal to human nature is contentious and huge philosophical disagreements prevail on whether there is a 'human nature', and if so, what it means. Moreover, even if one accepts that there is a human nature, not everyone accepts that it is ethically problematic to change it or to give it that protection advocated by Fukuyama. For example, transhumanists hold that current human nature can be improved using applied science and other rational methods, which may make it possible to increase our human health-span, extend our intellectual and physical capacities, and give us increased control over our own mental states and moods.¹¹⁹ However, Kass¹²⁰ has replied in response to the transhumanists' position:

I surely see no reason to adopt the optimism of the transhumanists – especially because they cannot provide a plausible picture of 'the new posthuman being,' and, worse, can offer no standards for judging whether their new 'creature' will be better than *Homo sapiens*.¹²¹

¹¹⁵ FUKUYAMA, F. 2002. *Our posthuman future: consequences of the biotechnology revolution*, London, Profile Books Ltd.

¹¹⁶ Ibid.p.101.

¹¹⁷ Ibid.pp.149-151.

¹¹⁸ Ibid.p.101.

¹¹⁹ BOSTROM, N. 2005. In Defense of Posthuman Dignity. *Bioethics*, 19, 202-214.

¹²⁰ KASS, L. 2008. Why Bioethics Must Care about Human Dignity: Old and New Concerns. *The President's Council on Bioethics: Human Dignity and Bioethics: Essays Commissioned by the President's Council on Bioethics*, 297-331.

¹²¹ Ibid.p.303.

Both Harris and Glover have rejected the argument based on human nature and concluded that it is flawed. First, that it assumes that if something is a part of human nature, then it is good, to such an extent that we never have reason to change it.^{122 123} Secondly, because our human nature is good for us, if left to its own devices, it will continue to be good for us.¹²⁴ Thirdly, that it does not follow from the fact that there is something good or dignified about a natural process that it needs to be defended for the simple and sufficient reason that there may be something better about its synthetic modification or replacement.¹²⁵ Moreover, the view of any medical intervention as an interference with nature is ubiquitous. As Harris writes elsewhere:

It is not rational to be against human enhancement; humans are creatures that result from an enhancement process called evolution (mixed as its benefits are) and moreover are inveterate self improvers in every conceivable way.¹²⁶

6.3.6 Violation of sole authorship of one's life and equality

In his book, *'The Future of Human Nature'*, Habermas¹²⁷ presents some arguments against various forms of human enhancements. On genetic enhancement, Habermas argues that any genetic intervention aimed at improving or enhancing children's traits is objectionable. First, because it violates the principle of autonomy and hence, the genetically programmed persons might no longer regard themselves as the sole authors of their own life history.¹²⁸ Secondly, because it violates the principle of equality, hence, the genetically enhanced children might no longer regard themselves as unconditionally equal-born persons in relation to previous generations.¹²⁹

In both arguments, Habermas sees the problem as that of potential harms caused by genetic enhancements to the prospective children. Fukuyama and co-authors also

¹²² GLOVER, J. 2007. *Choosing children: genes, disability, and design*, Oxford, Clarendon Press.pp.82.86.

¹²³ HARRIS, J. 2009. Enhancements are a moral obligation. In: SAVULESCU, J. & BOSTROM, N. (eds.) *Human Enhancements*. Oxford: Oxford University Press.

¹²⁴ Ibid.p.133.

¹²⁵ HARRIS, J. 2007. *Enhancing evolution: the ethical case for making better people*, Princeton, N.J., Princeton University Press.p.132.

¹²⁶ JOHN, H. 2009. Is it acceptable for people to take methylphenidate to enhance performance? Yes. *BMJ*, 338.

¹²⁷ HABERMAS, J. R. 2003. *The future of human nature*, Cambridge, UK, Polity.

¹²⁸ Ibid.p.79.

¹²⁹ Ibid.p.79.

share this idea.¹³⁰ Habermas appeals to freedom and argues that while in liberal societies every citizen has an equal right to pursue his individual life projects ‘as best as he can’, with genetic determination carried out according to the parents’ own preferences, there is no such opportunity.¹³¹ For this form of enhancement reduces the ethical freedom of the genetically altered person to an open future. Kass shares this view regarding some forms of enhancements and he sees it as kind of despotism of one generation over the next.¹³²

For Habermas, insofar as the genetically altered person feels that the scope for a possible use of their ethical freedom has been changed intentionally and irreversibly by a prenatal design, they may suffer from the consciousness of sharing the undivided authorship of their own life and their own destiny with someone else.¹³³ Therefore, by the designers making themselves the co-authors of the life of another, they intrude from the interior of another person’s consciousness. By so doing, the designers fracture the other person’s identity, which assures their inviolability as persons, their uniqueness as individuals and the irreplaceability of their own subjectivity.¹³⁴

While Habermas could be right, one could still object to his argument on the basis that the worry about autonomy and equality is not unique in genetic enhancements. Parents are always influencing their children’s life, whether through education, training, or any other environmental improvements. By so doing, they interfere with their autonomy and they change their identity. However, Habermas had foreseen this criticism and he replies that unlike other forms of interventions, genetic enhancements are irreversible: they do not allow any ‘critical reappraisal.’ Genetic enhancements do not allow the person looking back on the prenatal intervention to engage in a revisionary learning process.¹³⁵ Nevertheless, proponents of

¹³⁰ FUKUYAMA, F., FURGER, F. & JOHNS HOPKINS UNIVERSITY. SCHOOL OF ADVANCED INTERNATIONAL, S. 2006. *Beyond bioethics: a proposal for modernizing the regulation of human biotechnologies*, Washington, D.C., Paul H. Nitze School of Advanced International Studies, Johns Hopkins University.p.93.

¹³¹ HABERMAS, J. R. 2003. *The future of human nature*, Cambridge, UK, Polity.pp.60-62.

¹³² KASS, L. Beyond Therapy: Biotechnology and the Pursuit of Human Improvement. Paper presented to *The President's Council on Bioethics*, 2003 Washington, DC.

¹³³ HABERMAS, J. R. 2003. *The future of human nature*, Cambridge, UK, Polity.pp.63, 82.

¹³⁴ Ibid.pp.81-82.

¹³⁵ Ibid.

enhancements could still reply that some environmental and educational interventions are irreversible too, for example, unlearning to ride a bike, or the Italian language, or philosophy.

Overall, the concept of autonomy has been magnanimous in its influence on the human enhancement debate from both the camp of critics and supporters. Generally, liberal autonomy holds that it is wrong to prevent individuals from pursuing their goals if they are not harmful to others. This is a kind of base-line position for many other choices that we allow people to make and it requires justification to prevent people from doing what they want. Other possible caveats that limit autonomy are issues of distributive justice and public interest.¹³⁶ Furthermore, enhancement through drugs is a lifestyle choice.¹³⁷ Enhancement through drugs has the potential to enhance our human life just like other forms of enhancements that we choose and pursue to better ourselves such as education, good health habits, and information technology.^{138 139}

6.3.7 Other specific memory enhancement issues

The above discussion of social and ethical issues is not exhaustive and it just scratches the surface. Other issues particular to the ME debate are ethical and social issues specific to MD, some of which I discuss in detail in the papers – see cross-reference on footnotes. Thus, it suffices just to outline them here, they include:

6.3.7.1 Memory dampening results to loss of epistemic access

This is the concern that allowing MD may result in the permanent loss of some epistemic access to certain information about those past occasions, namely, to their evaluative significance as registered by the emotions experienced by the time.¹⁴⁰

¹³⁶ SAVULESCU, J. 2008. Autonomy, the Good Life, and Controversial Choices. In: RHODES, R., FRANCIS, L. P. & SILVERS, A. (eds.) *The Blackwell Guide to Medical Ethics*. Blackwell Publishing Ltd, Oxford, UK. pp.17-37.

¹³⁷ LUCKE, J. C., BELL, S. K., PARTRIDGE, B. J. & HALL, W. D. 2011. Academic doping or Viagra for the brain? The history of recreational drug use and pharmacological enhancement can provide insight into these uses of neuropharmaceuticals. *EMBO Rep.* England.

¹³⁸ LYNCH, G., PALMER, L. C. & GALL, C. M. 2011. The likelihood of cognitive enhancement. *Pharmacology Biochemistry and Behavior*, 99, 116-129.

¹³⁹ GREELY, H., SAHAKIAN, B., HARRIS, J., KESSLER, R. C., GAZZANIGA, M., CAMPBELL, P. & FARAH, M. J. 2008. Towards responsible use of cognitive-enhancing drugs by the healthy. *Nature*, 456, 702-705.

¹⁴⁰ TT, 8.4.

6.3.7.2 The presumption that the more of a good thing the better

Through this presumption, critics writing on MD have opposed it resting on one of the premises that ‘more’ or ‘superior’ memory is not necessarily good for us. Often their standard claims being that some individuals had more or superior memory yet they could not live a better life with it.¹⁴¹

6.3.7.3 Interests of the society in preserving memories for the greater good

Other arguments as well particular to the ME debate are that some individuals’ interests in MD would go against society’s interest in preserving them.¹⁴²

6.3.7.4 Negative emotions play an important part in forming our identity

Studies of the use of beta blockers like Propranolol to attenuate memories of traumatic events, suggest that the drugs work by blocking or inhibiting the emotional feel of trauma – hence, not attenuating memories per se but the emotions associated with the memories of the events.^{143 144 145 146 147 148 149} Critics of MD argue that emotions are an important part of our moral identity and negative emotions can have an important role in maintaining identity as positive ones and therefore, we should not allow MD.¹⁵⁰ Due to limitations of this thesis, I have not addressed this issue here but I will do so elsewhere.

¹⁴¹ TT, 8.6.

¹⁴² TT, 8.4, 9.7.1.

¹⁴³ PITMAN, R. K., SANDERS, K. M., ZUSMAN, R. M., HEALY, A. R., CHEEMA, F., LASKO, N. B., CAHILL, L. & ORR, S. P. 2002. Pilot study of secondary prevention of posttraumatic stress disorder with propranolol. *Biological Psychiatry*, 51, 189-192.

¹⁴⁴ GILES, J. 2005. Could a drug wipe out the horror of posttraumatic stress disorder? *Nature*, 436, 448-449.

¹⁴⁵ PCBE 2003. Beyond Therapy: Biotechnology and the Pursuit of Happiness. *The President's Council on Bioethics*. Washington, D.C.

¹⁴⁶ HENRY, M., FISHMAN, J. R. & YOUNGNER, S. J. 2007. Propranolol and the prevention of post-traumatic stress disorder: Is it wrong to erase the "sting" of bad memories? *American Journal of Bioethics*, 7, 12-20.

¹⁴⁷ GLANNON, W. 2006. Psychopharmacology and memory. *Journal of Medical Ethics*, 32, 74-78.

¹⁴⁸ HURLEY, E. A. 2010. Combat Trauma and the moral risks of memory manipulating drugs. *Journal of Applied Philosophy*, 27, 221-245.

¹⁴⁹ PITMAN, R. K. & DELAHANTY, D. L. 2005. Conceptually driven pharmacologic approaches to acute trauma. *CNS Spectrums*, 10, 99-106.

¹⁵⁰ KABASENCHE, W. P. 2007. Emotions, memory suppression, and identity. *American Journal of Bioethics*, 7, 33-34.

6.3.7.5 The problem of medicalization and drug mongering

This is the claim that the problem of medicalization and drug mongering remains as one of the major issues on memory enhancing drugs.^{151 152} Due to restrictions of this thesis, I have not addressed this issue here but I will do so elsewhere. In the next chapter, I will analyse the arguments for and against human enhancements from a legal and policy issues perspective.

¹⁵¹ HENRY, M., FISHMAN, J. R. & YOUNGNER, S. J. Ibid. Propranolol and the prevention of post-traumatic stress disorder: Is it wrong to erase the "sting" of bad memories? , 12-20.

¹⁵² SCHERMER, M., BOLT, I., DE JONGH, R. & OLIVIER, B. 2009. The future of psychopharmacological enhancements: Expectations and policies. *Neuroethics*, 2, 75-87.

Chapter 7

7 Arguments for and against human enhancements from a legal and policy issues perspective

The debate on human enhancement from a legal and policy issues perspective has over the last decade focused on the questions of regulation. Legal theorists have been questioning whether enhancements would be lawful, whether they need to be regulated and if so, why and what form would that regulation take. In grappling with the questions of regulation, some commentators have argued for total prohibition, others for total freedom, and even others for a middle position – against total prohibition and against unrestricted freedom. In what follows, I assess these arguments.

7.1.1 Regulation

The debate on regulation has focussed on the question of how the law and policy makers should respond to human enhancements. Commentators have suggested various options in literature. While most of the suggestions are about enhancements in general, the principles proposed encompass the issues of ME as well. Thus, instead of exploring these principles as for general enhancements, I will treat them specifically for my purpose here as addressing the concerns of law to ME. This is in line with the same criterion I have applied above while addressing ethical and social issues. By doing this, I will continue to engage the reader closely to my case for ME that I shall defend throughout in the thesis.

7.1.1.1 Prohibit entirely / moratorium

Some commentators have called for a total ban on human enhancements and enhancing technologies.^{1 2 3} They have proposed a moratorium, i.e. suspending

¹ MILLER, G. & SENJEN, R. 2006. *The social impacts of nanotechnology - Issue Summary (Friends of the Earth)* [Online]. Available:

<http://nano.foe.org.au/sites/default/files/The%20social%20impacts%20of%20nanotechnology%20-%20Issue%20Summary%20September%202006.pdf> [Accessed 05/12/ 2010].

² FUKUYAMA, F. 2002. *Our posthuman future: consequences of the biotechnology revolution*, London, Profile Books Ltd.

³ FUKUYAMA, F., FURGER, F. & JOHNS HOPKINS UNIVERSITY. SCHOOL OF ADVANCED INTERNATIONAL, S. 2006. *Beyond bioethics: a proposal for modernizing the regulation of human*

research on such technologies for a certain period in order to protect the society from unintended consequences.^{4 5} Closer to this, is the already discussed above appeal to the precautionary principle. Through this principle, critics of human enhancements argue that in the absence of scientific consensus on whether human enhancements would be harmful, the onus of proof lies on the supporters to demonstrate that they will not.⁶

However, total prohibition of human enhancements and in my case ME seems most unrealistic and unlikely to happen.⁷ First, because there is a huge interest in ME and this is not only from individuals, but also from other governmental and non-governmental organizations.⁸ Secondly, because some forms of ME for example MD are forms of therapy that could ease pain for millions of people, and denying such a therapy, especially if proven to be successful would require a huge justification. Thirdly, because even if public funding is withdrawn, as in the case of stem cell research in the US, this does not stop private companies from continuing to fund such research. Finally, the benefits of having an optimum memory for individuals are huge and they are most likely to be extendable to the wider society, for example in saving costs associated with treatment of memory loss.

7.1.1.2 Means and methods

This is the suggestion that we should permit some means of human enhancements and disallow others. Specifically applied to the debate of ME would be to argue that we allow some means of ME for example using pharmaceutical agents and reject others for example brain stimulation; permit external means and prohibit internal

biotechnologies, Washington, D.C., Paul H. Nitze School of Advanced International Studies, Johns Hopkins University.

⁴ FUKUYAMA, F. 2002. *Our posthuman future: consequences of the biotechnology revolution*, London, Profile Books Ltd.

⁵ FUKUYAMA, F., FURGER, F. & JOHNS HOPKINS UNIVERSITY. SCHOOL OF ADVANCED INTERNATIONAL, S. 2006. *Beyond bioethics: a proposal for modernizing the regulation of human biotechnologies*, Washington, D.C., Paul H. Nitze School of Advanced International Studies, Johns Hopkins University.

⁶ AGAR, N. 2010. Thoughts about our species' future: themes from Humanity's End: Why We Should Reject Radical Enhancement. *Journal of Evolution and Technology*, 21, 23-31.

⁷ ALLHOFF, F., LIN, P., MOOR, J. & AND WECKERT, J. 2010. Ethics of Human Enhancement: 25 Questions & Answers. *Studies in Ethics, Law, and Technology*, 4:1:4.

⁸ WILLIAMS, E. A. 2006. Good, Better, Best: The Human Quest for Enhancement. In: FRANKEL, M. S. (ed.). *American Association for the Advancement of Science*.

means. One would have to justify this based on the balance of harm-benefit ratio.^{9 10}

¹¹ I will address the questions of means and methods more in the second part of this thesis where I review both non-pharmacological and pharmacological means for ME.

7.1.1.3 Allow different groups of people

Some commentators have directly and others indirectly suggested that we should permit some enhancements in adults and restrict their use in healthy children and in those who cannot consent.¹² The question of when children are concerned is always a tricky one whether on issues of treatment, education, enhancements, etc. Parents have responsibilities over their children. Therefore, if ME for example in cases of MD proved to be a successful therapy, it would require some moral justifications to prevent parents from pursuing such therapy for their children. However, it is still possible that the law could prohibit the use of such treatment on children.

7.1.1.4 Regulatory authorities / bodies

This would involve instituting new regulatory authorities in the way that the Human Fertilisation Embryology Authority (HFEA) was created in order to regulate treatment and research involving human embryos in the UK.¹³ This would require that those offering any human enhancements or enhancing technologies to have licences issued by the regulating authority. Thus, for example, in my case we could have a new Memory Enhancement Authority (MEA), which could issue licenses for all/and/or any forms/methods of ME pursued in the UK. This would require forming similar authorities for other forms of human enhancements. The British Medical Association (BMA) gives an example of a Regulatory Authority for Cognitive

⁹ SYNOFZIK, M. 2009. Ethically Justified, Clinically Applicable Criteria for Physician Decision-Making in Psychopharmacological Enhancement. *Neuroethics*, 2, 89-102.

¹⁰ SAHAKIAN, B. & MOREIN-ZAMIR, S. 2007. Professor's little helper. *Nature*, 450, 1157-1159.

¹¹ TURNER, D. C. & SAHAKIAN, B. J. 2008. The Cognition-enhanced Classroom. In: ZONNEVELD, L., DIJSTELBLOEM, H. & RINGOIR, D. (eds.) *Reshaping the human condition: exploring human enhancement*. The Hague: Rathenau Institute, in collaboration with the British Embassy, Science and Innovation Network and the Parliamentary Office of Science & Technology. p.110.

¹² SAHAKIAN, B. & MOREIN-ZAMIR, S. 2007. Professor's little helper. *Nature*, 450, 1157-1159.

¹³ HFEA. 2013. *About the HFEA - Human Fertilisation & Embryology Authority* [Online]. HFEA, Finsbury Tower 103-105, Bunhill Row, London, EC1Y 8HF. Available: <http://www.hfea.gov.uk/25.html> [Accessed 24/06/ 2013].

Enhancements (RACE).¹⁴ However, given that the government has in the past targeted disbanding the HFEA,¹⁵ as a part of spending cuts, the formation of new regulatory authorities seems quite unlikely. Perhaps the alternative would be not to institute new authorities, but to use those already existing for example Medicines and Healthcare Products Regulatory Agency (MHRA).

7.1.1.5 Gatekeepers

This is the suggestion to have doctors, healthcare personnel, pharmacists, and other clinicians acting as gatekeepers for human enhancements. Thus, in my case for ME through pharmaceutical drugs, gate keeping would depend on how these drugs would be classified: Prescription Only Medicines (POM), Pharmacy Medicines (P), and General Sales lists (GSL).^{16 17}

However, would gate keeping memory enhancing drugs be the most appropriate tasks for doctors, clinicians, and other health care personnel? While it is agreeable that someone needs to act as a gatekeeper especially to control limited available resources, provide information and relevant advice in order to protect individuals from harm, this role does not need to be exclusive to doctors. As Greely et al, have suggested:

Many different professions have a role in dispensing, using, or working with people who use cognitive enhancers. By creating policy at the level of professional societies, it will be informed by the expertise of these professionals, and their commitment to the goals of their profession.¹⁸

Besides, if there was free market – where people can purchase whatever enhancements they need especially in liberal democracies, then, gate keeping roles as suggested above would be miniscule. Furthermore, most of the alleged controlled drugs are already widely available on the internet and controlling in one country

¹⁴ BMA 2007. Boosting Your Brainpower: Ethical Aspects of Cognitive Enhancement. *British Medical Association*, London, p.34.

¹⁵ GARVEY, J. 2010. *BBC Radio 4 - Woman's Hour*, 31/08/2010, *The Future of the HFEA* [Online]. Available: <http://www.bbc.co.uk/programmes/p009r0jw> [Accessed 30/11/ 2010].

¹⁶ *Medicines Act 1968* [Online]. Available: http://www.legislation.gov.uk/ukpga/1968/67/pdfs/ukpga_19680067_en.pdf [Accessed 01/01/ 2012].

¹⁷ PRAYLE, D. & BRAZIER, M. 1998. Supply of medicines: paternalism, autonomy and reality. *Journal of Medical Ethics*, 24, 93-98.

¹⁸ GREELY, H., SAHAKIAN, B., HARRIS, J., KESSLER, R. C., GAZZANIGA, M., CAMPBELL, P. & FARAH, M. J. 2008. Towards responsible use of cognitive-enhancing drugs by the healthy. *Nature*, 456, 702-705.

does not mean prohibiting elsewhere. Individuals are still able to access them online and from other regional or international markets where there are no such restrictions – medical tourism.^{19 20} Moreover, if we concede that memory is vital to the pursuit of happiness/well-being, it is difficult to justify why a doctor should act as a gatekeeper for such pursuits and why they would be in a better position than anyone else in making such a judgement.²¹ At the same time, we could argue that such gate keeping could affect negatively the fiduciary relationship between doctors and patients, thus breaking the trust and leading them to view each other as adversaries.²² However, this does not suggest that doctors should not offer their professional expertise about the usage of such drugs whenever appropriate. Many share the intuition that the government should not limit our freedom to control something as deeply personal as our own minds and, hence, that the government should not be in the business of regulating our control over our memories.²³

7.1.1.6 Therapeutic purposes only

This is the option that we should permit ME for therapeutic purposes only, thus for instance, allowing those with Post Traumatic Stress Disorder (PTSD) to dampen their memories and excluding healthy people from dampening their memories. However, given the huge difficulties that arise from therapy/enhancement, un/healthy distinctions, as already discussed above, this would be quite problematic. Moreover, it would further exacerbate three conditions: First, such regulation would expand the medical diagnostic categories and the invention of the new pathological conditions, for individuals seeking such enhancements would have to do so under the guise of therapy. This leads to the second problem of limited information – on the one hand, individuals with limited access to information might not know for example whether memory enhancing drugs exist and how they can obtain them. On the other hand, because such drugs will provide information about therapy only, there will be

¹⁹ BMA 2007. Boosting Your Brainpower: Ethical Aspects of Cognitive Enhancement. *British Medical Association*, London.p.33.

²⁰ SCHUIJFF, M., SMITS, M., COENEN, C., KLAASSEN, P., HENNEN, L., RADER, M. & WOLBRING, G. 2009. European Parliament Science and Technology Options Assessment (STOA) - Human Enhancement Study. Brussels: *European Parliament STOA*.pp.10, 95.

²¹ BMA 2007. Boosting Your Brainpower: Ethical Aspects of Cognitive Enhancement. *British Medical Association*, London.p.34.

²² MASON, J. K. & MCCALL SMITH, A. 1991. *Law and medical ethics*, London, Butterworths.p.15.

²³ KOLBER, A. 2006. Therapeutic Forgetting: The Legal and Ethical Implications of Memory Dampening. *Vanderbilt Law Review*, 59, pp.1561- 1626.

little information about their memory enhancing effects. This limited or lack of information that people can access on memory enhancing drugs could be disastrous, for individuals who would use such drugs without proper advice/information. Thirdly, it would stifle research and further progress on ME for probably no funding would be forthcoming, and getting such a regulatory approval for a pharmaceutical whose exclusive use is to improve cognitive function for the healthy population, might almost be impossible.^{24 25 26 27}

7.1.1.7 Rules governing particular activities or establishments

Allow ME for certain professionals and limit it in others, for example permitting their usage by police officers, combat troops, rescue workers, doctors and limiting their usage by academics. Others argue that academics have a moral duty to enhance their cognitive abilities in any way possible, including by chemical means.²⁸ Allhoff and co-authors also echo such an obligation when they write about an obligation to enhance.²⁹

The problem though will be how to reconcile such a duty with the freedom to be free to-or-not to enhance. It could be argued that such a duty could lead people in certain professions and activities being coerced to enhance their memories.³⁰ Interestingly, one may question whether society could demand some forms of ME for example dampening traumatic memories for PTSD sufferers, if individuals harbouring such memories were demonstrated to be a danger to society. Furthermore, in some cases, society permits not only involuntary admissions but also compulsory treatments for

²⁴ BOSTROM, N. 2008b. Drugs can be used to treat more than disease [2]. *Nature*, 451, 520.

²⁵ BOSTROM, N. 2008a. Cognitive Enhancement in the Public Interest. In: ZONNEVELD, L., DIJSTELBLOEM, H. & RINGOIR, D. (eds.) *Reshaping the human condition: exploring human enhancement*. The Hague: Rathenau Institute, in collaboration with the British Embassy, Science and Innovation Network and the Parliamentary Office of Science & Technology.

²⁶ SAHAKIAN, B. & MOREIN-ZAMIR, S. 2007. Professor's little helper. *Nature*, 450, 1157-1159.

²⁷ GREELY, H. T. 2006. The social effects of advances in neuroscience: legal problems, legal perspectives. In: ILLES, J. (ed.) *Neuroethics: defining the issues in theory, practice, and policy*. Oxford: Oxford University Press.p.258.

²⁸ QUIGLEY, M. 2008. Enhancing Me, Enhancing You: Academic Enhancement as a Moral Duty. *Expositions: Interdisciplinary Studies in the Humanities*, 2, 157-162.

²⁹ ALLHOFF, F., LIN, P., MOOR, J. & AND WECKERT, J. 2010. Ethics of Human Enhancement: 25 Questions & Answers. *Studies in Ethics, Law, and Technology*, 4:1:4.

³⁰ APPEL, J. M. 2008. When the boss turns pusher: a proposal for employee protections in the age of cosmetic neurology. *Journal of Medical Ethics*, 34, 616-618.

such individuals when it is necessary for their health or safety or for the protection of other persons that they should receive such treatment.³¹

7.1.1.8 Individual autonomy / laissez faire

This is leaving the ME decisions to the individual. Thus, not having it regulated per se. Supporters argue that regulation would hinder our personal freedom and violate our rights to improve our bodies, minds, and lives, as we deem appropriate.^{32 33 34 35} Through this option, ME could be made equally available to all, for example by making memory enhancing drugs free to everyone or by providing subsidies to those who, by some standard, could not afford them.³⁶ This form of self-regulation could also encompass regulating the alleged claims made by pharmaceutical companies regarding particular memory-enhancing agents in order to protect individuals and society from being misled and from potential harms.³⁷ At the same time, it could include regulations against coercion to enhance one's memory and especially in cases of unbalanced relationships like those of employer versus employees.³⁸

Should we regulate ME or not? I suppose following the above discussion, this would depend on the means and the methods applied.³⁹ If we break this down – should we regulate ME through pharmaceutical means? It seems to me that attempts to regulate ME on a local and national level will remain quite limited and ineffective as well. This is because as highlighted above, some of the drugs for ME for example modafinil are already widely available online, which in other words is to

³¹ See Mental Health Act (MHA) 2007 CHAPTER 12, Amendments to MHA 1983 Part 1, chapter four 'supervised community treatment'. *Mental Health Act 2007* [Online]. Available: http://www.legislation.gov.uk/ukpga/2007/12/pdfs/ukpga_20070012_en.pdf [Accessed 01/01/ 2012].

³² HARRIS, J. 2007. *Enhancing evolution: the ethical case for making better people*, Princeton, N.J., Princeton University Press.

³³ NAAM, R. 2005. *More than human: embracing the promise of biological enhancement*, New York, Broadway Books.

³⁴ ALLHOFF, F., LIN, P., MOOR, J. & AND WECKERT, J. 2010. Ethics of Human Enhancement: 25 Questions & Answers. *Studies in Ethics, Law, and Technology*, 4:1:4.

³⁵ BMA 2007. Boosting Your Brainpower: Ethical Aspects of Cognitive Enhancement. *British Medical Association*, London.

³⁶ GREELY, H. T. 2006. The social effects of advances in neuroscience: legal problems, legal perspectives. In: ILLES, J. (ed.) *Neuroethics: defining the issues in theory, practice, and policy*. Oxford: Oxford University Press.p.259.

³⁷ BMA 2007. Boosting Your Brainpower: Ethical Aspects of Cognitive Enhancement. *British Medical Association*, London.p.34.

³⁸ APPEL, J. M. 2008. When the boss turns pusher: a proposal for employee protections in the age of cosmetic neurology. *Journal of Medical Ethics*, 34, 616-618.

³⁹ See TT, 4, 5.

acknowledge that they are available beyond national borders. Individuals can acquire such memory-enhancers while relaxing on their sofa at home. By the same token, even other ME that may require specialized intervention for example from a doctor, if they are not available in one country, individuals may still be able to access them in another country, and this would only create more medical tourists as already highlighted above.

Overall, the regulation options discussed here and found to be inadequate to regulate ME do not mean that we should stop attempting any form of regulation. Many would share the idea that it is important to regulate some medicines so that individuals can get proper advice and protection. Nevertheless, it points out first, to the fact that there will always be those who will ignore whatever regulation is in place and try to circumvent the system. Second, it points out that regulatory options and frameworks need to keep up with this growing areas of technology and medicine.

Perhaps then, if any regulation for ME is to be effective, it may have to take some form of cross-border, regional⁴⁰ or even a global perspective. However, is such a regulatory system across borders, regions and indeed on a global perspective for such controversial and politicized issue as human enhancements feasible? One could imagine some merits of embarking on this route, especially given the global collaborative nature of scientific research. However, while I acknowledge that this is an important issue, the questions of feasibility, merits, and demerits for such a global regulatory framework are far beyond the remit of this thesis, and I will therefore not explore them any further. Besides the questions of regulation, other issues raised against human enhancements are those of coercion and discrimination, which I now turn to.

7.1.2 Privacy and confidentiality

Lifelogging devices such as SenseCam that could be used to enhance our autobiographic memories^{41 42 43} raise issues of privacy and sharing of data.⁴⁴ A

⁴⁰ For example creating some regulatory framework for the European Union, African Union, etc.

⁴¹ BERRY, E., KAPUR, N., WILLIAMS, L., HODGES, S., WATSON, P., SMYTH, G., SRINIVASAN, J., SMITH, R., WILSON, B. & WOOD, K. 2007. The use of a wearable camera, SenseCam, as a pictorial diary to improve autobiographical memory in a patient with limbic encephalitis: a preliminary report. *Neuropsychol Rehabil.* England.

SenseCam is a wearable still camera that automatically (without any user's conscious effort/intervention), keeps a digital record of the events that a person experiences.^{45 46} The user of lifelogging devices captures many photos, some of them unwanted and unintended. Some of these photos will also be taken without the consent of the captured individuals, neither their consent of how these photographs will be used or shared. Such issues and any other risks would need to be identified and managed in order not to hinder ME.

7.1.3 Coercion to use enhancing technologies

Even if freely pursued, human enhancements will impose some special burdens or coercion on parents, individuals, and groups who for religious, philosophical, or other reasons do not want to enhance themselves or their children.⁴⁷ For Fukuyama, if everyone around these parents were enhancing their children, it will be much harder to abstain, for fear of holding their own children back.^{48 49} Even worse, as Kass asserts, is the question of peer pressure: 'if most children are receiving ME or stimulant drugs, failure to provide them for your child might be seen as a form of child neglect.'⁵⁰ Kass perceives the question of peer pressure and coercion as a subtle one as far as enhancements are concerned. He is concerned that although coercion to use enhancing technologies might not happen in liberal democratic states, it could

⁴² HODGES, S., BERRY, E. & WOOD, K. 2011. SenseCam: a wearable camera that stimulates and rehabilitates autobiographical memory. *Memory*, 19, 685-96.

⁴³ HODGES, S., WILLIAMS, L., BERRY, E., IZADI, S., SRINIVASAN, J., BUTLER, A., SMYTH, G., KAPUR, N. & WOOD, K. 2006. SenseCam: A retrospective memory aid. *UbiComp 2006: Ubiquitous Computing*. Springer.

⁴⁴ SELLEN, A. J. & WHITTAKER, S. 2010. Beyond total capture: a constructive critique of lifelogging. *Communications of the ACM*, 53, 70-77.

⁴⁵ HODGES, S., BERRY, E. & WOOD, K. 2011. SenseCam: a wearable camera that stimulates and rehabilitates autobiographical memory. *Memory*, 19, 685-96.

⁴⁶ HODGES, S., WILLIAMS, L., BERRY, E., IZADI, S., SRINIVASAN, J., BUTLER, A., SMYTH, G., KAPUR, N. & WOOD, K. 2006. SenseCam: A retrospective memory aid. *UbiComp 2006: Ubiquitous Computing*. Springer.

⁴⁷ GREELY, H. T. 2006. The social effects of advances in neuroscience: legal problems, legal perspectives. In: ILLES, J. (ed.) *Neuroethics: defining the issues in theory, practice, and policy*. Oxford: Oxford University Press. p.259.

⁴⁸ FUKUYAMA, F. 2002. *Our posthuman future: consequences of the biotechnology revolution*, London, Profile Books Ltd. p.97.

⁴⁹ FUKUYAMA, F., FURGER, F. & JOHNS HOPKINS UNIVERSITY. SCHOOL OF ADVANCED INTERNATIONAL, S. 2006. *Beyond bioethics: a proposal for modernizing the regulation of human biotechnologies*, Washington, D.C., Paul H. Nitze School of Advanced International Studies, Johns Hopkins University.

⁵⁰ KASS, L. Beyond Therapy: Biotechnology and the Pursuit of Human Improvement. Paper presented to *The President's Council on Bioethics*, 2003 Washington, DC.

happen not only in tyrannical states but also in despotic families.⁵¹ Moreover, enhancement technologies of the future will be likely to be used in slavish adherence to certain socially defined and merely fashionable notions of ‘excellence’ or improvement, hence leading to conformity and homogenization.^{52 53}

Greely has claimed that while it may seem straightforward to say that the legal system should prohibit anyone from being compelled to use enhancing technologies, implementing that goal might prove difficult. For in some cases we may want to allow compelled enhancements for example, use of alertness drugs for physicians on night call to promote patients safety and use of similar drugs by long-distance pilots.⁵⁴

7.1.4 Discrimination of the unenhanced

I have already highlighted similar claims above, while discussing issues of justice. From a legal and policy issue perspective, these are claims that allowing some forms of human enhancements, would lead to intolerance of the unenhanced and especially people with disabilities.^{55 56} Disability groups and their sympathisers have been in the forefront of advancing such claims against pursuits of human enhancements. While most of these claims have focused on genetic enhancements and the infamous ‘designer babies’, their principles are applicable to desisting ME. Thus, critics for ME could for example claim that allowing people to enhance their memories will lead to devaluing those with memory loss and suffering from dementia. A rebuttal by Savulescu to McKibben⁵⁷ (when he argues above that enhancements would lead to an underclass of the unenhanced), would be sufficient here as well to lay such unwarranted claims to rest. Savulescu writes:

⁵¹ Ibid.

⁵² Ibid.

⁵³ AGAR, N. 2004. *Liberal eugenics: in defence of human enhancement*, Oxford, Blackwell Publishing.p.46.

⁵⁴ GREELY, H. T. 2006. The social effects of advances in neuroscience: legal problems, legal perspectives. In: ILLES, J. (ed.) *Neuroethics: defining the issues in theory, practice, and policy*. Oxford: Oxford University Press.p.258.

⁵⁵ MCKIBBEN, B. 2004. *Enough: genetic engineering and the end of human nature*, London, Bloomsbury.pp.39-40.

⁵⁶ HARRIS, J. 2007. *Enhancing evolution: the ethical case for making better people*, Princeton, N.J., Princeton University Press.pp.86-108.

⁵⁷ MCKIBBEN, B. 2004. *Enough: genetic engineering and the end of human nature*, London, Bloomsbury.pp.39-40.

We have free will and a sense of responsibility; it is up to us how we choose to use this technology and how we treat those who are not enhanced. Which laws and policies we form to protect the opportunities of the unenhanced is up to us. Whether someone is treated with concern and respect is completely independent of their biology – enhanced or unenhanced. It is a function of our attitudes and motivation to treat others with concern and respect. Discrimination is our choice – not written into biology.⁵⁸

7.1.5 Other specific legal issues

Other particular issues to the ME debate are legal issues specific to MD and which I discuss in detail in the papers – see footnotes for cross-reference of where the issue is discussed. Thus, it suffices just to outline them here, they include:

7.1.5.1 Consent and informed consent issues

Prior to beginning medical procedures, healthcare personnel are required to make certain disclosures to the patients to enable them to weigh out the costs, benefits, and risks of undergoing such a procedure. The concern here in the ME debate and specifically MD, is assessing whether the issues of informed consent would be fulfilled prior to MD, especially because initial research had indicated that beta blockers would have to be prescribed to the patient within a limited time, for them to be effective.⁵⁹

7.1.5.2 Obstruction of justice/perverting the course of justice issues

The legal issue here is evaluating whether those who dampened their memories could be said to be perverting the course of justice, especially if their memories could be required in a court of law for testimony purposes.⁶⁰

7.1.5.3 Mitigation of emotional distress damages

This is about the law deciding on the reasonableness of decisions to carry out certain actions or refusing to do so. The issue here would be to assess for example whether a claimant who refused to dampen his memory against a psychiatrist's advice, could

⁵⁸ SAVULESCU, J. 2006. Justice, Fairness, and Enhancement. *Annals of the New York Academy of Sciences*, 1093, 321-338.

⁵⁹ TT, 10.2.1.

⁶⁰ TT, 10.3.

still be compensated by the defendant for the emotional distress that could have been prevented, if the claimant adhered to the advice.⁶¹

7.1.5.4 Negligence issues

Negligence claims for failure to treat PTSD – these claims would arise when doctors failed to dampen patients’ traumatic memories and when they dampened some memories that they should have left alone.⁶²

7.1.5.5 Individual versus society interests

This is when we have to evaluate under what circumstances we have to overcome individuals’ interests for dampening their memories, for the greater good of societies’ interests in memory preservation.⁶³ I will explore some of these specific legal issues in the next part, together with other specific ethical issues already highlighted in chapter six above.

⁶¹ TT, 10.4.

⁶² TT, 10.5.

⁶³ TT, 8.4, 9.7.1.

Part III: Papers

Chapter 8

8 Optimum memory: the ultimate prize for memory manipulation

8.1 Abstract

Recently, researchers have shown an increased interest in memory enhancement (ME). One of the most exciting aspects of ME is memory dampening (MD), which refers to the technological and pharmacological possibility of modifying what we remember and how we remember it. While commentators have highlighted the moral and legal reasons for and against MD, so far, there has been little discussion about the ultimate aim of ME and the focus of this paper, MD. Here, I fill this gap and argue that an ‘optimum memory’ is what we should be aiming for, as the ultimate prize for memory manipulation in order to enhance our well-being. Individuals should be free to dampen their memories, regardless of whether they are negative or positive in order to achieve an optimum memory that would foster their well-being.

8.2 Introduction

In the last decade, the debate on MD has focussed on the ethical and legal implications arising from MD. Increasingly, proponents have made a case for MD or memory attenuation¹ for the prevention of Post Traumatic Stress Disorder (PTSD). By contrast, critics have opposed ME, MD and all other memory enhancing technologies resting amongst other on one of the premises that ‘more’ or ‘superior’ memory is not necessarily good for us. However, so far, there has been little discussion about the ultimate aim of ME and specifically MD, which is the subject of this paper. Often critics of ME quote studies of the Russian mnemonist Shereshevskii,² the case of AJ,³ a woman whose remembering dominates her life, her memory is ‘nonstop, uncontrollable, and automatic’ and the character of Jorge Luis

¹ I use the words memory dampening and memory attenuation synonymously in this paper.

² PCBE 2003. Beyond Therapy: Biotechnology and the Pursuit of Happiness. *The President's Council on Bioethics*. Washington, D.C.p.218.

³ PARKER, E. S., CAHILL, L. & MCGAUGH, J. L. 2006. Case of Unusual Autobiographical Remembering. *Neurocase*, 12, 35–49.

Borges ‘Funes, the Memorious,’⁴ as examples of why ME should not be allowed. Their standard claim is that these individuals had more or superior memory yet they could not live a better life with it. In this paper, I assess this claim and other arguments raised against ME – specifically MD and argue that they fail to justify its restrictions. I take a further step and argue that individuals should be free to dampen not only negative memories associated with diseases, but also other positive memories in order to achieve an optimum memory and in doing so improving their well-being. Some examples of positive memories that one could choose to dampen are first, some holiday events that Jack enjoyed together with his wife when they were still married, but given the circumstances now that they are divorced, Jack opts to dampen these memories regardless of how positive they were while he was still married. Second, prior to Jo getting married, she had enjoyed several sexual relationships and had a wide collection of videos and photographs that enhanced her memory of these relationships. However, after getting married, overall, Jo opts not only to dampen her memory of these past relationships, but also to destroy her collection of videos and photographs that could remind her of the past relationships. Third, after sex reassignment, Paula might wish to break with aspects of the opposite-sexed prior self.⁵

Throughout this paper, the term ‘well-being’ refers to our general health and happiness, and I take an ‘optimum memory’ to refer to the best possible memory that fosters the individual’s well-being. An optimum memory would enable an individual to remember well and at the right pitch. Remembering:

neither too much, engulfing us in trivia or imprisoning us in the past, nor too little, losing track of life’s defining moments or of knowledge needed for everyday life; neither with too much emotion, allowing past misfortunes to haunt or consume us, nor with too little emotion, recalling what is joyful, or horrible, or inconsequential, all with the same monotone affect.⁶

⁴ BORGES, J. 1964. *Labyrinths: selected stories & other writings*, New Directions Pub. Corp.

⁵ ALLEN, A. L. 2008. Dredging up the past: Lifelogging, Memory, and Surveillance. *The University of Chicago Law Review*, 75, 47-74.

⁶ PCBE 2003. Beyond Therapy: Biotechnology and the Pursuit of Happiness. *The President's Council on Bioethics*. Washington, D.C.p.219.

Contrary to the common assumption in the enhancements debate that ‘more is better’,⁷ an optimum memory is not limited to having ‘more’ memory, it could be ‘less’, through the practice of MD. An optimum memory as proposed in this paper and indeed throughout the thesis is limited to an individual’s perception and thus differs from one individual to another.⁸

Memory dampening/memory attenuation refer to the technological and pharmacological possibility to modify what we remember and how we remember it. However, in this paper, I address only the pharmacological option because some research has already been carried out in some clinical settings in this area.^{9 10 11} In the paper, I use MD to refer to two things: firstly, to the use of beta blockers for example, propranolol to diminish the highly emotionally charged memories associated with trauma, in order to prevent the development of Post Traumatic Stress Disorder (PTSD) and other stress related mental injuries. I describe this in the paper as negative memories and there has been some initial research carried out in some clinical settings in this area. Secondly, I use MD to refer to any other pharmaceutical means (post-propranolol or its more potent successor) that could diminish not only negative but also positive memories – this is futuristic and currently has not yet been demonstrated in the clinical setting. Examples of positive memories identified above through Jack, Jo, and Paula would suffice here. Notice also that in this paper MD is a form of ME. Other drugs targeting MD discussed in the literature include: mifepristone,¹² zeta inhibitory peptide (ZIP),^{13 14} midazolam, and propofol.^{15 16 17}

⁷ For example in sports weightlifting, rugby, and boxing, people often think of more muscles as being better. In cosmetic surgery and beauty industry the presumption that augmented breast and penis are better.

⁸ MENUZ, V., HURLIMANN, T. & GODARD, B. 2013. Is human enhancement also a personal matter? *Sci Eng Ethics*, 19, 161-77.

⁹ PITMAN, R. K., SANDERS, K. M., ZUSMAN, R. M., HEALY, A. R., CHEEMA, F., LASKO, N. B., CAHILL, L. & ORR, S. P. 2002. Pilot study of secondary prevention of posttraumatic stress disorder with propranolol. *Biological Psychiatry*, 51, 189-192.

¹⁰ VAIVA, G., DUCROCQ, F., JEZEQUEL, K., AVERLAND, B., LESTAVEL, P., BRUNET, A. & MARMAR, C. R. 2003. Immediate treatment with propranolol decreases posttraumatic stress disorder two months after trauma. *Ibid.* 54, 947-949.

¹¹ STRANGE, B. A., HURLEMANN, R. & DOLAN, R. J. 2003. An emotion-induced retrograde amnesia in humans is amygdala- and β -adrenergic-dependent. *Proceedings of the National Academy of Sciences of the United States of America*, 100, 13626-13631.

¹² WILLYARD, C. 2012. Remembered for Forgetting. *Nat Med*, 18, 482-484.

¹³ *Ibid.*

¹⁴ KOLBER, A. 2011. Neuroethics: Give memory-altering drugs a chance. *Nature*, 476, 275-276.

¹⁵ *Ibid.*

When stress hormones like adrenaline and norepinephrine are elevated, new memories are consolidated more firmly, making the recollection of emotionally charged events vivid. When one takes propranolol, it interferes with the stress hormone levels and prevents destructive memories from taking hold.¹⁸ This could possibly interfere with the consolidation of highly emotional positive memories as well as negative ones.^{19 20 21} Thus, both traditional²² and other methods of ME do not discriminate between those who are sick, for example those who suffer from PTSD, and from those who are not.

If the methods and means do not discriminate, why do we? Various ethical and/or legal reasons have been suggested in enhancement literature, for example, issues of safety, fairness, coercion, effectiveness, and informed consent. Because I have addressed these issues elsewhere²³ and they have already received wide coverage in the enhancement debate,^{24 25 26 27 28 29 30 31} I will not explore them here any further.

¹⁶ VESELIS, R. A. 2006. The remarkable memory effects of propofol. *British Journal of Anaesthesia*, 96, 289-291.

¹⁷ VESELIS, R. A., PRYOR, K. O., REINSEL, R. A., LI, Y., MEHTA, M. & JOHNSON, R., JR. 2009. Propofol and Midazolam Inhibit Conscious Memory Processes Very Soon after Encoding: An Event-related Potential Study of Familiarity and Recollection in Volunteers. *Anesthesiology*, 110.

¹⁸ MILLER, G. 2004. Learning to Forget. *Science*, 304, 34-36.

¹⁹ KOLBER, A. 2006. Therapeutic Forgetting: The Legal and Ethical Implications of Memory Dampening. *Vanderbilt Law Review*, 59, pp.1561- 1626.

²⁰ SCHACTER, D. 17/10/2002. *Session 4: Remembering and Forgetting: Psychological Aspects* [Online]. The President's Council on Bioethics. Available: <http://bioethics.georgetown.edu/pcbe/transcripts/oct02/session4.html> [Accessed 01/02/ 2010].

²¹ James L. McGaugh made this comment during the President's Council on Bioethics meeting held on 17/02/2002 in Washington, D.C. "But there's something else that I didn't emphasize, and I should put in the equation. This thing works equally well for good things that happen, as well as for bad things. So, I think when we think of the strong memory's persistence, I'm sure that Nobel Prize winners remember what they were doing – well, in the U.S. most of them were sleeping, but where they were and what they were doing when they got the call of winners and prizes. Anything as much coveted, you remember birthdays, weddings, and all of these kinds of things; they stand out."

²² This ranges from nutrition, physical exercises, sleep, computers to brain stimulation. See TT, 4.2.

²³ TT, 6, 6.3.

²⁴ KOLBER, A. 2006. Therapeutic Forgetting: The Legal and Ethical Implications of Memory Dampening. *Vanderbilt Law Review*, 59, pp.1561- 1626.

²⁵ DONOVAN, E. 2010. Propranolol use in the prevention and treatment of posttraumatic stress disorder in military veterans: Forgetting therapy revisited. *Perspectives in Biology and Medicine*, 53, 61-74.

²⁶ HURLEY, E. A. 2010. Combat Trauma and the moral risks of memory manipulating drugs. *Journal of Applied Philosophy*, 27, 221-245.

²⁷ GREELY, H., SAHAKIAN, B., HARRIS, J., KESSLER, R. C., GAZZANIGA, M., CAMPBELL, P. & FARAH, M. J. 2008. Towards responsible use of cognitive-enhancing drugs by the healthy. *Nature*, 456, 702-705.

²⁸ PCBE 2003. Beyond Therapy: Biotechnology and the Pursuit of Happiness. *The President's Council on Bioethics*. Washington, D.C.

Instead, I will embark on some other multidisciplinary positions that some commentators have appealed to, and if successful, these positions would threaten the pursuit of ME. This would be inimical to the ultimate benefit of ME – the optimum memory as proposed on this paper. These positions are: (1) Appealing to distinctions between: enhancement/therapeutic, normal/non-normal, species-typical functioning (2) MD results in the loss of epistemic access (3) MD results in a change of personality and identity (4) the presumption that the more of a good thing the better. I will devote the rest of the paper to examining these positions and to demonstrating why they fail as a case against MD. At the same time, while rejecting these positions, I will establish that an optimum memory is what we aim for – the ultimate prize for ME. This could be achieved through ME and this is not limited to having ‘more’ memory, it could be ‘less’, through the practice of MD.

8.3 Appealing to distinctions: enhancement/therapeutic, normal/non-normal, species-typical functioning

Creation of the above distinctions has been at the centre of the enhancement debate for the last decade. Both proponents^{32 33 34 35 36 37 38 39 40 41 42 43 44 45} and critics have

²⁹ HARRIS, J. 2007. *Enhancing evolution: the ethical case for making better people*, Princeton, N.J., Princeton University Press.

³⁰ CHATTERJEE, A. 2006. The promise and predicament of cosmetic neurology. *Journal of Medical Ethics*, 32, 110-113.

³¹ DE JONGH, R., BOLT, I., SCHERMER, M. & OLIVIER, B. 2008. Botox for the brain: enhancement of cognition, mood and pro-social behavior and blunting of unwanted memories. *Neuroscience and Biobehavioral Reviews*, 32, 760-776.

³² HARRIS, J. 2007. *Enhancing evolution: the ethical case for making better people*, Princeton, N.J., Princeton University Press.

³³ BOSTROM, N. & ROACHE, B. R. 2007. Ethical Issues in Human Enhancement. In: RYBERG, J., PETERSEN, T. & WOLF, C. (eds.) *New Waves in Applied Ethics*. New York: Palgrave Macmillan.

³⁴ SAVULESCU, J. 2007. Genetic Interventions and the Ethics of Enhancement of Human Beings. In: STEINBOCK, B. (ed.) *The Oxford Handbook of Bioethics*. Oxford: Oxford University Press.

³⁵ BUCHANAN, A. E. 2011. *Beyond Humanity?: The Ethics of Biomedical Enhancement*, Oxford, Oxford University Press.

³⁶ BUCHANAN, A. E., BROCK, D. W., DANIELS, N. & WIKLER, D. 2000. *From chance to choice: genetics and justice*, Cambridge, Cambridge University Press.

³⁷ AGAR, N. 2004. *Liberal eugenics: in defence of human enhancement*, Oxford, Blackwell Publishing.

³⁸ KASS, L. Beyond Therapy: Biotechnology and the Pursuit of Human Improvement. Paper presented to *The President's Council on Bioethics*, 2003 Washington, DC.

³⁹ BUCHANAN, A. E., BROCK, D. W., DANIELS, N. & WIKLER, D. 2000. *From chance to choice: genetics and justice*, Cambridge, Cambridge University Press.

⁴⁰ SANDEL, M. J. 2004. The Case Against Perfection. *The Atlantic Monthly*, 293, 251-263.

⁴¹ SANDEL, M. J. 2007. *The case against perfection: ethics in the age of genetic engineering*, Cambridge, Massachusetts, Belknap Press of Harvard University Press.

⁴² SELGELID, M. J. 2007. An Argument against Arguments for Enhancement. *Studies in Ethics, Law, and Technology*, 1:1:12.

used these distinctions to further their side of the debate, almost leading to a stalemate. Still, some have attempted to bridge the gap between the critics and opponents, arguing that both agree on some fundamental issues – but they are often talking against each other.^{46 47} In this paper, I demonstrate why the appeal to this distinction cannot successfully be used to oppose MD.

Critics of enhancements have continued to cite these distinctions to formulate their arguments against enhancements. Thus, for example, when considering the case for dampening both positive and negative memories, critics could invoke such distinctions and claim that we cannot allow dampening of positive memories, for it is not therapeutic and it is a departure from normality and normal species-typical functioning.

However, the enhancement/therapy distinction has widely been disputed and its inconsequential ramifications exposed.^{48 49 50 51 52} In a seminal book on these matters, John Harris has rendered the most persuasive case for why we ought to let go the enhancement/therapy distinction. Harris defines the term enhancement as ‘clearly anything that makes a change, a difference for the better’.⁵³ Harris argues that you cannot plausibly define enhancements as relative to normalcy, to normal species functioning, nor to species-typical functioning. For Harris, the overwhelming moral imperative for both therapy and enhancement is to prevent harm and to confer

⁴³ KAMM, F. M. 2005. Is there a problem with enhancement? *American Journal of Bioethics*, 5, 5 – 14.

⁴⁴ DANIELS, N. 2000. Normal Functioning and the Treatment-Enhancement. *Cambridge Quarterly of Healthcare Ethics*, 309-322.

⁴⁵ DANIELS, N. 1985. *Just Health Care*, Cambridge University Press.

⁴⁶ PARENS, E. 2010. The ethics of memory blunting and the narcissism of small differences. *Neuroethics*, 3, 99-107.

⁴⁷ PARENS, E. 2005. Authenticity and Ambivalence: Toward Understanding the Enhancement Debate. *The Hastings Center Report*, 35, 34-41.

⁴⁸ PCBE 2003. Beyond Therapy: Biotechnology and the Pursuit of Happiness. *The President's Council on Bioethics*. Washington, D.C.

⁴⁹ DE JONGH, R., BOLT, I., SCHERMER, M. & OLIVIER, B. 2008. Botox for the brain: enhancement of cognition, mood and pro-social behavior and blunting of unwanted memories. *Neuroscience and Biobehavioral Reviews*, 32, 760-776.

⁵⁰ BOSTROM, N. & ROACHE, B. R. 2007. Ethical Issues in Human Enhancement. In: RYBERG, J., PETERSEN, T. & WOLF, C. (eds.) *New Waves in Applied Ethics*. New York: Palgrave Macmillan.

⁵¹ HARRIS, J. 2009. Enhancements are a moral obligation. In: SAVULESCU, J. & BOSTROM, N. (eds.) *Human Enhancements*. Oxford: Oxford University Press.

⁵² BOSTROM, N. & ROACHE, B. R. 2007. Ethical Issues in Human Enhancement. In: RYBERG, J., PETERSEN, T. & WOLF, C. (eds.) *New Waves in Applied Ethics*. New York: Palgrave Macmillan.

⁵³ HARRIS, J. 2007. *Enhancing evolution: the ethical case for making better people*, Princeton, N.J., Princeton University Press.p.36.

benefit; and it is unimportant whether you classify the protection or benefit conferred as enhancement or improvement, protection or therapy. According to Harris, because the enhancement/therapy distinction fails to capture the moral purposes for which both therapy and enhancement standardly and most appropriately are applied, nor does it serve to identify the permissibility/impermissibility of the interventions, we ought to let it go.^{54 55}

Savulescu has maintained that the therapy/enhancement distinction is indefensible; arguing that what matters is human well-being, not only the treatment and prevention of disease. According to Savulescu, because we already accept environmental interventions to improve ourselves through education, diet, and training, striving to become better people and increase our opportunities in life – to be consistent, we should also accept biological manipulations, for there is no moral difference between these interventions.⁵⁶

Moreover, society allows people to abandon things, properties, ideals, etc, that they no longer want to have or keep. Likewise, it allows people to separate from those they no longer want to live with, despite the fact that such break-up could arguably be detrimental to those involved. Interestingly and perhaps relevant to MD, society allows individuals to get rid of some parts of their bodies, regardless of whether they are un/healthy, for example, through surgery, organ donations, circumcision, and other bodily mutilations. The interesting question is then, whether MD fits within any of these categories, as a property, a body part, a bodily function, an ideal, or whether it has its own domain. Whose memory is it anyway? Is my memory my own or is it a part of the fabric of the society? These questions, whilst interesting, are not within the scope of this paper.

Thus, it is conceivable after a bitter divorce or break-up to see couples shredding photographs, relocating, emigrating, and trying to do everything possible to forget their past memories, regardless of these being either negative or positive. However,

⁵⁴ Ibid.p.58.

⁵⁵ HARRIS, J. 2009. Enhancements are a moral obligation. *In*: SAVULESCU, J. & BOSTROM, N. (eds.) *Human Enhancements*. Oxford: Oxford University Press.

⁵⁶ SAVULESCU, J. 2007. Genetic Interventions and the Ethics of Enhancement of Human Beings. *In*: STEINBOCK, B. (ed.) *The Oxford Handbook of Bioethics*. Oxford: Oxford University Press.

it is plausible to foresee an injunction against destroying such photographs, if they were to be viewed as evidence for the divorce court. As some initial research has indicated, some non-selective beta blockers like propranolol can attenuate highly charged emotions associated with our memories. Compare the actions of two individuals. The first shreds photographs, destroys video clips, destroys any other information that might trigger his past memories and even relocates to start afresh. The second one ingests propranolol or its potent successor. Both aim to attenuate their memories. If we overcome issues of safety and effectiveness in the second, and if there are no relevant moral differences between their actions, why would one accept the former and reject the latter? To be consistent, we would have to allow both. We cannot consistently permit the former and reject the latter based simply on the irrelevant negative-positive distinctions.

Since I accept that Harris, Savulescu, Bostrom and Roache⁵⁷ have succeeded in convincingly rejecting the above therapy/enhancement distinctions, I will not explore these distinctions any further. Instead, I will examine the claim that MD results in a loss of epistemic access.

8.4 Memory dampening results in the loss of epistemic access

This is the concern that:

We should worry about propranolol's effect of severing memories of traumatic events from the emotions that would ordinarily accompany them because it seems to result in the permanent loss of epistemic access to certain information about those past occasions, namely, to their evaluative significance as registered by the emotions experienced by the time.⁵⁸

Liao and Wasserman⁵⁹ also echo this claim in their response to Henry et al, paper⁶⁰ about memory dampening to prevent PTSD, they write:

⁵⁷ BOSTROM, N. & ROACHE, B. R. 2007. Ethical Issues in Human Enhancement. *In*: RYBERG, J., PETERSEN, T. & WOLF, C. (eds.) *New Waves in Applied Ethics*. New York: Palgrave Macmillan.

⁵⁸ HURLEY, E. A. 2007. The moral costs of prophylactic propranolol. *American Journal of Bioethics*, 7, 35-36.

⁵⁹ LIAO, S. M. & WASSERMAN, D. T. *Ibid.* Neuroethical concerns about moderating traumatic memories. 38-40.

⁶⁰ HENRY, M., FISHMAN, J. R. & YOUNGNER, S. J. *Ibid.* Propranolol and the prevention of post-traumatic stress disorder: Is it wrong to erase the "sting" of bad memories? , 12-20.

...Henry et al, overlook many of the important issues regarding memory modification including the value of memory for knowledge... One issue is that modifying our memories may affect what we believe to be true about the world and about ourselves. In particular, memories serve as some sort of epistemic evidence for events that have transpired and for one's roles in those events. If we modify our memories in certain ways, we may alter what we believe to be true about these events.

The President's Council on Bioethics (PCBE) in *Beyond Therapy* reaffirms this.⁶¹ There are two forms of knowledge that one may sympathise with these commentators regarding MD to prevent PTSD.

(a) First, assuming that there is a crime involved, blunting such knowledge may hinder some investigation or deprive the prosecutors of some invaluable information.⁶² Additionally, in some circumstances, such as an airplane crash, tsunami, or other natural disasters, then dampening would deprive society of some invaluable information for preparing for future disasters as well as for instituting social change.⁶³ However, this is not persuasive and even Liao and Wasserman acknowledge this.⁶⁴ For on the one hand, there are alternative means for preserving such knowledge (for example through tape/video recorders, written notes and journals) without inflicting suffering on those having PTSD. On the other hand, not all PTSD results from crime and violence, circumstances which require redress or the administration of justice. For example, some PTSD arises from self-inflicted accidents and natural disasters.

(b) Second, that the PTSD sufferer,⁶⁵ by modifying their memory deprives themselves of some knowledge of how they might act when confronted with similar

⁶¹ PCBE 2003. *Beyond Therapy: Biotechnology and the Pursuit of Happiness. The President's Council on Bioethics*. Washington, D.C.pp225-228.

⁶² KOLBER, A. 2006. Therapeutic Forgetting: The Legal and Ethical Implications of Memory Dampening. *Vanderbilt Law Review*, 59, pp.1561- 1626.

⁶³ TENENBAUM, E. M. & REESE, B. 2007. Memory-altering drugs: Shifting the paradigm of informed consent. *American Journal of Bioethics*, 7, 40-42.

⁶⁴ LIAO, S. M. & WASSERMAN, D. T. Ibid.Neuroethical concerns about moderating traumatic memories. 38-40.

⁶⁵ Notice that in this paper it could be anyone with or without PTSD.

situations in the future.⁶⁶ Again, this is not convincing. Firstly, defenders of this view need to demonstrate why one would reasonably choose to continue suffering through the knowledge of some past events as opposed to alleviating it, on the basis that doing so, might deny the sufferer some knowledge of what to do in case of similar future events which may or may never occur at all. Second, the advocates need to defend their presumption that knowledge of the past is a necessary and sufficient condition for current or future actions. However, this is not that obvious. Having knowledge of some past events maybe important, but it is not automatic that it will guide us in our current actions and future undertakings.

Furthermore, what is the purpose of knowledge? Is all knowledge worth keeping, no matter how harmful and inconsequential it is to the beholder? If not all knowledge for all the people, at least, all knowledge for the sufferers of PTSD. Though not explicitly put that way, this is implied through the claim that those who dampen their memories using propranolol risk the loss of epistemic access. However, to claim and/or assume that all knowledge is worth retaining, (specifically for PTSD sufferers), regardless of how detrimental or negative it is, seems absurd to me. For it seems to contradict the actions that reasonable people ordinarily take when confronted with harmful events or decisions. This claim is similar to saying that if one got a bite from a mosquito today and consequently contracted malaria; that, instead of worrying about the cure⁶⁷ for this malaria, he should be worrying about how he might lose the epistemic access/experience of mosquito bites, causes, and effects of malaria. Fortunately, drugs for curing malaria do not attenuate the epistemic access/experience of mosquito bites, in the way that those for curing PTSD do. However, even if they did, it would be difficult to see the rationale of choosing the retention of that knowledge over the curing of malaria.

One could object that you might have reasons to re-awaken the memories after the drug so that you would protect yourself from the bites in the future. However, as argued above, first it is not obvious that the fact that you have these memories means that you will act upon them to prevent the bites. Second, perhaps you may never

⁶⁶ LIAO, S. M. & WASSERMAN, D. T. 2007. Neuroethical concerns about moderating traumatic memories. *American Journal of Bioethics*, 7, 38-40.

⁶⁷ Supposing that drugs curing malaria have some dampening side effects.

have these bites in the future. Third, perhaps dampening pathological memories could be justified on the ground that a life of psychic suffering is worse than the loss of episodic emotional memory.⁶⁸ Finally, maybe the worst could even happen – death caused by malaria as you try to preserve your epistemic access and the memories associated with it.

Moreover, it is even questionable what value of knowledge (if any) would one find in such a sufferer of PTSD, if the sufferings have already paralysed the knowledge? The presumption here is that such knowledge and specifically the knowledge lost through MD has intrinsic value.⁶⁹ However, this is strange to think that sufferers of PTSD should prioritise retaining detrimental and harmful knowledge that has resulted in their PTSD over the cure of PTSD and promotion of their well-being. Defenders of this position need to remember that when we take drugs to fight malaria, HIV-Aids, cancer and any other harmful diseases, we do so to get rid of these diseases for they are detrimental to our health and consequently to our well-being. PTSD is no different. Although PTSD may not be as harmful as these diseases in terms of killing millions of people, it still debilitates and all things being equal we should strive to prevent and cure it whenever possible. Notice that my charge is not about the value of memory for knowledge in general, but rather, about some specific knowledge that results from traumatic memories and is harmful to the bearer.

8.5 Memory dampening results in a change of personal identity and personality

Elliott^{70 71 72} and the now disbanded former President's Council on Bioethics⁷³ claim that use of psychopharmaceuticals such as Prozac threatens personal identity and authenticity. In Elliott's own words, he says 'It would be worrying if Prozac altered my personality, even if it gave me a better personality, simply because it isn't my

⁶⁸ GLANNON, W. 2006. Psychopharmacology and memory. *Journal of Medical Ethics*, 32, 74-78.

⁶⁹ ROSENBERG, L. B. 2007. Necessary forgetting: On the use of propranolol in post-traumatic stress disorder management. *American Journal of Bioethics*, 7, 27-28.

⁷⁰ ELLIOTT, C. 2007. Against happiness. *Medicine, health care, and philosophy*, 10, 167-171.

⁷¹ ELLIOTT, C. 1998. The Tyranny of Happiness: Ethics and Cosmetic Psychopharmacology. In: PARENS, E. (ed.) *Enhancing Human Traits: Ethical and Social Implications*. Washington: Georgetown University Press.

⁷² ELLIOTT, C. & KRAMER, P. D. 2004. *Better Than Well: American Medicine Meets the American Dream*, W. W. Norton, pp.257-258.

⁷³ PCBE 2003. Beyond Therapy: Biotechnology and the Pursuit of Happiness. *The President's Council on Bioethics*. Washington, D.C. pp.128, 151-154, 239.

personality.’⁷⁴ In contrast, Kramer⁷⁵ and Degrazia⁷⁶ claim that use of such drugs promotes one’s personality, helping people to become who they really are. In the light of this debate, Bolt and Schermer⁷⁷ did some empirical studies to see whether they could shed any new insights on the question of whether psychopharmaceuticals enhance identity. Their studies focused on 1 to 1½ hour-long interviews of 19 adults with ADHD, whose answers could be taken to represent the adult ADHD sufferers. Three adults out of the 19 interviewed were not taking Ritalin. In summary, here are the results:

(a) That most of the respondents appeared to have difficulties separating their personality or character from their disorder. (b) That most of the respondents felt that medication changed their personality or their self to some degree. One respondent could therefore keep a job for more than ½ a year. (c) Others felt that they became less themselves, less authentic while on medication and hence, avoided medication. (d) One respondent felt indifferent and cynical and used medication only for certain jobs or activities. (e) Influence on friends – use of medication led to loss of friends, as mentioned by two respondents. (f) One respondent did not want societal pressure to conform to a uniform ideal of personality. (g) Others described positive effects of medication – they felt more themselves. (h) Others responded that medication did not influence their personality at all.⁷⁸

Do any of the eight statements above from 19 adults with ADHD give us any rationale for rejecting the use of psychopharmaceuticals to enhance our memories or to promote our well-being because doing so, threaten our personality? Bolt and Schermer are conscious of how limited their studies are and thus claim ‘...the threat to personal identity and authenticity cannot be resolved by merely referring to empirical research. In order to answer this question we need concepts for personal

⁷⁴ ELLIOTT, C. 1998. The Tyranny of Happiness: Ethics and Cosmetic Psychopharmacology. In: PARENS, E. (ed.) *Enhancing Human Traits: Ethical and Social Implications*. Washington: Georgetown University Press.

⁷⁵ KRAMER, P. D. 1997. *Listening to Prozac*, New York, Penguin Books.

⁷⁶ DEGRAZIA, D. 2000. Prozac, Enhancement, and Self-Creation. *The Hastings Center Report*, 30, 34-40.

⁷⁷ BOLT, I. & SCHERMER, M. 2009. Psychopharmaceutical enhancers: Enhancing identity? *Neuroethics*, 2, 103-111.

⁷⁸ Ibid.

identity and authenticity.⁷⁹ They then proceed to discuss two philosophical views of personal identity, authenticity, and self. On the one hand, the self-control view elaborated by Frankfurt⁸⁰, whereby according to him what is distinctive of human beings, is that they do not only have desires and motives that move them to do things, but that they want to have certain desires and motives. In case of conflicting desires, they are not simply led by the strongest desire, but they have the capacity to 'take sides'. And on the other hand the self-expression view by Schechtman,⁸¹ whereby according to her the self-control view provides a legitimate view on what it means for a person to be herself, but it fails to fully capture what it means to be oneself, since being oneself also involves expressing one's nature and, interestingly, self-control can sometimes prevent this.⁸² Through this discussion, Bolt and Schemer hope that they will contribute to a better understanding whether and in which cases personal identity and authenticity are threatened by psychopharmacology. Finally, they tell us that both views do not endanger authenticity and we need to balance them to understand fully what it means to be really oneself.⁸³

How then do we resolve the claim that MD results in change of personality? There are three ambiguous presuppositions underlying this claim. First, that either our personality is too good to be changed/improved. Second, that either/or/and, because our personality is good for us, if left to its own devices, our personality will continue to be good for us. Third, that even if we allowed any changes to our personalities, that psychopharmacological drugs will not be amongst the morally acceptable tools to accomplish such changes, and consequently they should be excluded. Harris⁸⁴ ⁸⁵ and Caplan⁸⁶ have already exposed the ambiguity of similar claims often made about evolution and the preservation of the human genome. However, none of these ambiguous presuppositions are plausible to warrant the rejection of MD. Consider

⁷⁹ Ibid.

⁸⁰ FRANKFURT, H. G. 1988. *The Importance of What We Care About: Philosophical Essays*, Cambridge, Cambridge University Press.

⁸¹ SCHECHTMAN, M. 2004. Self-Expression and Self-Control. *Ratio*, 17, 409-427.

⁸² BOLT, I. & SCHERMER, M. 2009. Psychopharmaceutical enhancers: Enhancing identity? *Neuroethics*, 2, 103-111.

⁸³ Ibid.

⁸⁴ HARRIS, J. 2007. *Enhancing evolution: the ethical case for making better people*, Princeton, N.J., Princeton University Press, pp.34-40.

⁸⁵ HARRIS, J. 2009. Enhancements are a moral obligation. In: SAVULESCU, J. & BOSTROM, N. (eds.) *Human Enhancements*. Oxford: Oxford University Press.

⁸⁶ CAPLAN, A. 2006. Is it wrong to try to improve human nature? In: MILLER, P. & WILSDON, J. (eds.) *Better Humans? The politics of human enhancement and life extension*. Demos, London.

the case of education. The pursuit of education is ubiquitous and its gigantic impact on our way of thinking is widely known. Education has long-term effects (debatably some are even negative) on one's identity and personality. Quite often education makes someone think beyond his or her culture and transcend some boundaries that one would never have imagined ever crossing. This is, to say the least, altering one's personality and one's way of looking at things. Thus, it is indubitable that education alters our personality. Despite this, education is not only accepted but it is obligatory in many modern societies. I am yet to come across any modern society that rejects education based on fear of changing personality. Faith and religion could be other examples of this nature. They all alter and shape whatever we are and whatever we become. In the absence of clear relevant moral differences between personality altered by education, religion, faith, and environment and personality altered by pharmacological drugs, we should be hesitant of widely accepting the former and rejecting the latter.⁸⁷ For without witnessing the torment of unremitting post-traumatic stress disorder, it is easy to exaggerate the benefits of holding on to bitter memories. But a person crippled by bitter memories is a diminished person; there is nothing ennobling about it.⁸⁸ There is nothing beneficial, for either individuals or for society, about debilitating, unbidden memories of combat, rape or acts of terrorism.⁸⁹

90

Thus, in the absence of convincing arguments from those who want to reject MD, we should continue to further the research in MD, prevent harmful debilitating diseases, and promote our well-being with all safe and effective means available, provided that in doing so, we are not harmful to other people.

Notice that although I only address the agent's own well-being here, it is not the only relevant moral consideration. One could go beyond the individual and argue widely for an optimum memory and well-being for humankind, society/community or even to a larger extent the planet. However, due to the limitation and scope of this paper, I

⁸⁷ SAVULESCU, J. 2007. Genetic Interventions and the Ethics of Enhancement of Human Beings. In: STEINBOCK, B. (ed.) *The Oxford Handbook of Bioethics*. Oxford: Oxford University Press.

⁸⁸ HENIG, R. M. April 4 2004. The Quest to Forget. *New York Times* [Online]. Available: <http://www.nytimes.com/2004/04/04/magazine/the-quest-to-forget.html?pagewanted=all&src=pm> [Accessed 01/01/2010].

⁸⁹ Ibid.

⁹⁰ I have qualified this on the discussion of memory and epistemic access. See TT, 8.4.

am not exploring this argument here, but I will do so elsewhere. Indeed other commentators might also propose different aspects as being central to the ME and MD debate, however, for me, as I argue in this paper, an optimum memory and well-being are fundamental in this debate.

8.6 The presumption that the more of a good thing the better!

The presumption that the more of a good thing the better, is quite common in the enhancement literature and some bioethicists have reflected on this assumption.^{91 92} Consider, in sports for example weightlifting, rugby, and boxing, people often think of more muscles as being better. In cosmetic surgery and beauty industry the presumption that augmented breast and penis are better. In addition, in cognition presuming that higher IQ is better. Viewed with the same glasses, is the presumption that more memory is better. Hence, critics have opposed ME, MD and all other memory enhancing technologies resting amongst others on one of the premises that ‘more’ or ‘superior’ memory is not necessarily good for us. Often they quote studies of the Russian mnemonist Shereshevskii,⁹³ the case of AJ,^{94 95} a woman whose remembering dominates her life, her memory is ‘nonstop, uncontrollable, and automatic’, and the example of Jorge Luis Borges character, ‘Funes, the Memorious’,⁹⁶ as exemplary of why ME should not be allowed. Their standard claims being that these individuals had more or superior memory yet they could not live a better life with it.

Although, this is quite a common way of framing some issues in the enhancement debate,⁹⁷ it seems to me, to be misleading and thus inapplicable to the ME debate. And as Wolpe has pointed out ‘that the idea that attention is good, so increased

⁹¹ PARENS, E. 1998. Special Supplement: Is Better Always Good? The Enhancement Project. *The Hastings Center Report*, 28, S1-S17.

⁹² GEMS, D. 2003. Is More Life Always Better? *The New Biology of Aging and the Meaning of Life*. Ibid.33, 31-39.

⁹³ PCBE 2003. Beyond Therapy: Biotechnology and the Pursuit of Happiness. *The President's Council on Bioethics*. Washington, D.C.p.218.

⁹⁴ PARKER, E. S., CAHILL, L. & MCGAUGH, J. L. 2006. Case of Unusual Autobiographical Remembering. *Neurocase*, 12, 35–49.

⁹⁵ AJ is no longer an anonymous identity. AJ disclosed herself to the media. Her real name is Jill Price (née Rosenberg, born December 1965 in New York City).

⁹⁶ BORGES, J. 1964. *Labyrinths: selected stories & other writings*, New Directions Pub. Corp.

⁹⁷ This problem of seeing more as better is quite common in bioethical discourses e.g. on sanctity of life – presuming that life is sacred no matter the quality, hence, the more you live the better; clinical effectiveness in health care rationing; organ donations, etc.

attention is better, or that cognition is good, so increased cognition is better, may turn out to have unexpected consequences'.⁹⁸ A better memory does not have to be more – it may be less! What is at stake in the ME debate is not necessarily more memory, but rather an optimum memory, which for me is the best possible memory that fosters the individual's well-being. It is thus not a universal standardized memory that one would think about for example when we talk of optimal computer memory, but rather an individualized one that enables the beholder to lead a better life. In other words, my optimum memory is different from yours and vice-versa.

However, in foresight a critic could challenge my conception of optimum memory: if your optimum memory is different from mine, this implies, there is no ideal/standard. If so, how then can individuals aim/strive or target for optimum memory?

To answer my critic, the difference between your optimum memory and mine, needs not to suggest that there is no ideal or standard optimum memory that we can aim/strive for as individuals. We can analogously compare optimum memory to the Aristotelian *doctrine of the mean*, which Aristotle develops in his discussion of virtue in the *Nicomachean ethics*.⁹⁹ The doctrine of the mean is the position that Aristotle adopts as the middle state between two extremes: the excess and deficiency.¹⁰⁰ The rationale behind the doctrine of the mean is that both excesses and deficiencies destroy perfection, whereas the mean preserves it.¹⁰¹ The mean in relation to us is that which is neither excessive nor deficient, and this is not one – and the same for all.¹⁰² From this Aristotelian perspective, virtue when conceived through the doctrine of the mean, would be the purposive disposition, lying in a mean that is relative to us and determined by a rational principle, and by that which a prudent man would use to determine it.¹⁰³

⁹⁸ WOLPE, P. R. 2002. Treatment, enhancement, and the ethics of neurotherapeutics. *Brain and Cognition*, 50, 387-395.

⁹⁹ ARISTOTLE 2004. *The Nicomachean Ethics*, Translated by J.A.K Thomson, Revised with Notes and Appendices by Hugh Tredennick, Introduction and Further Reading by Jonathan Barnes: London, Penguin Books. 1106a28-29.

¹⁰⁰ Ibid. 1106a28-29.

¹⁰¹ Ibid. 1106b12.

¹⁰² Ibid. 1106b31-32.

¹⁰³ Ibid. 1107a1-2.

Analogous to the doctrine of mean, optimum memory is not on the one hand having excessive memory as in cases of Shereshevskii, AJ and Borges ‘Funes, the Memorious’ already cited above, and neither on the other hand is it having a deficient memory as in cases of those suffering from dementia or memory loss or memory obliteration. Instead, optimum memory, like the mean, would signify a harmony and balance that exists far away from two extremes, neither excessive nor deficient, and this is not one – and the same for all. Optimum memory could be an incorporation of the elements of each extreme, ‘excessive or deficient memory’ but at the same time, avoiding the evils that are found at the unbridled ends.¹⁰⁴ Thus, ideally to attain optimum memory, in cases of extreme excessive memory, they could be ‘enhanced’¹⁰⁵ through the process of MD, and in extreme cases of deficient memory, they could be ‘enhanced’ through drugs, technology or other non-pharmacological means. Moreover, optimum memory, like the mean, takes into account the unique person and his specific environment. This characteristic of the optimum memory, like the Aristotelian mean, is what would allow individuals to aim, strive, and rationally choose optimum memory, despite being relative from one person to the other.

Notice also that my claim that a better memory may be less is not unique to ME. For example, we prune trees to make them grow stronger and better; reptiles such as snakes shed their skins to generate new, better ones; we delete files on our computers to improve their memory; and finally animals including ourselves shed skin cells every day.

Gauged from this perspective, it seems to me that Shereshevskii, AJ, and Funes all had impaired memories. No matter how much critics want to view the three above as having superior memory, these individuals lacked an optimum memory. As in any other cases for negative memories, theirs would have called for some intervention. Technology allowing, perhaps the three candidates above would have welcomed dampening of not only negative memories, but also of any other positive memories that would have resulted in an optimum memory and consequently, the ability to

¹⁰⁴ HYUN HWANG, J. & SCOTT KRETCHMAR, R. 2010. Aristotle’s Golden Mean: Its Implications for the Doping Debate. *Journal of the Philosophy of Sport*, 37, 102-121.

¹⁰⁵ I consider in this paper and indeed this thesis, any processes that increases or decreases the memory, or its intensity aiming at optimum memory as a form of enhancement.

lead a better life. For example, AJ is very clear on her e-mail to McGaugh that she sees her memory not as a gift but as a burden. ‘Most have called it a gift but I call it a burden. I run my entire life through my head every day and it drives me crazy...’¹⁰⁶ Interestingly, Funes the Memorius in the dialogue with Borges refers to his memory too as a ‘garbage heap’.¹⁰⁷

8.7 Conclusion

I have critically assessed some multidisciplinary positions that threaten the pursuit of ME – and thus are inimical to the ultimate benefit of ME, which is the optimum memory as proposed on this paper. These positions are: (1) Appealing to distinctions between: enhancement/therapeutic, normal/non-normal, species-typical functioning (2) MD results in the loss of epistemic access (3) MD results in a change of personality and identity (4) the presumption that the more of a good thing the better. I have argued that none of these positions is plausible to warrant the rejection of MD.

Although I have only addressed the agent’s own well-being in this paper, it is not the only relevant moral consideration. One could go beyond the individual and argue widely for an optimum memory and well-being for humankind, society/community or even to a larger extent the planet. Other commentators might also propose different aspects as being central to the ME and MD debate, however, for me, as I have argued in this paper, an optimum memory and well-being are fundamental in this debate.

I consistently conclude what I have argued in this paper, that in the absence of convincing arguments from those who want to reject MD, we should continue to further the research in MD, prevent harmful debilitating diseases, and promote our well-being with all safe and effective means available, provided that in doing so, we are not harmful to other people.

¹⁰⁶ PARKER, E. S., CAHILL, L. & MCGAUGH, J. L. 2006. Case of Unusual Autobiographical Remembering. *Neurocase*, 12, 35–49.

¹⁰⁷ BORGES, J. 1964. *Labyrinths: selected stories & other writings*, New Directions Pub. Corp.p.152.

Chapter 9

9 Is there a duty to remember or an obligation not to forget?

9.1 Abstract

Researchers have recently suggested that memory dampening (MD) would create more opportunities to consciously alter our inclinations to remember or forget; leading perhaps to more responsibility for whatever memories we keep or discard. However, five main claims have been suggested against MD and which imply that we have a duty to remember or an obligation not to forget. First, that society has some interest in preserving some memories for the greater good; second, MD would make us become less sensitive and un-empathetic; third, MD risks severing our identity, hence, leading an inauthentic life; fourth, that we owe a debt to our predecessors / justice issues; and fifth, that MD leads to the loss of epistemic access. In this paper, I will examine and evaluate critically the first four claims and in doing so, assess whether there is a duty to remember. I will highlight the philosophical and legal assumptions entailed on such a duty especially in the light of advancing research in ME. I will argue that a duty to remember would rule out MD, and this would put severe constraints on those suffering from traumatic memories. Although this is not that evident, to advocate a duty to remember and especially for those with severe traumatic memories is tantamount to advocate for a duty to suffer; and this is indefensible even from a human rights perspective.

9.2 Introduction

Researchers have recently suggested that MD would create more opportunities to consciously alter our inclinations to remember or forget, leading perhaps to more responsibility for whatever memories we keep or discard.¹ However, five main claims have been suggested against MD and which imply that we have a duty to remember or an obligation not to forget. Elsewhere,² I have considered the worry that MD would lead to the loss of epistemic access. In this paper, I will explore four further arguments attributed to the use of MD and which imply that we have a duty

¹ KOLBER, A. 2006. Therapeutic Forgetting: The Legal and Ethical Implications of Memory Dampening. *Vanderbilt Law Review*, 59, pp.1561- 1626.p.1615.

² TT,8.4.

to remember or an obligation not to forget. These claims are first, that society has some interest in preserving some memories for the greater good;³ second, MD would make us become less sensitive and un-empathetic;⁴ third, MD risks severing our identity, hence, leading an inauthentic life;^{5 6} and fourth, that we owe a debt to our predecessors / justice issues.^{7 8 9} I will examine and evaluate critically these claims and in doing so, assess whether there is a duty to remember or an obligation not to forget. I will highlight the philosophical and legal assumptions entailed on such a duty especially in the light of advancing research in ME. I will argue that a duty to remember would rule out MD, and this would put severe constraints on those suffering from traumatic memories. Although this is not that obvious, to advocate for a duty to remember, and particularly for those with severe traumatic memories is tantamount to advocate for a duty to suffer, which is indefensible even from a human rights perspective. For ‘no one shall be subjected ...to inhuman or degrading treatment...’^{10 11} One could object, that suffering is not necessary inhuman or degrading. Indeed, for the greater good or our own good we undergo suffering, as for example through a dentist, for our beliefs, and for the defence of our country. However, even if we acknowledged this, it might be entirely false for some purposeless and/or unnecessary suffering; as I will argue it is the case for traumatic memories.

In raising the question whether there is a duty to remember or an obligation not to forget, I will scrutinize whether attempting to remember and MD are proper subjects of moral praise and/or moral blame.¹² The pharmacological and technological

³ KOLBER, A. 2006. Therapeutic Forgetting: The Legal and Ethical Implications of Memory Dampening. *Vanderbilt Law Review*, 59, pp.1561- 1626.

⁴ PCBE 2003. Beyond Therapy: Biotechnology and the Pursuit of Happiness. *The President's Council on Bioethics*. Washington, D.C.pp.229, 231.

⁵ Ibid.pp.228, 230.

⁶ ERLER, A. 2010. Does Memory Modification Threaten Our Authenticity? *Neuroethics*, 235-249.

⁷ RICOEUR, P., BLAMEY, K. & PELLAUER, D. 2006. *Memory, History, Forgetting*, University of Chicago Press.

⁸ BIENENSTOCK, M. 2010. Is There a Duty of Memory? Reflections on a French Debate. *Modern Judaism*, 30, 332-347.

⁹ LIAO, S. M. & WASSERMAN, D. T. 2007. Neuroethical concerns about moderating traumatic memories. *American Journal of Bioethics*, 7, 38-40.

¹⁰ ECHR. 1950. *European Convention on Human Rights and its Five Protocols* [Online]. Available: <http://www.hri.org/docs/ECHR50.html#C.Art3> [Accessed 05/12/ 2012].

¹¹ UN. 1948. *The Universal Declaration of Human Rights* [Online]. Available: <http://www.un.org/en/documents/udhr/index.shtml> [Accessed 01/04/ 2010].

¹² MARGALIT, A. 2002. *The ethics of memory*, Cambridge, MA, Harvard University Press.

potentiality that would enable us to choose and modify what we remember and forget raises interesting ethical, social, and legal questions. Given these potentialities, some commentators have implicitly argued that there is a duty to remember, as I elucidate in this paper. Thus, pursuit of MD on an individual level would contradict such a duty and on a societal level, it would be inimical to the society interests in remembering and/or preserving some memories. Other interconnected claims raised are that MD leads to the loss of epistemic access; MD would make us less sensitive and un-empathetic; MD would sever our identity, hence, leading an inauthentic life and finally, that MD risks or threatens the possibility of justice. In this case, one can view justice from various perspectives; one example is whereby some commentators view the duty of memory as a debt that we owe to our predecessors. Thus, it is a matter of justice that we should remember some people, events and/or some information from the past.^{13 14} I will refer to this later, but for now, I clarify how I use some terms for the purposes of this paper.

Memory dampening/memory attenuation in this paper refers to the technological and pharmacological possibility to modify what we remember and how we remember it. In this paper, I use the term duty to mean something that you have to do because it is your moral or legal responsibility.¹⁵ I use the words duty and obligation interchangeably. In the paper, I also take a ‘duty to remember’ and an ‘obligation not to forget’ to imply each other. Thus to say that ‘I will remember’ is also to say that ‘I will not forget’ and *vice-versa*. *Therefore, I cannot remember and forget X at the same time.*^{16 17} I take ‘suffering’ to be any physical or mental pain.

¹³ RICOEUR, P., BLAMEY, K. & PELLAUER, D. 2006. *Memory, History, Forgetting*, University of Chicago Press.

¹⁴ BIENENSTOCK, M. 2010. Is There a Duty of Memory? Reflections on a French Debate. *Modern Judaism*, 30, 332-347.

¹⁵ HORNBY, A. S., WEHMEIER, S. & ASHBY, M. 2002. *Oxford advanced learner's dictionary of current English*, Oxford, Oxford University Press.

¹⁶ RICOEUR, P., BLAMEY, K. & PELLAUER, D. 2006. *Memory, History, Forgetting*, University of Chicago Press.p.87.

¹⁷ BIENENSTOCK, M. 2010. Is There a Duty of Memory? Reflections on a French Debate. *Modern Judaism*, 30, 332-347. Italics mine.

9.3 What is it to remember?

‘To remember’ is the process by which the effects of past learning are retrieved and manifest themselves in the present.¹⁸ Various processes are quite related and are all concerned with remembering. These include: (i) Recalling – we recall whenever we recreate or reproduce some past activity or experience.¹⁹ (ii) Recollecting – we recollect when we recall not just the event or the activity but also the experiences of learning it.²⁰ (iii) Recognising – a form of remembering characterized by a feeling of familiarity when something previously experienced is again encountered. We recognise whenever we react to some present experience as being familiar.²¹

9.3.1 What is the nature of the obligation to remember?

Remembering can on the one hand be so personal, private and wholly dependent on the individual. On the other hand, remembering can be ‘collective’ or ‘public’. One would think that the former would be less controversial – for individuals just remember whatever they want to remember or sometimes things that they simply cannot remember and which ‘just pop into their minds’! It is their personal business! However, it is not that simple and things become a bit more interesting and complex as we start to reflect about it. For example, we do not just remember what we have personally experienced but also whatever our parents, friends, and our community have passed to us. Thus, at various points in our lives, (as far as the memory is concerned) we only exist in the memories of others.²² As it is the case, most people remember little or nothing below the period of three years of age, a stage psychologists refer to as the period of childhood amnesia.²³ It is also true for some people when they are dead. While certainly the dead would not remember anything, some of them would have done things worth remembering, and others have written

¹⁸ HUNTER, I. M. L. 1962. *Memory facts and fallacies*, Harmondsworth, Middlesex, Penguin.p.15.

¹⁹ Ibid.p.20.

²⁰ Ibid.p.21.

²¹ Ibid.p.20.

²² The point I am clarifying here is that although we may not remember some events in our lives, it need not be the case that these events are forgotten. These events may still exist in the memory of other people, in our community, indeed they could be recorded in books, journals, photographs, and videos.

²³ BPS Revised April 2010. Guidelines on Memory and the Law: Recommendations from the Scientific Study of Human Memory. A Report from the Research Board, *The British Psychological Society*, Leicester.p12.

things worth reading and they all survive their deaths²⁴ in the memories of others, either through their acts and/or their writings. Of course, there is another group of people who have done nasty things (not worth anyone's remembrance), but paradoxically, those wicked things allow them to survive their deaths too in the memories of others. For those who do not believe in the immortality of the soul and the life after death, perhaps this is a different way of looking at things and perhaps a consolation – immortality of our memories. Thus, although I will die physically, perhaps I may never 'die' for I will continue to live/survive in the memory of others.

Societal obligations to remember are explicitly embedded in most cultural and modern societies. This is evidenced through the daily functioning systems of the society. A quick glimpse on the economic and financial institutions illustrates this clearly. We are all obliged to remember our passwords, pin numbers, pass codes, etc, if we are to access our accounts on ATM/Cash points, if we are to access our emails, online accounts, and many more. Likewise, we are obliged to pay our taxes, to pay our bills, and our debts. On a different category, other things being equal, we are expected to remember the names of our children and colleagues; turn up to work, keep our promises, and many more. 'To keep our promises, we have to remember them. It is commonly required that we remember our promises, as much as it is required that we keep them.'²⁵ Failure to remember your children's names and in some societies failure to remember their birthday too is often viewed as disgraceful. In financial institutions, forgetting to pay your credit card attracts not only financial penalties but also an interest on top. The more you delay in making the payment, the more the interest. Forgetting is not usually a successful defence in such cases or in other similar cases like filing one's taxes.

However, are there similar obligations to remember tragic or catastrophic moments involving highly emotionally charged memories or are they any different? I suggest that they belong to a different category and that we should not fault and/or penalise individuals when they fail or choose not to remember in such cases as we do in financial institutions above (more of this later). Can we see forgetting as a systems

²⁴ By surviving their deaths here, I am not implying that they have not physically ceased to exist, but that despite their demise, people still remember them.

²⁵ MARGALIT, A. 2002. *The ethics of memory*, Cambridge, MA, Harvard University Press.p.57.

failure rather than failure of character? Perhaps we can but at what cost? This is the question and it is probably a trade-off not a clear answer. Moreover, we do not blame Jane, suffering from dementia, for failing not only to remember but also to recognise that Joe is her husband. Neither do we ordinarily take incompetent people to be moral failures. Why then should we not see all those who happen to forget vital information (through no fault of their character but of their memory systems), through the same glasses? This leads us to reflect further about the nature of remembering.

9.3.2 Is remembering voluntary or involuntary?

According to Kolber, the nature of our obligations to remember is radically underexplored. Partly because prior to the realistic possibility of MD, there was little we could do to alter our memories or escape obligations to remember.²⁶ Can we remember or forget at will? To ask this question is to attempt to situate whether forgetting and remembering are acts of moral agency and if so, analysing whether forgetting and remembering are proper subjects for moral praise and moral blame.²⁷ Is remembering ‘something we do’ or ‘something that happens to us’?²⁸ Kolber has asserted that in a world without MD, we cannot possibly be responsible for failing to remember, as we have limited control over our memories, and voluntary control is often thought to be a prerequisite to responsibility.²⁹ The former PCBE³⁰ as well as Margalit³¹ share this assertion. For Margalit, remembering and forgetting are involuntary. We cannot remember or forget on demand and neither do we choose when to remember and when to forget.³² Besides, it is the case that we often forget what we should remember and remember what we should forget.³³

²⁶ KOLBER, A. 2006. Therapeutic Forgetting: The Legal and Ethical Implications of Memory Dampening. *Vanderbilt Law Review*, 59, pp.1561- 1626.

²⁷ MARGALIT, A. 2002. *The ethics of memory*, Cambridge, MA, Harvard University Press.p.7.

²⁸ PCBE 2003. Beyond Therapy: Biotechnology and the Pursuit of Happiness. *The President's Council on Bioethics*. Washington, D.C.p.232.

²⁹ KOLBER, A. 2006. Therapeutic Forgetting: The Legal and Ethical Implications of Memory Dampening. *Vanderbilt Law Review*, 59, pp.1561- 1626.

³⁰ PCBE 2003. Beyond Therapy: Biotechnology and the Pursuit of Happiness. *The President's Council on Bioethics*. Washington, D.C.p.232.

³¹ MARGALIT, A. 2002. *The ethics of memory*, Cambridge, MA, Harvard University Press.pp.55-56, 201.

³² Ibid.pp.55-56, 201.

³³ HODGES, S., WILLIAMS, L., BERRY, E., IZADI, S., SRINIVASAN, J., BUTLER, A., SMYTH, G., KAPUR, N. & WOOD, K. 2006. SenseCam: A retrospective memory aid. *UbiComp 2006: Ubiquitous Computing*. Springer.

Consider for example Paula, a practicing psychiatrist who forgets a very important meeting, which results to the client being in a worse off situation than she would have been if not for Paula's forgetfulness. Consider further that this is not an isolated incidence but that Paula is always forgetting – her forgetting is habitual, despite the fact that she is not suffering from Alzheimer's disease, dementia or any other 'forgetfulness syndrome' that is medically diagnosable. Should we view Paula's forgetfulness as a failure in character, hence a form of moral irresponsibility? And if so, should Paula be struck off from the association of practicing psychiatrists register? Should Paula be further punished for negligence? Furthermore, one could argue that such an action would send a clear deterrent message to other would-be negligent psychiatrists. Could this be interpreted then that that punishment aids memory – in the sense that we tend to remember what is worthwhile remembering?

In her defence, Paula argues that she should not be struck off or even be further punished for she has genuinely forgotten those important appointments. Even if we were to accept Paula's defence that looks highly improbable, how then would we determine those who have genuinely forgotten from those who have not? Other things being equal, it is not something you can easily prove that Paula forgot even with lie detectors (whose evidence might not yet be admissible in courts) and through other technological applications like brain imaging, it is still difficult to come up with a conclusion that is beyond any reasonable doubt. One way of interpreting this is saying that it will always be difficult to draw a borderline between the forgetfulness that should be punishable to the one that should not. Alternatively, we could make a case that we often forget things that we 'do not care' much about, and from this perspective we could distinguish the act of forgetting as being involuntary from the act of 'not caring much' as being voluntary and hence moral and legal culpability for the latter and not for the former. Kolber has explained that one of the reasons why we hold people responsible for forgetting for example Paula above and in other similar cases like failing to file tax returns and to care for one's children, is that we are actually faulting people not for their involuntary forgetfulness but for some intentional failure at an earlier point in time.³⁴ Thus, perhaps both Paula and the neglectful taxpayer would have recorded their important appointments and

³⁴ KOLBER, A. 2006. Therapeutic Forgetting: The Legal and Ethical Implications of Memory Dampening. *Vanderbilt Law Review*, 59, pp.1561- 1626.

filing deadline respectively on their calendars or both would have made other deliberate choices that would have prevented their memory failure.³⁵

Alternatively, should we have stronger and weaker moral obligations similar to a sliding scale when it comes to remembering? For example, we could have weaker obligations where nobody is harmed or is on the risk of being harmed and stronger obligations where there are likely to be serious risks or even death. An example of this could be situations whereby parents forget their children in cars, and in unfortunate circumstances results to serious health risks and often even to death. To what extent should we hold such parents to be not only morally but also legally accountable?³⁶ However, reaching a consensus on such questions is not straightforward, especially given that it is possible for individuals (with or without MD) to allege forgetfulness especially due to alcohol intoxication in attempts to escape their moral and legal responsibility as demonstrated in some court cases.^{37 38}

39 40

9.4 All change please!

The situation changes dramatically with the introduction of memory enhancing drugs as Kolber explains. In a world with memory altering drugs (either enhancing or dampening), we would have more opportunities to consciously alter our inclinations to remember or forget, leading perhaps to more responsibility for whatever memories we keep or discard.⁴¹ This means that with the availability of memory enhancing drugs and other technological devices, remembering and forgetting are largely divorced from involuntary acts and levelled to the realm of moral agency, at least for

³⁵ Ibid.

³⁶ KASS, L. *Beyond Therapy: Biotechnology and the Pursuit of Human Improvement*. Paper presented to *The President's Council on Bioethics*, 2003 Washington, DC.

³⁷ *R. v Creighton (Paul Benjamin)* [2012] EWCA Crim 388. The accused claimed to have no recollection of the offences concerned, having been very drunk at the time. Note that this claim was rejected.

³⁸ *Caves v Revenue and Customs Commissioners* [2012] UKFTT 508. Mrs Caves had invoked a defence of forgetting to challenge a penalty for failing to file her tax returns in time. The Judge upholding the penalty said that Mrs. Caves had not advanced a reasonable excuse for her late filing of the return.

³⁹ *AST Systems Limited v The Commissioners for Her Majesty's Revenue and Customs (Income tax)* [2011] UKFTT 802 (TC), 2011 WL 6328987. Note the Judges accepted the appeal.

⁴⁰ *Kinlet Properties Limited v The Commissioners for Her Majesty's Revenue and Customs* [2011] UKFTT 403 (TC), 2011 WL 2649509. The Judge confirmed the penalty issued.

⁴¹ KOLBER, A. 2006. *Therapeutic Forgetting: The Legal and Ethical Implications of Memory Dampening*. *Vanderbilt Law Review*, 59, pp.1561- 1626.

those who chose to use them. For one can now engage with the choice of what to remember and what to forget. Consequently, forgetting and remembering become subjects for moral praise and blame. In the absence of this ‘pharmacological-cum-technological’ development, the status quo, (which according to Margalit is ‘that we cannot be morally or ethically praised for remembering or failing to remember, if memory is not under our control’)⁴² remains the overarching driving force for the majority. However, while this is true for individual’s memory, it is a different matter for shared memory as Margalit explains:

We are collectively responsible to see to it that someone looks at the ill. But we are not obligated as individuals to do it ourselves, as long as there are enough people who will do it.⁴³

The responsibility over a shared memory is on each and every one in a community of memory to see to it that the memory will be kept. But it is not an obligation of each one to remember all.⁴⁴

Although the borderline between an individual’s memory and a shared memory is not a clear-cut distinction, in this paper, I attempt to focus on the former and I only highlight the latter very briefly whenever its appeal seems to impact negatively on the individual’s memory. However, for now I turn briefly to the science of forgetting.

9.5 What is it to forget?

Forgetting refers to the inability to remember something that has happened in the past or to give the required information that you knew in the past.^{45 46} It reflects the loss of accessibility of a memory, but this does not necessarily mean that the information has been lost.⁴⁷ Indeed some might argue that nothing is ever completely forgotten, citing evidence from studies of brain stimulation that appears to evoke

⁴² MARGALIT, A. 2002. *The ethics of memory*, Cambridge, MA, Harvard University Press.p.56.

⁴³ Ibid.p.58.

⁴⁴ Ibid.p.58.

⁴⁵ HORNBY, A. S., WEHMEIER, S. & ASHBY, M. 2002. *Oxford advanced learner's dictionary of current English*, Oxford, Oxford University Press.

⁴⁶ HUNTER, I. M. L. 1962. *Memory facts and fallacies*, Harmondsworth, Middlesex, Penguin.pp.15,62.

⁴⁷ BADDELEY, A. D. 1999. *Essentials of Human Memory*, Psychology Press.p.128.

clear and vivid memories.⁴⁸ Forgetting and retaining are related. For if there is a failure to retain, then, there must be forgetting. However, forgetting can occur without retention being impaired. Therefore, while loss of retention always implies forgetting, forgetting does not necessarily imply loss of retention.⁴⁹

There are two categories of the major factors responsible for forgetting. First, the maintenance processes – which are the processes of a physiological kind which go on inside a person and have to do with the maintenance of health and life itself, serving the body's need for repair and recovery from fatigue and injury.⁵⁰ Within this category, forgetting can occur on one hand due to deterioration of the organic changes produced by learning and on the other hand due to the actual injury or disease to the brain.⁵¹ Examples of this would include Alzheimer's disease, Age-related decline (Mild Cognitive Impairment), Head Trauma, 'Retrograde Amnesia',⁵² and Head Trauma 'Anterograde Amnesia',⁵³ Experiential Trauma 'Post-Traumatic Stress Disorder'.⁵⁴ Secondly, behavioural processes – this is what goes on between the person and their environment. Within this category, forgetting may occur due to factors like transience or retroactive interference, altered conditions during remembering and repression.⁵⁵ If some other conditions both environmental and attitudinal are not present during the attempted recall, forgetting is also most likely to occur.⁵⁶

Forgetting is not so much a matter of the decay of old impressions and associations as it is a matter of the interference, inhibition, or obliteration of the old by the new.⁵⁷ Most of our ordinary activities of daily life bring about a substantial degree of forgetting. Some temporary forgetting can be due to altered conditions in the environment, whereas others tend to be due to a lack of warming-up. This is in the

⁴⁸ Ibid.p.128.

⁴⁹ HUNTER, I. M. L. 1962. *Memory facts and fallacies*, Harmondsworth, Middlesex, Penguin.pp.15-16.

⁵⁰ Ibid.p.63.

⁵¹ Ibid.p.63.

⁵² Retrograde amnesia – difficulties in remembering events occurring prior to amnesia.

⁵³ Anterograde amnesia – difficulties in remembering new information after the onset of amnesia.

⁵⁴ PCBE-STAFF. March 7, 2003. *Better Memories? The Promise and Perils of Pharmacological Interventions* [Online]. Washington DC: The President's Council on Bioethics. Available: <http://bioethics.georgetown.edu/pcbe/transcripts/march03/session4.html> [Accessed 02/07 2010].

⁵⁵ HUNTER, I. M. L. 1962. *Memory facts and fallacies*, Harmondsworth, Middlesex, Penguin.p.63.

⁵⁶ Ibid.p.81.

⁵⁷ Ibid.p.72.

sense that if one is deeply engaged in an arithmetic problem and someone else suddenly asks a historical question about, say, the caste system in India, the former is most likely to have trouble in recalling the answer.⁵⁸ On the contrary, when someone undertakes to perform some activity that he has previously learned, his initial attempt tends to be slow, irregular, and inexact. However, as he persists in the attempt, he tends to return to the former level of efficiency. This is what the psychologists refer as the ‘warming-up effect’.⁵⁹ Therefore, if we can establish the appropriate background, our remembering is most likely to be enhanced, for attempted recall facilitates further recall through this warming-up effect.⁶⁰

Schacter has discussed the following other ways of which forgetting occurs: Absent-mindedness – lapses of attentions that are associated with forgetting to do things. Blocking – when you are paying attention but you cannot get to the information when you need it. Misattribution – when you remember some aspect of a past event but you attribute that memory to the incorrect source. Suggestibility – situations in which implanted memories arise resulting from leading questions or suggestions. Bias – retrospective distortions produced by current knowledge and beliefs, when what you know, believe, and feel in the present skews your reconstruction of the past. Persistence – unwanted recollections that people cannot forget.⁶¹

9.6 Are we obligated to remember people, information, and events from the past?

Consider the following case of *Jina*,⁶² a nine-year old girl from the *Moja*⁶³ community. The *Moja* community is a small indigenous group of people living in a tiny rural village in the northern part of Kenya. The *Moja* community are hunters and gatherers. The *Moja* community has no modern watches, diaries, calendars, phones, or any other modern gadgets that we use to tell/remind us time. The *Moja* community can only estimate time by looking specifically at the sun, and alluding to

⁵⁸ Ibid.pp.78-80.

⁵⁹ Ibid.pp.78-80.

⁶⁰ Ibid.pp.78-80.

⁶¹ SCHACTER, D. 17/10/2002. *Session 4: Remembering and Forgetting: Psychological Aspects* [Online]. The President's Council on Bioethics. Available: <http://bioethics.georgetown.edu/pcbe/transcripts/oct02/session4.html> [Accessed 01/02/ 2010].

⁶² *Jina* in Swahili means ‘name’.

⁶³ *Moja* in Swahili means ‘one or first’, thus, in this case alluding to the first community.

daylight and darkness. Thus, when the sun dawns, this marks the beginning of the day, when the sun is in the middle of the sky, marks lunchtime and the sunset marks the end of the day. Luckily, in that part of the world, sunshine is not as scarce and rare commodity as on the Northern Hemisphere and hence you are likely to experience it for twelve hours per day throughout the year. Besides the lack of watches and other gadgets, the *Moja* community has not come across any books yet or any writing technologies. As a result, they are illiterate. Despite all this, the *Moja* community has a way of preserving their memories and making sure that any significant events and/or information are not forgotten but that they are ‘remembered appropriately’ and passed on to the next generation.

Tonight at the basin of Lake Turkana, the Sun is just setting and *Jina*, her family, friends, and the whole of *Moja* community have gathered to celebrate their prolific catch – for the first time they have caught a hippopotamus. They are eating, drinking, singing, dancing, and drumming. The elders of the *Moja* community then tell the story of the all-powerful *Mungu*⁶⁴ who has provided a prolific capture to them. They then retell the story carefully to all the children. Immediately after the children are retold the story, unexpectedly *Jina* is thrown into a deep pond of cold water for a short period before being rescued. The idea being that *Jina* will be able to retell that story (of the all-powerful *Mungu* who provides and/or enables prolific capture of hippopotami) vividly later through the association of being thrown and submerged into the deep pond. While the *Moja* community may not understand scientifically what is going on, we know that *Jina*’s level of adrenaline is raised through the event and she is hence, able to remember vividly what preceded that.

At 19 years old, *Jina* is now extremely depressed, ‘waterphobic’ and suffering from severe PTSD. She is lonely and she avoids all social gatherings. Come every evening *Jina* relives the event of ten years ago. She thought she was going to die, surrounded by her family, friends, and community. Although, *Jina* was meant to be a witness to the prolific capture/event and to pass on the knowledge of the all-powerful *Mungu* to the next generation, *Jina* cannot now form any relationships. She does not trust anybody, she feels betrayed and let down by her family, friends, and community.

⁶⁴ *Mungu* in Swahili means ‘God’.

She feels that those she trusted could not even protect her from the event ten years ago. Due to these severe traumatic memories, *Jina* has already attempted suicide three times. Does *Jina* have an obligation to remember the above event and pass on the information to the next generation?⁶⁵ I will explore this below as I assess the rationale for defending a duty to remember.

9.7 A case for a duty to remember

9.7.1 Interests of society in preserving memories for the greater good

This is the claim that society has an interest in remembering and/or preserving some memories for its greater good and this may trump the individual's interest in dampening and/or altering their memories. The issue here is about evaluating the benefits that society derives from such an obligation in remembering some information, people and events from the past and at the same time highlighting the risks or what may be lost if society forfeited such a duty. Thus, for example, the practice of MD would alter/and/or lead to loss of some socially invaluable information⁶⁶ or epistemic access.⁶⁷ In terms of harms to society, consider for example the case of Jason a serial rapist and Jane his latest victim. If Jason attempted to cover up his latest crime through pharmacological intervention⁶⁸ by not only dampening his memories but also those of his latest victim Jane, then, society would lose some invaluable information on how it may protect itself from criminals like Jason and perhaps on how to catch them.⁶⁹ Now, if the society has a right to protect itself from criminals, it follows then, that it has some obligation to remember some people, events, and/or information from the past. Meilaender puts it this way:

We might think that there is indeed an obligation not to forget. For the sake of victims treated unjustly, we may need to remember the evil done to them ...Not to remember the face of evil is to miss the evil of which we ourselves

⁶⁵ Note that this is an imaginary story and I have constructed both the character *Jina* and her *Moja* community.

⁶⁶ KOLBER, A. 2006. Therapeutic Forgetting: The Legal and Ethical Implications of Memory Dampening. *Vanderbilt Law Review*, 59, pp.1561- 1626.

⁶⁷ LIAO, S. M. & WASSERMAN, D. T. 2007. Neuroethical concerns about moderating traumatic memories. *American Journal of Bioethics*, 7, 38-40.

⁶⁸ One could argue that criminals should be deprived such a pharmacological intervention or similar technologies for they should face the consequences of their actions. A more nuanced argument is the suggestion that for particularly heinous crimes, enhancement of guilt-ridden memory could serve as a form of punishment, a kind of forced internalization. See WASSERMAN, D. 2004. Making memory lose its sting. *Journal of Philosophy and Public Affairs Quarterly*, 24, 12-18.

⁶⁹ PCBE 2003. Beyond Therapy: Biotechnology and the Pursuit of Happiness. *The President's Council on Bioethics*. Washington, D.C.p.224.

are capable. Not to remember evils done to others is to make it impossible for us to tell the stories of their lives...⁷⁰

Whereas, according to Rebecca Dresser, society has a stake in having its citizens retain their own painful, awkward memories as a check on behaviour. 'There probably is some sting that we would rather not have as individuals, but it is good for the rest of us that others have it.'⁷¹ Finally, The President's Council on Bioethics expresses this duty distinctly:

...as a community, there are certain events that we have an obligation to remember – an obligation that falls disproportionately, one might even say unfairly, on those who experience such events most directly.⁷²

I am not against any society that chooses to remember and protect some memories of people, events, and/or information from the past that they want to; my problem is how they choose to safeguard and protect these memories. Do these memories/information especially traumatic memories have to be protected internally or could this be done externally for example, by uploading our memories to an electronic memorizer – a similar labouring device to the electric monk⁷³ depicted in Adam Douglas Novel, but in our case, one that could do all the remembering for us? Given that we are no longer living like the *Moja* community⁷⁴ above and given our widespread technological advances, could preservation of these memories be digital

⁷⁰ MEILAENDER, G. 2003. Why Remember? *First Things*. [Accessed 01/01/2010] Online ed. <http://www.firstthings.com/article/2007/03/why-remember-46>.

⁷¹ Rebecca Dresser was a member of the former PCBE. Quoted in HENIG, R. M. April 4 2004. The Quest to Forget. *New York Times* [Online]. Available: <http://www.nytimes.com/2004/04/04/magazine/the-quest-to-forget.html?pagewanted=all&src=pm> [Accessed 01/01/2010].

⁷² PCBE 2003. Beyond Therapy: Biotechnology and the Pursuit of Happiness. *The President's Council on Bioethics*. Washington, D.C.231.

⁷³ DOUGLAS, A. 1987. *Dirk Gently's Holistic Detective Agency*, Pan Books LTD.p.4. 'The Electric Monk was a labour-saving device, like a dishwasher or a video recorder. Dishwashers washed tedious dishes for you, thus saving you the bother of washing them yourself, video recorders watched tedious television for you, thus saving you the bother of looking at it yourself; Electric Monks believed things for you, thus saving you what was becoming an increasingly onerous task, that of believing all the things the world expected you to believe. Unfortunately, this Electric Monk had developed a fault, and had started to believe all kinds of things, more or less at random. It was even beginning to believe things they would have difficulty believing in Salt Lake City.'

⁷⁴ Some real communities similar to *Moja* community in terms of lack of technological devices do currently exist. See for example PALMER, J. 20/05/2011. *Amondawa tribe lacks abstract idea of time, study says* [Online]. BBC-NEWS. Available: <http://www.bbc.co.uk/news/science-environment-13452711> [Accessed 27/08/ 2012].

as elucidated by Mayer Schonberger?⁷⁵ Schonberger depicts a starker scenario whereby Google conceded that until the spring of 2007, it had stored every single search query ever entered by one of its users, and every single search result a user subsequently clicked on to access it.⁷⁶ This means that ‘Google could remember’ all these details, which is perhaps more accurately than we could possibly ever remember in our lifetime. Similarly, other social networks and commercial shopping websites do the same sort of ‘remembering’ for us. Thus, it is clear that there are many ways of ‘remembering’ what we want to remember. Unambiguously, ‘the internet records everything and forgets nothing!’^{77 78} This has led to the newly proposed regulation ‘right to be forgotten’ in the EU – to protect individual privacy.⁷⁹

Given this, if some societies want to maintain such an obligation to preserve some memories, then perhaps they should do so without inflicting any pain on individuals involved. This means rather than expecting individuals to continue suffering as bearers of these traumatic memories, they should apply external technological means that would do the same form of remembering perhaps more perfectly than these individuals remember. This is vitally important especially given that the significance of a particular memory is not immediately known or imaginable. We could imagine for example those who respond to emergencies such as ambulance, fire crew, and police wearing lifelogging devices such as SenseCam. A SenseCam is a wearable still camera that automatically (without any user's conscious effort/intervention), keeps a digital record of the events that a person experiences.^{80 81 82 83} Such devices

⁷⁵ MAYER-SCHÖNBERGER, V. 2009. *Delete: the virtue of forgetting in the digital age*, Princeton, N.J., Princeton University Press.

⁷⁶ Ibid.p.6.

⁷⁷ ROSEN, J. 2012. The Right to Be Forgotten. *Stanford Law Review Online*, 64, 88.

⁷⁸ HENDEL, J. Feb 3 2011. In Europe, a Right to Be Forgotten Trumps the Memory of the Internet.

The Atlantic Technology [Online]. Available:

<http://www.theatlantic.com/technology/archive/2011/02/in-europe-a-right-to-be-forgotten-trumps-the-memory-of-the-internet/70643/> [Accessed 22/05/2013].

⁷⁹ EUROPEAN-COMMISSION. 2012. *Proposal for a regulation of the European Parliament and of the Council on the protection of individuals with regard to the processing of personal data and on the free movement of such data* [Online]. Available: http://ec.europa.eu/justice/data-protection/document/review2012/com_2012_11_en.pdf [Accessed 01/06/ 2012].

⁸⁰ HODGES, S., BERRY, E. & WOOD, K. 2011. SenseCam: a wearable camera that stimulates and rehabilitates autobiographical memory. *Memory*, 19, 685-96.

⁸¹ HODGES, S., WILLIAMS, L., BERRY, E., IZADI, S., SRINIVASAN, J., BUTLER, A., SMYTH, G., KAPUR, N. & WOOD, K. 2006. SenseCam: A retrospective memory aid. *UbiComp 2006: Ubiquitous Computing*. Springer.

attempt to maintain records and memories of various events both from an individual and collective perspective. The use of SenseCam and other logging devices for such crew would not be a radical move to raise alarm bells. Indeed, recently front line soldiers in combatant roles in Afghanistan have worn helmet-cameras that were able to capture the actual record of the war.^{84 85} However, to be sure, use of such logging devices, would raise ethical and legal issues for example on autonomy, privacy, data sharing, confidentiality, consent, and many others that I have not addressed here, but I will do so elsewhere. Other researchers are already grappling with such ethical issues.⁸⁶ Nevertheless, those who argue that we should remember fitly and truly are uneasy with the pharmacological-cum-technological development highlighted above – and this is my next concern.

9.7.2 Living authentically – remembering fitly and truly

Is there any rationality why individuals, like *Jina* above, should hold on to their nightmarish memories and work through them using common methods like psychotherapy, cognitive behaviour therapy, and/or antidepressants?⁸⁷ On the one hand, it could be argued that having survived the horror is part of what makes individuals like *Jina* who they are. And if they dampened their memories they would be diminishing their humanity – keeping them away from learning from the experience and impairing their ability to testify against their assailants whenever appropriate.⁸⁸ On the other hand, Erler⁸⁹ has argued that memory editing can cause us to live an inauthentic life in two main ways. First, it can undermine the truthfulness of our lives. Secondly, even when it does not do so, it can still mean deliberately interfering with a disposition we possess to respond in certain ways to

⁸² HODGES, S., BERRY, E. & WOOD, K. 2011. SenseCam: a wearable camera that stimulates and rehabilitates autobiographical memory. *Memory*, 19, 685-96.

⁸³ ALLEN, A. L. 2008. Dredging up the past: Lifelogging, Memory, and Surveillance. *The University of Chicago Law Review*, 75, 47-74.

⁸⁴ TELEGRAPH-REPORTERS. 2012. *BBC to broadcast soldiers being fatally wounded in Afghanistan* [Online]. Available: <http://www.telegraph.co.uk/news/uknews/defence/9487172/BBC-to-broadcast-soldiers-being-fatally-wounded-in-Afghanistan.html> [Accessed 20/08/ 2012].

⁸⁵ BBC 2011. BBC Three - Our War, Series 1.

⁸⁶ KELLY, P., MARSHALL, S. J., BADLAND, H., KERR, J., OLIVER, M., DOHERTY, A. R. & FOSTER, C. 2013. An Ethical Framework for Automated, Wearable Cameras in Health Behavior Research. *American Journal of Preventive Medicine*, 44, 314-319.

⁸⁷ HENIG, R. M. April 4 2004. The Quest to Forget. *New York Times* [Online]. Available: <http://www.nytimes.com/2004/04/04/magazine/the-quest-to-forget.html?pagewanted=all&src=pm> [Accessed 01/01/2010].

⁸⁸ Ibid.

⁸⁹ ERLER, A. 2010. Does Memory Modification Threaten Our Authenticity? *Neuroethics*, 235-249.

some past events, when we have reasons to respond in such ways. Correspondingly, for the PCBE, it is quite clear why we should not dampen our memories. From the PCBE perspective, to live authentically encompasses remembering fitly and truly. If we were to dampen our memories, we would be distorting this authenticity by compromising the truthfulness of what we remember and how we remember it. They write:

Altering the formation of emotionally powerful memories risks severing what we remember from how we remember it and distorting the link between our perception of significant human events and the significance of the events themselves. It risks, in a word, falsifying our perception and understanding of the world. It risks making shameful acts seem less shameful, or terrible acts less terrible, than they really are.⁹⁰

There may be a great cost to acting compassionately for those who suffer bad memories, if we do so by compromising the truthfulness of how they remember. We risk having them live falsely in order simply to cope, to survive by whatever means possible.⁹¹

However, the risks highlighted above by the PCBE are not particularly unique to MD via pharmaceutical means. ‘Natural memory dampening’ is constantly happening without the influence of any psychopharmacology or any other MD technologies. We do not normally complain or view natural memory dampening as being threatened by any of the above four risks. As Schonberger has recently argued, since time immemorial forgetting has always been the default and remembering the exception. It is only today with the help of widespread technology that remembering seems to have become the norm and forgetting the exception.⁹² Thus, without the influence of widespread digital technology, natural memory dampening (which in this case is a form of forgetting), would have continued to be the norm – without the charge of inauthenticity. Contra to the inauthenticity charge, MD and other memory enhancing technologies would promote authenticity. For through MD we make a

⁹⁰ PCBE 2003. *Beyond Therapy: Biotechnology and the Pursuit of Happiness. The President's Council on Bioethics*. Washington, D.C.p.228.

⁹¹ *Ibid.*p.230.

⁹² MAYER-SCHÖNBERGER, V. 2009. *Delete: the virtue of forgetting in the digital age*, Princeton, N.J., Princeton University Press.p.2.

quantum leap from chance to choice and thus cross a frontier we would never have before – the ability to choose what we want to remember and what we want to forget. If there are some things that it is better never to have experienced at all, why not erase them from the memory of those unfortunate enough to have suffered them?⁹³ If there are some things it is better never to have known or seen, why not use our power over memory to restore a witness's shattered peace of mind?⁹⁴

Are our memories not both for the good and the bad, the things that make us who we are?⁹⁵ If we eliminate our troubling memories, or stop them from forming in the first place, are we disabling the mechanism through which people learn, grow, and transform? Is a pain-free set of memories an impoverished one?⁹⁶ I do not think so. Compare for example the pain of childbirth. At some point, this was widely accepted and people had no choice. Perhaps one could even have viewed undergoing the pain of childbirth without any relieving agents as a form of heroism. Contrary, nowadays women giving birth have a wide variety of pain relieving agents. We do not suppose that those who choose to use them see their pain-free childbirth as an impoverished one, in comparison to those who do not opt for these relieving agents. Perhaps, a day is coming too when the pang of painful memories will be reduced just like that of pain of childbirth.

9.7.3 Appeal to empathy

Similar to living authentically, some commentators appeal to what I refer to as 'empathy claim'.⁹⁷ This is the claim that the ability to suffer some painful memory is where a lot of empathy comes from. That is when we have an embarrassing experience; we develop empathy for others who have a similar experience. If we dampen the painful memories, then we make people become less sensitive and un-

⁹³ PCBE 2003. Beyond Therapy: Biotechnology and the Pursuit of Happiness. *The President's Council on Bioethics*. Washington, D.C.p.230.

⁹⁴ Ibid.p.230.

⁹⁵ HENIG, R. M. April 4 2004. The Quest to Forget. *New York Times* [Online]. Available: <http://www.nytimes.com/2004/04/04/magazine/the-quest-to-forget.html?pagewanted=all&src=pm> [Accessed 01/01/2010].

⁹⁶ Ibid.

⁹⁷ PCBE 2003. Beyond Therapy: Biotechnology and the Pursuit of Happiness. *The President's Council on Bioethics*. Washington, D.C.p.229.

empathetic. We make people to become too comfortable with the world, perhaps being unmoved by suffering, wrongdoing or cruelty.⁹⁸

...the memory of being embarrassed is a source of empathy for others who suffer embarrassment; the memory of losing a loved one is a source of empathy for those who experience a similar loss.⁹⁹

While this is a possibility, I think the ‘empathy claim’ is not persuasive and it is indiscriminately false in many situations. One self-evident example is that pain and sufferings are not prerequisites for empathy. We do not need to undergo painful memories in order to be empathetic. Perhaps many of us are quite empathetic, for example, to the victims of earthquakes in Haiti, Japan, and New Zealand to mention a few, despite the fact that we have never been victims of an earthquake or such a similar natural catastrophe. Given this, it seems to me that appealing to the empathy card here to discredit MD and to infer to a duty to remember is backing on the wrong horse.

9.7.4 Duty to remember versus issue of justice

The claim on justice comes in many colours and flavours. I will mention two. The first way of looking at the justice issue is that advanced by the eminent French philosopher Paul Ricoeur in his magnum opus: ‘Memory, History, Forgetting’,¹⁰⁰ and the one invoked recently by Bienenstock.¹⁰¹ Here Ricoeur views the duty of memory as an imperative of justice or as a duty to do justice through memories, to an other than self.¹⁰² As Bienenstock explains, this duty of memory might be translated here more appropriately as a ‘debt of remembrance’ or ‘debt of memory’. I need to remember that I have a debt towards somebody, that I am indebted to somebody, and that I must pay for it.¹⁰³ Bienenstock writes:

We are indebted to them for what we are. The duty – or debt – of memory therefore does not merely oblige us to preserve the material, written trace of

⁹⁸ Ibid.p.229.

⁹⁹ Ibid.p.231.

¹⁰⁰ RICOEUR, P., BLAMEY, K. & PELLAUER, D. 2006. *Memory, History, Forgetting*, University of Chicago Press.

¹⁰¹ BIENENSTOCK, M. 2010. Is There a Duty of Memory? Reflections on a French Debate. *Modern Judaism*, 30, 332-347.

¹⁰² RICOEUR, P., BLAMEY, K. & PELLAUER, D. 2006. *Memory, History, Forgetting*, University of Chicago Press.

¹⁰³ BIENENSTOCK, M. 2010. Is There a Duty of Memory? Reflections on a French Debate. *Modern Judaism*, 30, 332-347.

past events. It also commands us to be aware of the weighty debt we owe to our predecessors, and to keep this debt alive. It is according to this perspective that the duty of memory partakes of justice: we have a duty of memory in order to exercise justice, i.e., to give back, or to transmit, whatever it is which we have received.

Surely, there would be little disagreement that we have all benefited from memories that have been passed on to us from previous generations, but it is altogether debatable to view this as a debt that we have to pay back as a matter of justice. If it is a debt, then, indubitably we never asked for this debt in the first place! Equally, perhaps we never even consented to this debt. It is doubtful justice if we are obliged to pay back for what we never borrowed. While we can pass on these memories at will, it is hardly an obligation to remember and thus one that should be inimical to MD as the initial claim seems to imply. It is equally problematic and unclear that those persons of previous generations who passed these memories to us did so believing that they were creating a debt that we have to pay back, paradoxically, not back to them, but to others either living or future generations. Furthermore, it would be a debt that would fall disproportionately on those unfortunate enough to have been passed on traumatic negative memories as opposed to positive ones.

What if one views this duty to remember as a matter of justice that is generated by 'fair play', a term that John Rawls¹⁰⁴ uses to describe the sorts of obligations whereby those who benefit from participation in various cooperative ventures according to certain rules and thus voluntarily restrict their liberty have obligations to each other? On the same footing, they have a right to a similar acquiescence, on the part of those who have benefited from their submission. Hence, no one should gain from the cooperative efforts of others without doing their fair share.¹⁰⁵ I suspect this like the debt perspective above would still be problematic. Robert Nozick has argued that those who unavoidably derive benefits from cooperative ventures that they neither approve of nor consent to, do not incur any obligations as a result. I incur no obligations to the members of social groups merely because I am the beneficiary of their group largesse.^{106 107} If we accept this, then, it would be difficult

¹⁰⁴ RAWLS, J. 2005. *A theory of justice*, Cambridge, Massachusetts, Belknap Press.pp.526-527.

¹⁰⁵ Ibid.p.343.

¹⁰⁶ NOZICK, R. 1974. *Anarchy, state and Utopia*, Oxford, Basil Blackwell.pp.90-97.

to comprehend why we would accept a 'duty to remember viewed as a matter of justice generated by fair play'. Furthermore, this would entail that being a beneficiary of the memories passed to me is not a sufficient condition to set obligations for me to remember.

The second way of looking at the justice issue is the one put forward by Meilaender and equally the former PCBE of which he was a member. From this perspective, both Meilaender and the PCBE subscribe to the view that truthful memory is a necessary condition for any justice or even possibility of justice. PCBE write:

Without truthful memory, we could not hold others or ourselves to account for what we do and who we are. Without truthful memory, there could be no justice or even the possibility of justice; without memory, there could be no forgiveness or the possibility of forgiveness – all would simply be forgotten.¹⁰⁸

Although the above claim is far-fetched, for me the real cause of disagreement is what we mean by 'truthful memories'. It seems to me that for PCBE and equally for Meilaender; 'truthful memories' imply only those memories that involve individuals. Truthful memories are those experienced and relived by real people in real lives, remembering truly and fitly as discussed above. To be precise, from this criterion any recorded memories for example from a tape recorder, CCTV, no matter how accurate they may be, are categorically excluded from the class of truthful memories. They do not fit in truthful memories. However, it seems to me this is not simply a categorical mistake but also an issue disputed by evidence from clinical psychology. A quick example is the widely discussed recovered repressed memories of childhood sexual abuse. In these cases, it is widely discussed that memory of childhood sexual abuse can be manipulated and even be implanted on an individual where it never occurred at all.^{109 110 111} This evidence discredits PCBE's appeal to truthful

¹⁰⁷ CAPLAN, A. L. 1984. Is There a Duty to Serve as a Subject in Biomedical Research? *IRB: Ethics and Human Research*, 6, 1-5.

¹⁰⁸ PCBE 2003. Beyond Therapy: Biotechnology and the Pursuit of Happiness. *The President's Council on Bioethics*. Washington, D.C.p.232.

¹⁰⁹ These cases are widely discussed in literature that it is unnecessary to give a wide range of references here.

¹¹⁰ LANEY, C. & LOFTUS, E. F. 2005. Traumatic memories are not necessarily accurate memories. *Can J Psychiatry*, 50, 823-8.

memories and specifically to their usage of what they mean by truthful memories. Not all memories that individuals cling to and swear to remember fitly and truly are ‘truthful’. Some are altogether false memories. Therefore, even if one sympathises with PCBE that there could be no justice without truthful memories, one could still locate these truthful memories elsewhere and perhaps even more accurately than simply on what individuals remember and believe to be true. Thus, for example, Jason’s evidence of a burglary collated via CCTV, might be admissible in court and could even count as ‘truthful’, accurate, even if Jason denied it or even if there was no specific person who remembered and/or witnessed it.

9.8 A case against a case for a duty to remember

Many objections could be raised against a duty to remember. I have already highlighted some above while responding to the claims put forward as a case for a duty to remember. Nevertheless, in what follows I explore very briefly one objection that deserves our attention: that advocating for a duty to remember could be tantamount to advocating for a duty to suffer. Wasserman puts it simply as if they are on a seesaw against each other: ‘The duty to remember versus the duty to suffer’.¹¹²

9.8.1 The wrong of a duty to remember

For those suffering from severe mental illness and PTSD a duty to remember would place severe constraints on them, for it would hamper the choice of ‘therapeutic forgetting technologies.’ Although it is not that obvious, it seems to me that to advocate for a duty to remember, for those with PTSD, could be equivalent to advocating for a duty to suffer and this is indefensible even from a human rights perspective: for no one shall be subjected... to inhuman or degrading treatment.¹¹³

Earlier in the paper, I suggested that one could object that suffering is not necessary inhuman or degrading, because for the greater good or our own good we undergo suffering; as for example through a dentist, for our beliefs, and for the defence of our

¹¹¹ BPS Revised April 2010. Guidelines on Memory and the Law: Recommendations from the Scientific Study of Human Memory. A Report from the Research Board, *The British Psychological Society*, Leicester.

¹¹² WASSERMAN, D. 2004. Making memory lose its sting. *Journal of Philosophy and Public Affairs Quarterly*, 24, 12-18.

¹¹³ ECHR. 1950. *European Convention on Human Rights and its Five Protocols* [Online]. Available: <http://www.hri.org/docs/ECHR50.html#C.Art3> [Accessed 05/12/ 2012].

country. I pointed out that even if we acknowledged the force of this claim, it might be utterly false for some purposeless and/or unnecessary suffering as in the case for traumatic memories. Why is this more plausible? What counts as degrading or inhuman treatment from a human rights perspective? The European Court of Human Rights (ECtHR) and other Courts have assessed this question through various judgments and they can enlighten us on the matter.

In *D v United Kingdom*,¹¹⁴ the ECtHR held that the prohibition against torture or inhuman or degrading treatment or punishment in Art.3 was an absolute one, which applied regardless of the conduct of the individual concerned and had to be respected when a state was considering an expulsion. On other occasions,^{115 116 117 118 119 120 121} the ECtHR and other Courts have upheld several complaints that the lack of appropriate medical treatment/care, conditions for transport of prisoners, conditions of detention, all amounted to breaches of Art. 3. Additionally, the ECtHR has found states in breach of Art.3 based upon inadequate conditions of confinement such as overcrowded and unsanitary conditions,^{122 123 124 125} inadequate size, lighting and ventilation,¹²⁶ and inadequate toilet facilities.^{127 128}

As we can learn from the above-cited cases, the ECtHR has set the threshold of article 3 very high. Just a mere duty to remember or an obligation not to forget might not on its own reach the threshold demanded to qualify as degrading or inhuman treatment. It is on the onus of the complainant to demonstrate successfully that a duty to remember has resulted to the breach of their article 3 rights under ECtHR. All things being equal, court's decision regarding such a breach of article 3 will depend on the facts of the particular case.

¹¹⁴ *D v United Kingdom* (30240/96) [1997] 24 E.H.R.R. 423 (ECtHR).

¹¹⁵ *Keenan v United Kingdom* [2001] 33 EHRR.

¹¹⁶ *Mouisel v France* [2004] 38 E.H.R.R. 34.

¹¹⁷ *McGlinchey v United Kingdom* [2003] 37 EHRR. 41.

¹¹⁸ *Nevmerzhitsky v Ukraine* [2006] 43 E.H.R.R. 32.

¹¹⁹ *Mayzit v Russia* [2006] 43 E.H.R.R. 38.

¹²⁰ *Moiseyev v Russia* [2011] 53 E.H.R.R.

¹²¹ *Napier v The Scottish Ministers* [2002] UKHRR 308.

¹²² *Dougoz v Greece* [2002] 34 E.H.R.R. 61.

¹²³ *Poltoratskiy v Ukraine* [2004] 39 E.H.R.R. 43.

¹²⁴ *Novoselov v Russia* [2007] 44 E.H.R.R. 1.

¹²⁵ *Alver v Estonia* [2006] 43 E.H.R.R. 40.

¹²⁶ *Peers v Greece* [2001] 33 E.H.R.R. 5.

¹²⁷ *Napier v The Scottish Ministers* [2002] UKHRR 308.

¹²⁸ *Peers v Greece* [2001] 33 E.H.R.R. 5.

Nevertheless, to be clear, not all people with traumatic memories when given a choice will opt to dampen their memories. Some would still choose not to. However, it is a different matter altogether for those who would want to dampen their traumatic memories but they are hampered by some societal obligations to remember people, events and/or information of the past. The duty to remember would fall disproportionately and perhaps discriminatively on this group of people. That is the cause of concern and has been the subject of this paper.

The idea that forgetting through the practice of MD could ever be a good thing seems counterintuitive, especially in a culture steeped in fear of Alzheimer's disease. When it comes to memory, ordinarily most people would look for ways to having more of it, not less. For if you can boost your ability to remember, you can be smarter, perform brilliantly in school, in social settings and at work.¹²⁹ However, for me, this is a constant reminder that this need not be the case, an optimum memory does not have to be more – it could be less and that is what we should be aiming for, for the service of enhancing our well-being and leading a better life.¹³⁰ Notice that although in this paper I have only discussed the duty to remember from an individual's based perspective, this is not the only question of value here. One could approach a duty to remember from a collective point of view and propose a different thesis. However, a collective duty to remember needs not to contradict the argument I have advanced in this paper from an individual's point of view.

9.9 Conclusion

In this paper, I have responded to the question whether there is a duty to remember or an obligation not to forget. To facilitate the response and assessment to this question, I have analysed other significant questions, such as, what is it to remember? What is the nature of the obligation to remember? Is remembering voluntary or involuntary? Are we obligated to remember people, information, and events from the past? I have explored the case for a duty to remember and the arguments advanced by those who support such a duty. Some of the arguments I

¹²⁹ HENIG, R. M. April 4 2004. The Quest to Forget. *New York Times* [Online]. Available: <http://www.nytimes.com/2004/04/04/magazine/the-quest-to-forget.html?pagewanted=all&src=pm> [Accessed 01/01/2010].

¹³⁰ For a fully-fledged discussion on this matter, see TT, 8.

have assessed are, first, that society has some interest in preserving memories for the greater good. Second, that we need to live authentically – and this involves remembering fitly and truly. Third, MD would make us become less sensitive and un-empathetic. Fourth, that we owe a debt to our predecessors / justice issues. I looked at the wrong of a duty to remember and argued that a duty to remember would rule out MD. This would put severe constraints on those suffering from traumatic memories. I have argued that advocating for a duty to remember is tantamount to advocating for a duty to suffer and this is indefensible even from a human rights perspective.

Chapter 10

10 What legal issues does the quest of optimum memory raise?

10.1 Introduction

The quest for optimum memory raises a variety of legal issues, which could also be viewed as objections to the pursuit of optimum memory. The most critical and notable legal issues in this quest are in the cases of memory dampening (MD). In this paper, I will explore, assess, and critically review some of the legal issues that would arise through the practice of MD. I will expound some instances in which they are likely to occur. In doing so, I will propose some counter arguments demonstrating why such objections could not successfully constitute a case against MD. In this paper, I use the words ‘memory dampening’ and ‘therapeutic forgetting’ synonymously. My primary focus is on the law in England and Wales, though I will discuss the law in other jurisdictions where relevant.

10.2 What legal issues does the quest for an optimum memory through the practice of memory dampening raise?

10.2.1 Consent and informed consent issues

Before beginning medical procedures and/or treatment, the law requires that healthcare personnel/professionals should obtain the consent of a mentally competent person.¹ The healthcare professionals are required to make certain disclosures to the patients to enable them to weigh up the costs, benefits, and risks of undergoing such a procedure and/or treatment. The law has unambiguously demonstrated its commitment to patient autonomy in a number of cases. In *Re T*² the Court of Appeal made it clear that first, an adult, who is a mentally competent patient enjoys an absolute right to consent to medical treatment, to refuse it or to choose one rather than another of the treatments being offered regardless of the consequences of patient’s decision – even if it leads to death. Second, this right of choice is not restricted to decisions that other people might regard as sensible, but it exists even if the reasons for making the choice are ‘rational, irrational, unknown, or

¹ MACLEAN, A. 2009. *Autonomy, Informed Consent and Medical Law: A Relational Challenge*, Cambridge University Press.p.149.

² *Re T (Adult Refusal of Treatment)* [1993] Fam CA 95 pp.103,114,116.

even non-existent'.³ Third, without the consent of a mentally competent adult, any medical procedure, treatment, or care that involves touching a person is prima facie an assault, a civil trespass to the person and a crime, except in emergency cases.^{4 5} This could render the actor liable in tort law to battery and/or in criminal law to assault. In other cases, whereby the patient claims not to have received sufficient information about the medical procedure/treatment or the ensuing significant risks, then, the patient could bring an action in negligence as in *Pearce v United Bristol Healthcare NHS Trust*⁶ and *Chester v Afshar*.⁷

Consent (albeit not exclusively as in *R v Brown*)⁸ is usually one of the most important defences in facing such actions, as the burden of proof falls on the claimant, who must show an absence of consent. The claimant must demonstrate the breach of his bodily integrity.⁹

Initial pilot studies on MD specifically by use of propranolol had suggested that, for this drug to be effective, it would have to be prescribed within a short period (the first six hours) after the traumatic effect, while the memory was still in the process of consolidating.¹⁰ The idea being that if propranolol is administered soon enough after the traumatic event, then it would block the formation of overly strong emotional memory and fear conditioning that subsequently manifest themselves as Post Traumatic Stress Disorder (PTSD) symptoms.^{11 12}

³ Ibid.

⁴ Ibid.

⁵ *Chatterton v Gerson* [1981] 1 All ER 257.

⁶ *Pearce v United Bristol Healthcare NHS Trust* [1998] 48 BMLR 118.

⁷ *Chester v Afshar* [2004] UKHL 41.

⁸ *R v Brown* [1994] 1 AC 212.

⁹ MACLEAN, A. 2009. *Autonomy, Informed Consent and Medical Law: A Relational Challenge*, Cambridge University Press.p.150.

¹⁰ PITMAN, R. K., SANDERS, K. M., ZUSMAN, R. M., HEALY, A. R., CHEEMA, F., LASKO, N. B., CAHILL, L. & ORR, S. P. 2002. Pilot study of secondary prevention of posttraumatic stress disorder with propranolol. *Biological Psychiatry*, 51, 189-192.

¹¹ Ibid.

¹² VAIVA, G., DUCROCQ, F., JEZEQUEL, K., AVERLAND, B., LESTAVEL, P., BRUNET, A. & MARMAR, C. R. 2003. Immediate treatment with propranolol decreases posttraumatic stress disorder two months after trauma. *Ibid.*54, 947-949.

Given the above, earlier in the MD debate Meilander¹³ and the former President's Council on Bioethics (PCBE)¹⁴ suggested that the time limitation on propranolol-style MD would make it difficult, if not impossible, for patients to give their informed consent to treatment, because they would not yet know the role that their painful memories would play on their lives.¹⁵ This is clear from the questions posed by the former President's Council on Bioethics (PCBE)¹⁶ on the issue. First, they question, how we could make on the spot that the prospective judgment of a particular event is sufficiently terrible to warrant pre-emptive MD. Secondly, they ask whether the drugs in question would be given to everyone or only to those with an observed susceptibility to PTSD, and, if the latter, how we would distinguish them. Thirdly, they assert that in some cases merely witnessing a disturbing event is sufficient to cause PTSD-like symptoms long afterwards. Given this, they question whether we should then as soon as disaster strikes, consider giving memory-altering drugs to all the witnesses, in addition to those directly involved.¹⁷

Meilander and the PCBE are questioning the quality of informed consent. That doctors would have to prescribe beta blockers like propranolol and seek informed consent before they can predict whether a particular patient would go on to develop PTSD.^{18 19}

In his paper, Meilaender conceives that even if people were to consent to the MD treatment *within the six hours*, we could still question the timing of that consent, *whether it was the 'best time' to agree to such a treatment.*²⁰ He writes:

Granting that these people could consent to take the medication, how could they know or decide in that moment whether doing so was wise? Is that the

¹³ MEILAENDER, G. 2003. Why Remember? *First Things*. [Accessed 01/01/2010] Online ed. <http://www.firstthings.com/article/2007/03/why-remember-46>.

¹⁴ PCBE 2003. Beyond Therapy: Biotechnology and the Pursuit of Happiness. *The President's Council on Bioethics*. Washington, D.C.pp.226-227.

¹⁵ KOLBER, A. 2006. Therapeutic Forgetting: The Legal and Ethical Implications of Memory Dampening. *Vanderbilt Law Review*, 59, pp.1561- 1626.

¹⁶ PCBE 2003. Beyond Therapy: Biotechnology and the Pursuit of Happiness. *The President's Council on Bioethics*. Washington, D.C.pp.226-227.

¹⁷ Ibid.p.226.

¹⁸ KOLBER, A. 2006. Therapeutic Forgetting: The Legal and Ethical Implications of Memory Dampening. *Vanderbilt Law Review*, 59, pp.1561- 1626.

¹⁹ AOKI, C. R. A. 2008. Rewriting My Autobiography. *Bulletin of Science, Technology & Society*, 28, 349-359.

²⁰ MEILAENDER, G. 2003. Why Remember? *First Things*. [Accessed 01/01/2010] Online ed. <http://www.firstthings.com/article/2007/03/why-remember-46>. *Italics emphasis added*.

moment in which to decide whether one wants to carry such painful memories along throughout life or to erase them?²¹

Perhaps one can answer Meilaender that if this was the only window of opportunity before these memories were consolidated as the earlier research had indicated,²² then, that would be pragmatically the ‘best time’. For having MD, any other time would not be effective and consequently would be of no benefit to the prospective patient. However, this looks too simple a solution and I suppose Meilaender’s question is more subtle than one requiring just a simple pragmatic yes or no answer. I make this supposition given that Meilaender’s overall view in the paper is that all our memories regardless of whether they are embarrassing, troubling, or painful; connect to the narrative of who we are, and thus we should not erase such memories. He writes:

How essential memory is to our sense of what it means to have a human life may be seen if we consider a life “story” that – almost – is no longer a story, because, lacking memory, it lacks coherence, lacks connection, lacks a story line.²³

Elsewhere in the paper:

Each moment, therefore, contains a narrative in miniature, and every life is a story whose plot may be partially hidden in the present. We cannot know the full significance of any moment in that story – what it contributes and how it affects other moments – unless and until we can read the story as a whole.²⁴

If I am right to assume that Meilaender’s concern is more subtle than just a simple pragmatic question, then, we have to set the pragmatic answer aside, and look for other grounds to challenge his claim on the best timing of informed consent. That is what I will do. However, before proceeding further, I need to make two succinct points, which will further enlighten the current debate on informed consent and timing issues. First, the proposed problem of timing and the charge of possible lack of informed consent in cases of MD are based on the limitation of one drug – propranolol. That generalization is misleading and perhaps other and future beta blockers will not be as limited as propranolol, hence requiring to be administered

²¹ Ibid.

²² SHADMEHR, R. & HOLCOMB, H. H. 1997. Neural Correlates of Motor Memory Consolidation. *Science*, 277, 821-825.

²³ MEILAENDER, G. 2003. Why Remember? *First Things*. [Accessed 01/01/2010] Online ed. <http://www.firstthings.com/article/2007/03/why-remember-46>.

²⁴ Ibid.

within a limited time to be effective. Secondly, further recent research into the effectiveness of propranolol, has demonstrated that the drug could be used and is effective as a MD agent during memory retrieval and reconsolidation processes. Brunet et al, write:

Propranolol given after reactivation of the memory of a past traumatic event reduces physiologic responding during subsequent mental imagery of the event in a similar manner to propranolol given shortly after the occurrence of a traumatic event.²⁵

Other studies have confirmed similar results that propranolol can change fear memories during the process of reconsolidation.^{26 27} This is in the sense that even if one did not make the choice during the consolidation process, one could still do so, and start the therapy during the processes of memory retrieval and reconsolidation.

As I have suggested earlier, Meilaender's question on the timing of informed consent is rather subtler than one that requires a pragmatic yes or no answer. In what follows, I will briefly explore critically from a legal perspective Meilaender's concern and see what it implies.

From a legal perspective, for consent to be valid, it must be given voluntarily, without coercion or any undue influence,²⁸ or deception.²⁹ The patient must have the capacity to consent, and must understand the nature of treatment he has consented to.³⁰ Thus, for those who would want to claim that there is a lack of consent in cases of therapeutic forgetting, from a legal perspective, they would need to establish that the consent given does not satisfy the validity test. Their claim would be upheld whenever there is a breach of the validity test either partly or in full. In other words, they need to establish that there is such a contravention and/either/or because any of the following happened in the process of obtaining the consent.

²⁵ DONOVAN, E. 2010. Propranolol use in the prevention and treatment of posttraumatic stress disorder in military veterans: Forgetting therapy revisited. *Perspectives in Biology and Medicine*, 53, 61-74.

²⁶ KINDT, M., SOETER, M. & VERVLIT, B. 2009. Beyond extinction: Erasing human fear responses and preventing the return of fear. *Nature Neuroscience*, 12, 256-258.

²⁷ SOETER, M. & KINDT, M. 2010. Dissociating response systems: Erasing fear from memory. *Neurobiology of Learning and Memory*, 94, 30-41.

²⁸ *Re T (Adult Refusal of Treatment)* [1993] Fam CA.

²⁹ *Re T (Adult Refusal of Treatment)* [1993] Fam CA.

³⁰ *Chatterton v Gerson* [1981] 1 All ER 257.

1. The individual who gave the consent was not a competent adult, for example, maybe because he lacked the capacity or he was a young child who was not Gillick competent.³¹
2. He gave the consent involuntarily. He was coerced to give the consent either directly or indirectly, implicitly or explicitly. Coercion here could be more in forms of persuasion, manipulation, exploitation,³² excessive influence, or pressure from families, doctors, religious affiliations, employers, and so forth. Such a case was recognized in *Re T (Adult Refusal of Treatment)*.³³
3. His consent was obtained fraudulently, for example, he consented mistakenly for a different treatment, to what he was made to believe he was consenting to. Such was the case in *R v Tabassum*,³⁴ whereby three women had consented to Tabassum showing them how to carry out a breast self-examination. The women had given their consent mistakenly believing that Tabassum was a medical doctor, and the indecent touching of their breasts was for medical purposes. However, this was established not to have been the case; the judge ruled in their favour that there was no true consent and Tabassum was convicted of indecent assault.

That is what would have to be established and it is what the courts would be persuaded to make a judgment if such a claim were to reach the courtroom. However, it looks like an uphill climb; how could we establish a lack of consent if all factors into play have been fulfilled? Let us get back to Meilaender's worry on best timing for consenting to therapeutic forgetting treatment and analyse his concerns. Meilaender asks 'Is that the moment in which to decide whether one wants to carry such painful memories along throughout life or to erase them?'³⁵

³¹ *Gillick v West Norfolk & Wisbech Area Health Authority* [1985] UKHL.

³² JACKSON, E. 2010. *Medical law: text, cases, and materials*, Oxford, Oxford University Press, p.279.

³³ *Re T (Adult Refusal of Treatment)* [1993] Fam CA. T was 34 weeks pregnant and was undergoing treatment following a road traffic accident. Although T was not a member of Jehovah's Witnesses, T's mother was. Following the birth of T's stillborn child, her condition had deteriorated. T's mother had influenced her to refuse a blood transfusion. T was sedated and placed on ventilator, when her father and T's boyfriend applied for a court declaration that it would not be unlawful for the hospital to administer a blood transfusion in the absence of her consent. The judge agreed and granted the declaration.

³⁴ *R v Tabassum* [2000] 2 Cr App Rep 328 CA.

³⁵ MEILAENDER, G. 2003. Why Remember? *First Things*. [Accessed 01/01/2010] Online ed. <http://www.firstthings.com/article/2007/03/why-remember-46>.

We can deduce two issues from what Meilaender is saying here. The first would be that Meilaender is complaining and faulting the actual consent process and saying that ‘although a valid consent has been given it is still not a valid consent’. Secondly, he could be saying that although there is a valid consent, since, MD issues are novel and controversial, perhaps, consent should not inform the debate of warranting therapeutic forgetting treatments for now. Thus, we would need to examine MD cases more carefully to ensure they are lawful. Since it is very implausible to hold the first option from both logical and legal perspective, I will assume that Meilaender’s concern is in the second form, which I will now proceed to examine.

Meilaender’s contention is not a strange view to hold. Courts in the past have made judgments and ruled on the grounds of policy and public interests that certain acts and/or treatments are illegal despite the existence of a valid consent. For example in the judgment of *R v Brown*,³⁶ whereby some men were convicted of consensual sadomasochistic sexual acts, the House of Lords held that a valid consent was not a successful defence for assault occasioning actual bodily harm. From this ruling, it has become clear that consent will not normally offer a defence to the infliction of actual or grievous bodily harm.³⁷ This excludes:

‘...the accepted legality of properly conducted games and sports, lawful chastisement or correction, reasonable surgical interference, dangerous exhibitions, etc. These apparent exceptions can be justified as involving the exercise of a legal right, in the case of chastisement or correction, or as needed in the public interest, in the other cases’.³⁸

Notice, the qualification of ‘reasonable surgical interference’ that some forms of treatment from this perspective are illegal as well, even where a valid consent exists. Examples of such cases discussed in literature are those of female circumcision,

³⁶ *R v Brown* [1994] 1 AC 212.

³⁷ JACKSON, E. 2010. *Medical law: text, cases, and materials*, Oxford, Oxford University Press, pp.217-218.

³⁸ *Attorney General’s Reference (No 6 of 1980)* EWCA Crim 1, [1981] QB 715.

which is specifically proscribed by the Female Genital Mutilation Act 2003³⁹ and the controversial cases that involve amputation of health limbs.^{40 41 42}

In the civil law context, there are cases which demonstrate that a valid consent will not necessarily prevent a patient from claiming damages. From this perspective, patients could make a claim in negligence if they were not given adequate information of the prospective medical procedure and/or treatment.⁴³ In *Chester v Afshar*,⁴⁴ it was held that ‘surgery performed without the informed consent of the patient is unlawful’. Usually, informed consent will presuppose a general warning by the surgeon of a significant risk of the surgery and the court is the final arbiter of what constitutes informed consent. Such a view is also articulated in *Pearce v United Bristol Healthcare NHS Trust*.⁴⁵

In a case where it is being alleged that a plaintiff has been deprived of the opportunity to make a proper decision as to what course he or she should take in relation to treatment, it seems to me to be the law, as indicated in the cases to which I have just referred, that if there is a significant risk which would affect the judgment of a reasonable patient, then in the normal course it is the responsibility of a doctor to inform the patient of that significant risk, if the information is needed so that the patient can determine for him or herself as to what course he or she should adopt.

However, are the cases of therapeutic forgetting in the same category of cases such as [a] *R v Brown* above, whereby a valid consent does not afford a defence for a

³⁹ *Female Genital Mutilation Act 2003 - ukpgaen_20030031_en.pdf* [Online]. Available: http://www.legislation.gov.uk/ukpga/2003/31/pdfs/ukpgaen_20030031_en.pdf [Accessed 07/07/2013].

⁴⁰ Dr Robert Smith, a consultant orthopaedic surgeon at Falkirk and District Royal Infirmary, had removed one lower leg from each of two private patients. This caused a lot of controversy both from ethical and legal perspectives. Although, Dr Smith did not face any disciplinary actions from NHS and neither did he face any criminal charges, it is widely discussed in Medical Law Literature that such cases would be illegal and would lead to criminal convictions if performed in UK now. See report of the case in BBC-NEWS. 2013. *Surgeon defends amputations* [Online]. Available: <http://news.bbc.co.uk/1/hi/scotland/625680.stm> [Accessed 01/01/2012].

⁴¹ BAYNE, T. I. M. & LEVY, N. 2005. Amputees By Choice: Body Integrity Identity Disorder and the Ethics of Amputation. *Journal of Applied Philosophy*, 22, 75-86.

⁴² ELLIOTT, T. 2009. Body Dysmorphic Disorder, Radical Surgery and the Limits of Consent. *Medical Law Review*, 17, 149-182.

⁴³ See for example *Bolam v Friern Hospital Management Committee* [1957] 1 WLR 582 and *Bolitho v City and Hackney Health Authority* [1997] 4 All ER 771.

⁴⁴ *Chester v Afshar* [2004] UKHL 41, para.14.

⁴⁵ *Pearce v United Bristol Healthcare NHS Trust* [1998] 48 BMLR 118.

charge of assault or [b] do they fall on the latter accepted category of the reasonable surgical interference model and other legal properly conducted activities?⁴⁶ To answer this question, one has to bear in mind that *R v Brown* was held unlawful on the ground of the public interest.

it was not in the public interest that a person should wound or cause actual bodily harm to another for no good reason and, in the absence of such a reason, the victim's consent afforded no defence to a charge under section 20 or 47 of the Act of 1861.⁴⁷

In deciding when public interests require the courts to intervene, there are three heads under which the public interest may be said to arise: (i) where the assault causes permanent injury or maims, (ii) where a breach of the peace is likely to result and (iii) where what is done is injurious to the public.⁴⁸

Do validly consented therapeutic forgetting fulfil any of the three options above or all of them? (i) Will therapeutic forgetting cause permanent injury or maims? As it stands, therapeutic forgetting treatments through pharmacological drugs as discussed in this thesis⁴⁹ are very unlikely to cause permanent injury or maims. However, this does not imply that such treatments are risk-free. Like many other treatments, therapeutic forgetting treatments will as well carry some risks. However given that they would be beneficial to the would-be patient and arguably to society, the risks involved would be acceptable even when in rare circumstances they would cause some unforeseen harm to the patient. Therefore, therapeutic forgetting treatments are unlikely to attract public policy interests from this perspective. (ii) Are therapeutic forgetting treatments likely to result to the breach of peace? This would not apply in the context discussed in this paper and in this thesis. (iii) Are therapeutic treatments injurious to the public? This is probably debatable and is likely to be more contentious. However, on the context of an individual's pursuit of therapeutic forgetting as advanced in this thesis, the treatment would be of benefit both to the individual and debatable to the public as opposed to being harmful. A different conclusion could be reached if such therapeutic forgetting were practiced in large-

⁴⁶ *Attorney General's Reference (No 6 of 1980)* EWCA Crim 1, [1981] QB 715.

⁴⁷ *R v Brown* [1994] 1 AC 212 page 217.

⁴⁸ *R v Brown* [1994] 1 AC 212 page 217.

⁴⁹ TT, 5.

scale to wipe out memories for example of a 'specific group of people or community'.

Given the above, I have to conclude that MD cases do not fall within the [a] cases above, where a valid consent is no defence for a charge of assault and consequently categorize them on the latter [b] cases where they would be accepted on the 'reasonable surgical interference model' and other legal properly conducted activities. Nevertheless, there remain other issues surrounding consent as originally proposed that I will now address briefly.

Even if propranolol were to be prescribed within six hours as originally suggested, the issues of consent and informed consent would not successfully constitute a case against MD. Traumatized patients are likely to have some level of psychological disturbance that could cloud their decision to consent, regardless of whether it is immediately after the traumatic event or later.⁵⁰ Furthermore, even if they consented, they would only have limited information as to the relative costs and benefits of undergoing the therapy⁵¹, and even Meilaender acknowledges this fact.⁵²

To be sure, timing and informed consent issues as in the context proposed are not unique to MD cases. They would fit well with the already widely accepted use of preventative medicines on people who are unlikely to develop the illnesses we seek to prevent.⁵³ In extreme cases, some women known to have genetic predisposition to develop cancer opt for preventative mastectomies, even though many of them would never actually develop the disease.⁵⁴ In similar but rather ordinary cases, some women would ingest the morning-after pill, and this must be done within a limited time if it is going to be effective. Such women would make such a decision without the knowledge of whether they would fall pregnant or not. When they do so, we do not question whether that is the best timing to make such a decision; and neither do

⁵⁰ KOLBER, A. 2006. Therapeutic Forgetting: The Legal and Ethical Implications of Memory Dampening. *Vanderbilt Law Review*, 59, pp.1561- 1626.

⁵¹ Ibid.

⁵² MEILAENDER, G. 2003. Why Remember? *First Things*. [Accessed 01/01/2010] Online ed. <http://www.firstthings.com/article/2007/03/why-remember-46>.

⁵³ KOLBER, A. 2006. Therapeutic Forgetting: The Legal and Ethical Implications of Memory Dampening. *Vanderbilt Law Review*, 59, pp.1561- 1626.

⁵⁴ Ibid.

we question their consent as long as the consent given is valid. Here the validity test from a legal perspective as discussed above is that that patient must have the capacity to consent, she understands the nature of treatment she has consented to; she has given the consent voluntarily, without coercion, any undue influence, or deception. At the same time, there would not be any claim in negligence if the patient has been provided with information of the risks/benefits/alternative treatments.

Further two questions posed by PCBE above: First, whether the drugs in question are to be given to everyone or only to those with an observed susceptibility to PTSD, and, if the latter, how do we distinguish them? Second, whether we would consider giving memory-altering drugs to all the witnesses, in addition to those directly involved; do not add any new light to merit treating those cases differently.

Indeed, one can argue that these questions are not only misleading but also are extraneous as far as our discussion of informed consent for competent individual goes. How do we decide whether certain people are to undergo a particular treatment or not? There are many factors to consider. However as far as the question of consent to treatment goes, for mentally competent persons, other things being equal, they make this choice independently. We do not ordinarily make such decisions for them, at least in democratic societies, where we value self-determination and autonomy. As Dworkin elucidates:

The value of autonomy, on this view derives, from the capacity it protects: the capacity to express one's own character – values, commitments, convictions, and critical as well as experiential interests – in the life one leads. Recognizing an individual right of autonomy makes self-creation possible. It allows each of us to be responsible for shaping our lives according to our own coherent or incoherent – but, in any case, distinctive – personality. It allows us to lead our lives rather than be led along them, so that each of us can be, to the extent a scheme of rights can make this possible, what we have made of ourselves. We allow someone to choose death over

radical amputation or a blood transfusion, if that is his informed wish, because we acknowledge his right to a life structured by his own values.⁵⁵

Accordingly, it is extraneous to ask whether to give MD drugs to all witnesses in addition to those directly involved. It is a different issue for children and for those who lack capacity; and a separate issue as well for emergency cases, and perhaps PCBE could be inferring to these two sets of issues. However, even for those individuals who cannot self-determine and consequently are unable to consent to proposed treatment, perhaps because they are children or they lack capacity; when it comes to making choices of treatment, we make such choices based on their best interests. 'Best interests' here is not limited to medical interests but also accounts for other important factors as well.^{56 57}

There is a wider authority of cases in common law,⁵⁸ which elaborates what the best interests' principles are and what would count as good practice when it comes to treating or refusing to treat such individuals. This is further affirmed through the Mental Capacity Act (MCA) 2005, which stipulates the best interests' guidelines when it comes to treatment of those who lack capacity and therefore cannot legally consent to treatment.⁵⁹ If traumatic memories were so severe, it does not seem to me to be disproportionately unreasonable to apply such principles, if and only if that was the only window of opportunity to treat them, as original research had suggested. However, given the fact that MD through drugs like propranolol can also be effective during the processes of memory retrieval and reconsolidation then, we would not need to go on that route, for those who cannot temporary consent.

Given the above discussion, it is safe to conclude that therapeutic forgetting treatments are unlikely to cause any problems related to informed consent as it had

⁵⁵ DWORKIN, R. 1993. *Life's dominion: an argument about abortion, euthanasia, and individual freedom*, Knopf.p.224.

⁵⁶ *Re S (Adult Patient: Sterilisation)* [2001] Fam 15.

⁵⁷ JOHN, C., MARGARET, B., PAUL, M., DAVID, P. & MUIREANN, Q. 2008. Best interests and potential organ donors. *BMJ*, 336.

⁵⁸ For an example see *Airedale NHS Trust v Bland* [1993] HL and *Re T (Adult Refusal of Treatment)* [1993] Fam CA.

⁵⁹ *Mental Capacity Act 2005* [Online]. Available: http://www.legislation.gov.uk/ukpga/2005/9/pdfs/ukpga_20050009_en.pdf [Accessed 12/05/ 2011].. See preliminary number 4 on best Interests.

been suggested, so long as the patients are informed of the risks/benefits and alternative treatments.

Consent and informed consent issues are broad and of paramount importance; thus, it is an insurmountable task to address them fully in such a short paper. Recognising this fact, I put them to rest and examine the problem of perverting the course of justice that arises in MD cases.

10.3 Obstruction of justice / perverting the course of justice

According to the Criminal Prosecution (CPS) Sentencing Manual, one is claimed to have perverted the course of justice, if he: threatens or intimidates potential witnesses; interferes with prosecution witness; conceals evidence; gives false allegations resulting to innocent arrests; interferes with jurors; gives false information in mitigation or finally *engages in all of the above*.⁶⁰ From the context of MD, how then, could one pervert the course of justice? One must have engaged in either one or all of the above. Since I have not so far come across such a case in court, below I will explore the likelihood of invoking the crime of perverting the course of justice in MD cases. Although I have used the obstruction of justice / perverting the course of justice on the heading above, the former is in the US context, whereby the latter is from an English law perspective. I will endeavour to maintain the latter, except when I quote from literature written in the US context. I am concerned here only in circumstances when one would dampen memory of events that he would be required to testify or give evidence about them in prospective court proceedings. Notice too that any attempt to do any of the above to pervert the course of justice, even if one did not successfully accomplish it, is also a criminal offence.⁶¹ For example, in *R v Hurrell*,⁶² the accused asked to provide a sample of breath by the police officer, prevaricated and was arrested. He offered the police officer £2,000 to forget about the test and he continued to try to bribe the officer while being conveyed to the police station. He provided a sample while in the

⁶⁰ CPS. 2013. *Pervverting the course of justice: Administration of justice: Sentencing manual: Legal Guidance: The Crown Prosecution Service* [Online]. Available: http://www.cps.gov.uk/legal/s_to_u/sentencing_manual/perverting_the_course_of_justice/ [Accessed 01/01/ 2013]. *Italics my emphasis.*

⁶¹ Ibid.

⁶² *R v Hurrell* [2004] 2 Cr. App. R. (S.) 23.

police station and claimed that his attempt to bribe was light-headed. Though he only attempted to bribe, he was convicted for three months for perverting the course of justice.⁶³

10.3.1 How could one possibly pervert the course of justice in memory dampening cases?

Below are some circumstances ‘ifs’ in which we could consider one to have perverted the course of justice in MD cases.

1. Threatens or intimidates potential witnesses

This could occur if someone threatened or intimidated the potential witness to dampen their memories. The threat could come from the accused or any other interested parties.

2. Interferes with prosecution witness

This could be any attempts or forms of interference with the prosecution witness to dampen their memories. It could be for example through bribes or other subtle means like persuasion.

3. Conceals evidence

This might be quite relevant in MD cases. If we take MD to refer to the technological and pharmacological possibility to modify what we remember and how we remember it,⁶⁴ any pharmacological and technological attempt to dampen one’s or another person’s memory in order to prevent that person from testifying in court, could be classified as concealing the evidence. Kolber gives similar case, that long before our recent interest in MD it was held to be obstruction of justice to intentionally get a witness drunk in order to prevent them from testifying in court.⁶⁵

4. Gives false allegations resulting in innocent arrests

In MD cases, this is likely to occur in conjunction with other false allegations, rather than independently. An example is someone who falsely claim to have been raped,

⁶³ CPS. 2013. *Pervverting the course of justice: Administration of justice: Sentencing manual: Legal Guidance: The Crown Prosecution Service* [Online]. Available: http://www.cps.gov.uk/legal/s_to_u/sentencing_manual/pervverting_the_course_of_justice/ [Accessed 01/01/ 2013].

⁶⁴ TT, 8.2.

⁶⁵ KOLBER, A. 2006. Therapeutic Forgetting: The Legal and Ethical Implications of Memory Dampening. *Vanderbilt Law Review*, 59, pp.1561- 1626.

could also allege that the rapist gave her some pills to dampen her memory of the rape.

5. Interferes with jurors

This could occur if it was possible for the accused or other interested parties to dampen memories of the jurors. However, the most likelihood is a nuanced version which suggests that use of MD especially by perpetrators will fool juries and judges, making the perpetrators look as if they are innocent, as it enables them to dampen their emotional connectedness, their guilt and shame feelings.⁶⁶

6. Gives false information in mitigation

This could be quite relevant in MD, especially because the drugs attenuate the highly emotional content of the event. Thus it could be argued that an individual who dampened his memories to diminish his guilt feelings and remorse while he faces the jury, could be giving some form of false mitigation in order to influence, impede or obstruct the jury, judges, and even the outcome.⁶⁷

From the above instances, it is clear that an individual that dampens his memories or forces others to do so, in order to prevent them from testifying in court could be perverting the course of justice. However, are reasons of perverting the course of justice and misuse of MD drugs/agents successful objections to MD? Overall, it is unlikely that this will pose as a convincing objection to MD. The fact that individuals can misuse MD drugs to pervert the course of justice is not a necessary and sufficient condition to warrant prohibiting them. The choice to misuse or pervert the course of justice should be viewed independently from the reasons to allow MD. Other suggestions that the use of MD especially by perpetrators will fool juries and judges, making the perpetrators look as if they are innocent, as it enables them to dampen their emotional connectedness, their guilt and shame feelings, would not go anywhere near to warrant prohibition.⁶⁸ Surely, even long before the introduction of MD agents, it has been common for some criminals in courts not to show any emotional connectedness, remorse and/or even any guilt for whatever they have done. I do not suppose that this convinces the juries and the judges that they are innocent. It is difficult to comprehend why the judges and juries would be convinced

⁶⁶ AOKI, C. R. A. 2008. Rewriting My Autobiography. *Bulletin of Science, Technology & Society*, 28, 349-359.

⁶⁷ Ibid.

⁶⁸ Ibid.

if these criminals had dampened their memories. While I am not in favour of criminals using such dampening agents to pervert the course of justice, I propose that the questions of misuse of dampening agents or any other technologies are rather separate issues and demand different justifications. Moreover, even if they were not, it seems to me that it would be doubtful justice to deny or prohibit beneficial therapies and/or technologies to individuals based on the likelihood that some might misuse them.

Furthermore, at least in democratic societies, we allow people some other forms of freedoms to fiddle about with their bodies and minds, in ways that could be misused and cause more harm than MD. We could imagine education being misused and leading to brainwashing (which could be quite harmful), yet most modern societies obligate their children to undergo primary and secondary education. We could imagine religious freedom being misused and leading to fundamentalism, which again could be harmful. There are many examples, but I will mention one more that is currently hotly debated in the UK – press freedom; following the recommendations of the Leveson inquiry report⁶⁹ in the wake of News of the World phone hacking scandals. Yet, few if any, have argued against prohibition of press freedom. Indeed all what this points to, are questions and options for regulation rather than prohibition as such. The right questions similarly in our current discussion would be therefore to ask whether we should regulate the use of MD drugs and/or technologies, and if so, how? What kind of policies would we need?⁷⁰ These are vital questions on the debate, but due to the scope and limitation of this paper, I am unable to explore them here, but I have addressed them elsewhere.⁷¹

⁶⁹ LEVESON-INQUIRY. 2012. *An inquiry into the culture, practices and ethics of the press: report [Leveson]* [Online]. Stationery Office. Available: <http://www.official-documents.gov.uk/document/hc1213/hc07/0780/0780.asp> [Accessed 29/05/ 2013].

⁷⁰ FARAH, M. J., ILLES, J., COOK-DEEGAN, R., GARDNER, H., KANDEL, E., KING, P., PARENS, E., SAHAKIAN, B. & WOLPE, P. R. 2004. Neurocognitive enhancement: What can we do and what should we do? *Nature Reviews Neuroscience*, 5, 421-425.

⁷¹ TT, 7.

10.4 Mitigation of emotional distress damages / duty to mitigate loss/damages

According to Gluckstein, a claimant cannot sit back and allow their losses to accumulate and then expect to recover damages for losses they ought to have avoided as it is clearly set out in *Janiak v Ippolito*.⁷²

Every plaintiff has a duty to minimize losses from personal injury by surgery or other medical treatment. The general rule of mitigation of damage applicable to both breach of contract and tort is that the aggrieved party must take all reasonable steps to mitigate the loss and cannot claim for avoidable loss ... In the case of contract, damages for breach are reduced by the amount of loss that should have been avoided if the plaintiff had taken reasonable steps to mitigate.

In cases of MD, even if individuals were free to dampen their memories and assuming that MD drugs were part of the mainstream medical practice, the law would need to establish background expectations about the reasonableness of decisions to dampen or for refusing to do so.⁷³ Courts would be asked to decide whether and under what circumstances a claimant could be put to the choice of either dampening painful memories or else forgoing compensation for the pain attached to those memories that could have been dampened.⁷⁴

For example, in a hypothetical case of a road traffic accident, whereby Sahau ends up being hospitalized for physical and emotional injuries but declines a psychiatrist's reasonable advice to dampen her memories, Joe could argue that he need not compensate Sahau for damages that could have been prevented, had Sahau taken reasonable steps to avoid them.⁷⁵ Thus, while Joe agrees to compensate Sahau for the physical damages caused, he could argue that emotional damages should be reduced proportionately to Sahau's failure to dampen her memories.⁷⁶ In *Morris v Richards*,⁷⁷ the court held that it is up to the defendant to prove that the claimant has failed to

⁷² *Janiak v Ippolito*, [1985] 1 S.C.R. 146. Quoted in GLUCKSTEIN, C. E. 2013. *The Duty To Mitigate: Does The Claimant Have A Duty To "Get Better"?* [Online]. Available: <http://www.gluckstein.com/uploads/pdfs/TheDutyToMitigate.pdf> [Accessed 12/03/ 2013].

⁷³ KOLBER, A. 2006. Therapeutic Forgetting: The Legal and Ethical Implications of Memory Dampening. *Vanderbilt Law Review*, 59, pp.1561- 1626.

⁷⁴ Ibid.

⁷⁵ Ibid.

⁷⁶ Ibid.

⁷⁷ *Morris v Richards* [2003] EWCA Civ 232.

mitigate her loss. In such circumstances, the standard of reasonable conduct required must take into account that a claimant is not to be unduly pressed at the instance of the defendant. The claimant's conduct ought not to be weighed in nice scales at the instance of the party which occasioned the difficulty.⁷⁸ It seems from this that courts are reluctant to penalise claimants and they hold that it is up to the defendant to prove that the claimant has failed to mitigate loss.⁷⁹ As it is held in *Janiak v Ippolito*:⁸⁰

The question of whether or not a person has been reasonable in refusing to accept the recommended medical treatment is for the trier of fact to decide. In making that finding, the trier of fact must take into consideration the degree of risk from the surgery, the gravity of the consequences of refusing it, and the potential benefits to be derived from it. If any one of several recommended courses of treatment is followed, a plaintiff cannot be said to have acted unreasonably.

However, as mental health treatments become more effective, a claimant's failure to use them may appear more unreasonable, and courts may become more willing to penalize plaintiffs who fail to mitigate emotional damages.⁸¹

10.5 Negligence and other possible claims for failure to treat traumatic memories

Negligence cases could arise when doctors fail to dampen patients' traumatic memories and when they dampen some memories that they should have left alone.⁸² Outside the clinician environment, other claims that could occur are when alleged pharmaceuticals claims about particular dampening drugs do not materialise whenever individuals use them; or if such dampening drugs proved to be defective and consequently unfit for the purposes described.⁸³ Such claims for personal injury caused by defective products and misleading indication could be recovered through

⁷⁸ Ibid.

⁷⁹ Ibid.

⁸⁰ *Janiak v Ippolito*, [1985] 1 S.C.R. 146. Quoted in GLUCKSTEIN, C. E. 2013. *The Duty To Mitigate: Does The Claimant Have A Duty To "Get Better"?* [Online]. Available: <http://www.gluckstein.com/uploads/pdfs/TheDutyToMitigate.pdf> [Accessed 12/03/ 2013].

⁸¹ KOLBER, A. 2006. Therapeutic Forgetting: The Legal and Ethical Implications of Memory Dampening. *Vanderbilt Law Review*, 59, pp.1561- 1626.

⁸² Ibid.

⁸³ PRAYLE, D. & BRAZIER, M. 1998. Supply of medicines: paternalism, autonomy and reality. *Journal of Medical Ethics*, 24, 93-98.

the Consumer Protection Act.⁸⁴ While issues of negligence are important and have likelihood of occurring as well in MD cases, they are unlikely to pose broad objections to MD.

10.6 Individual versus societies' interests

This is when we have to evaluate under what circumstances (if any), could societies' interests in memory preservation overcome individual's interests in MD for the greater good. From this perspective, one can argue that individuals who dampen their memories may be denying society some valuable information that it could use first to protect itself from harmful/dangerous people and/or secondly, for instituting social change.⁸⁵ A more nuanced version of this claim is one advanced by Liao and Wasserman when they claim that MD results to loss of epistemic access.⁸⁶ I have responded to both versions of this claim elsewhere.⁸⁷

10.7 Conclusion

In this paper, I have critically assessed the main legal issues that arise through the quest of optimum memory. I have examined their likelihood and suggested that they are likely to occur in MD cases. To recap the main legal issues are those of consent/informed consent, objection/perverting the course of justice, and mitigation of emotional distress damages. Other possible legal issues in MD cases are those of negligence and society's greater interests in preservation of memories that would otherwise be dampened. While these legal issues could be viewed as objections against MD, I have argued that they cannot successfully constitute a case against MD. I have argued that these legal issues are not particularly unique to MD cases to warrant their prohibition. Furthermore, the choices to misuse or pervert the course of justice are independent choices from allowing or disallowing the practice of MD.

⁸⁴ *Consumer Protection Act 1987* [Online]. Available:

http://www.legislation.gov.uk/ukpga/1987/43/pdfs/ukpga_19870043_en.pdf [Accessed 01/01/ 2012].

⁸⁵ HURLEY, E. A. 2007. The moral costs of prophylactic propranolol. *American Journal of Bioethics*, 7, 35-36.

⁸⁶ LIAO, S. M. & WASSERMAN, D. T. Ibid. Neuroethical concerns about moderating traumatic memories. 38-40.

⁸⁷ TT, 8.4, 9.

Chapter 11

11 What are the implications of optimum memory on eyewitness testimony/evidence?

11.1 Abstract

In the last two decades, advances in medicine, science and technology have enabled burgeoning research that has increased our understanding of memory. This increase in understanding has raised enormous interest in treating memory-associated injuries as well as in enhancing our memories. While both bioethicists and legal scholars have assessed both ethical and legal arguments for and against permitting cognitive enhancements, there has been little discussion on how the pursuit of ME through pharmacological and technological means would influence the law and legal practice. In this paper, I fill this gap and propose that in addition to other factors that the law contemplates in deciding whether to regulate or not, the law should also specifically be interested in the ME debate through pharmacological and technological means for its own sake; because of the indispensable role that memory plays in eyewitness testimony.

11.2 Introduction

In this paper, I take ‘optimum memory’ to refer to the best possible memory that fosters the individual’s well-being.¹ Contrary to the common assumption in the enhancements debate that ‘more is better’,² an optimum memory is not limited to having ‘more’ memory, it could be ‘less’, through the practice of memory dampening (MD). I take MD to refer to the technological and pharmacological possibility to modify what we remember and how we remember it.³ Whereas eyewitness testimony in this paper refers to a formal written or spoken statement saying what you know to be true in a court of law.⁴ I use the words ‘eyewitness testimony’ and ‘eyewitness evidence’ synonymously. Finally, eyewitness memory

¹ TT, 8.

² For example, in sports weightlifting, rugby, and boxing, people often think of more muscles as being better. In cosmetic surgery and beauty industry the presumption that augmented breast and penis are better. See TT, 8.6.

³ TT, 8.

⁴ HORNBY, A. S., WEHMEIER, S. & ASHBY, M. 2002. *Oxford advanced learner's dictionary of current English*, Oxford, Oxford University Press.

refers to what you have seen and you can describe afterwards for example, while testifying in court.

Among many other legal issues, the quest of an optimum memory influences the fundamental issue of legal testimony and this has some implications on legal practice itself. In this paper, I assess this implication, commencing with a brief assessment on the role of memory in eyewitness testimony.

11.3 The role of memory in eyewitness testimony

Why should the law bother about memory? Why should it be interested in an optimum memory? I propose that besides many other purposes that the law serves and protects the law should also specifically be interested in an optimum memory for its own sake, because of the indispensable role that memory plays in eyewitness testimony. We gather memories through witness statement, trial testimony, police investigations, line-ups, and more to help establish the underlying facts that set the entitlements of disputing parties.⁵ Memories and their associated affective states can also form part of a claim for damages.⁶ For example if you injure Jack and cause him to have upsetting memories, Jack can sometimes seek redress for the intentional or negligent infliction of the emotional distress associated with those memories.⁷ However, it is in criminal law where eyewitness testimony role is uttermost critical. Henceforward, I will address the impact of optimum memory from a criminal law perspective.

Eyewitness testimony plays a significant role in the apprehension, prosecution, and adjudication of criminals.⁸ ⁹ The success of the criminal justice system relies critically on the accuracy of eyewitness testimony, which is often vital to prosecution

⁵ KOLBER, A. 2006. Therapeutic Forgetting: The Legal and Ethical Implications of Memory Dampening. *Vanderbilt Law Review*, 59, pp.1561- 1626.

⁶ Ibid.

⁷ Ibid.

⁸ CUTLER, B. L. & PENROD, S. D. 1995. *Mistaken Identification: The Eyewitness, Psychology and the Law*, Cambridge University Press.

⁹ KLAMING, L. & VEDDER, A. 2009. Brushing Up our Memories: Can we use Neurotechnologies to Improve Eyewitness Memory? *Law, Innovation and Technology*, 1, 203-221.

of guilty suspects and acquittal of the innocent.^{10 11} Those who offer eyewitness testimony frequently rely on their memory in recounting what they have seen. This sort of memory is what I will henceforth refer as ‘eyewitness memory’. Indeed, in some legal cases, eyewitness memory may feature prominently as the main or as the only source of evidence.¹² When this happens, such cases may sometimes be decided exclusively based on eyewitness testimony.¹³ Unfortunately, the significance generally assigned to eyewitness evidence does not exactly match the actual accuracy of eyewitness memory.^{14 15} For eyewitness testimony can be vague, incomplete, or inaccurate¹⁶ and has indeed been a subject of controversy for many years.¹⁷ Given this deficiency, psychologists, legal theorists and practitioners have continued to search and develop new methods that could improve eyewitness memory and in doing so, improving the accuracy of eyewitness testimony. A skim through the vast literature on the matter demonstrates such a constant endeavour.^{18 19}

20

However, according to Klaming and Vedder, although psychological research has improved the collection of eyewitness evidence over the past years, the majority of methods aiming at enhancement of eyewitness memory, such as hypnosis and the

¹⁰ GHETTI, S., SCHAAF, J. M., QIN, J. & GOODMAN, G. S. 2004. Chapter 22 - Issues in Eyewitness Testimony. In: WILLIAM, T. O. D. & ERIC, R. L. (eds.) *Handbook of Forensic Psychology*. San Diego: Academic Press.

¹¹ WELLS, G. L., MEMON, A. & PENROD, S. D. 2006. Eyewitness Evidence: Improving Its Probative Value. *Psychological Science in the Public Interest*, 7, 45-75.

¹² BPS Revised April 2010. Guidelines on Memory and the Law: Recommendations from the Scientific Study of Human Memory. A Report from the Research Board, *The British Psychological Society*, Leicester.

¹³ VEDDER, A. & KLAMING, L. 2010. Human Enhancement for the Common Good—Using Neurotechnologies to Improve Eyewitness Memory. *AJOB Neuroscience*, 1, 22-33.

¹⁴ KLAMING, L. & VEDDER, A. 2009. Brushing Up our Memories: Can we use Neurotechnologies to Improve Eyewitness Memory? *Law, Innovation and Technology*, 1, 203-221.

¹⁵ VEDDER, A. & KLAMING, L. 2010. Human Enhancement for the Common Good—Using Neurotechnologies to Improve Eyewitness Memory. *AJOB Neuroscience*, 1, 22-33.

¹⁶ WAGENAAR, W. A. 2008. Enhancing Memory in the Criminal Trial Process. In: ZONNEVELD, L., DIJSTELBLOEM, H. & RINGOIR, D. (eds.) *Reshaping the human condition: exploring human enhancement*. The Hague: Rathenau Institute. pp.65-75.

¹⁷ GHETTI, S., SCHAAF, J. M., QIN, J. & GOODMAN, G. S. 2004. Chapter 22 - Issues in Eyewitness Testimony. In: WILLIAM, T. O. D. & ERIC, R. L. (eds.) *Handbook of Forensic Psychology*. San Diego: Academic Press.

¹⁸ GABBERT, F., HOPE, L. & FISHER, R. P. 2009. Protecting Eyewitness Evidence: Examining the Efficacy of a Self-Administered Interview Tool. *Law and Human Behavior*, 33, 298-307.

¹⁹ TOGLIA, M. P., READ, J. D., ROSS, D. F. & LINDSAY, R. C. L. 2006. *Handbook of Eyewitness Psychology: Memory for events*, Lawrence Erlbaum Associates.

²⁰ LINDSAY, R. C. L., ROSS, D. F., TOGLIA, M. P. & READ, J. D. 2007. *The Handbook of Eyewitness Psychology: Volume II: Memory for People*, Ibid.

cognitive interview, have been found to be limited or to have no potential in leading to more reliable evidence.^{21 22} It is therefore necessary to explore new and potentially initially controversial methods for the improvement of eyewitness memory.²³ Given this, Klaming and Vedder have recently argued that we can use neurotechnologies (which are used for cognitive enhancements) for example transcranial magnetic stimulation (TMS) and deep brain stimulation (DBS) to improve eyewitness memory for the common good.^{24 25} In this paper, by using psychopharmacological drugs such as propranolol²⁶ and technological logging devices such as SenseCam²⁷ to enhance and attain an optimum memory, we could as well be improving the accuracy of potential eyewitness testimony.

11.4 What are the difficulties in eyewitness memory?

Two main problems affect eyewitness memory that in turn influences the accuracy or the reliability of the eyewitness testimony given in court. Firstly, malleability of memory and secondly, mistaken identifications.

11.4.1 Malleability of memory

Any attempts to understand the human memory, one has to confront some simple but key facts about the memory. Firstly, that the memory refers not to static entities – memory is not like any other recording media such as videos or audio recordings. Memory is not a record of the events themselves but rather is a record of people's experiences of events.^{28 29} Secondly, that memory is not a singular phenomenon or unitary system, neither is it mediated by a single biological or psychological

²¹ KLAMING, L. & VEDDER, A. 2009. Brushing Up our Memories: Can we use Neurotechnologies to Improve Eyewitness Memory? *Law, Innovation and Technology*, 1, 203-221.

²² VEDDER, A. & KLAMING, L. 2010. Human Enhancement for the Common Good—Using Neurotechnologies to Improve Eyewitness Memory. *AJOB Neuroscience*, 1, 22-33.

²³ KLAMING, L. & VEDDER, A. 2009. Brushing Up our Memories: Can we use Neurotechnologies to Improve Eyewitness Memory? *Law, Innovation and Technology*, 1, 203-221.

²⁴ Ibid.

²⁵ VEDDER, A. & KLAMING, L. 2010. Human Enhancement for the Common Good—Using Neurotechnologies to Improve Eyewitness Memory. *AJOB Neuroscience*, 1, 22-33.

²⁶ TT, 5.3.1.4.

²⁷ TT, 4.3.2.

²⁸ BPS Revised April 2010. Guidelines on Memory and the Law: Recommendations from the Scientific Study of Human Memory. A Report from the Research Board, *The British Psychological Society*, Leicester.

²⁹ HUNTER, I. M. L. 1962. *Memory facts and fallacies*, Harmondsworth, Middlesex, Penguin.

system.³⁰ Thirdly, that memory is not stored in any single location in the brain as some researchers used to believe, but that different kinds of information are processed and stored in different parts of the brain.^{31 32} Fourthly, that memory is constructive³³ and reconstructive in nature,³⁴ it is an array of interacting systems and a vast number of interrelated activities or processes each capable of encoding or registering information, storing it and making it available for retrieval.^{35 36 37} Without this capability for information storage, we could not perceive adequately, learn from our past, understand the present, or plan the future.³⁸ For this retention and retrieval combines bits of information from the past with what we currently know and believe.³⁹ For us to be able to understand the malleability of memory, we need to study the memory processes that are fundamental to its characterization, namely: encoding, retention/storage and retrieval.^{40 41}

11.4.1.1 Memory processes

11.4.1.2 Encoding/learning

This is the process of acquiring some knowledge or data.⁴² In the initial stages of encoding, information is perceived through one or more of the senses, subsequently

³⁰ SCHACTER, D. L. 1996. *Searching for memory: the brain, the mind, and the past*, New York, Basic Books.

³¹ Ibid.

³² SQUIRE, L. R. 1992. Declarative and Nondeclarative Memory: Multiple Brain Systems Supporting Learning and Memory. *Journal of Cognitive Neuroscience*, 4, 232-243.

³³ BPS Revised April 2010. Guidelines on Memory and the Law: Recommendations from the Scientific Study of Human Memory. A Report from the Research Board, *The British Psychological Society*, Leicester.

³⁴ LOFTUS, E. F. 1996. *Eyewitness Testimony: With a New Preface by the Author*, Harvard University Press.

³⁵ SCHACTER, D. L. 1996. *Searching for memory: the brain, the mind, and the past*, New York, Basic Books.

³⁶ BADDELEY, A. D. 1999. *Essentials of Human Memory*, Psychology Press.

³⁷ HUNTER, I. M. L. 1962. *Memory facts and fallacies*, Harmondsworth, Middlesex, Penguin.

³⁸ Ibid.

³⁹ SCHACTER, D. 17/10/2002. *Session 4: Remembering and Forgetting: Psychological Aspects* [Online]. The President's Council on Bioethics. Available: <http://bioethics.georgetown.edu/pcbe/transcripts/oct02/session4.html> [Accessed 01/02/ 2010].

⁴⁰ GHETTI, S., SCHAAF, J. M., QIN, J. & GOODMAN, G. S. 2004. Chapter 22 - Issues in Eyewitness Testimony. In: WILLIAM, T. O. D. & ERIC, R. L. (eds.) *Handbook of Forensic Psychology*. San Diego: Academic Press.

⁴¹ WAGENAAR, W. A. 2008. Enhancing Memory in the Criminal Trial Process. In: ZONNEVELD, L., DIJSTELBLOEM, H. & RINGOIR, D. (eds.) *Reshaping the human condition: exploring human enhancement*. The Hague: Rathenau Institute. pp.65-75.

⁴² HUNTER, I. M. L. 1962. *Memory facts and fallacies*, Harmondsworth, Middlesex, Penguin. p.15.

processed, and prepared for storage in long-term memory.^{43 44} The better the information is encoded, the better will be the subsequent remembering and by inference the retaining.⁴⁵ Encoding is not a passive but a complex and active process by which information is considerably transformed and in some cases even distorted.⁴⁶ In situations relevant to eyewitness testimony, encoding happens when a victim experiences or a bystander witnesses a criminal act.⁴⁷ Eyewitness accuracy is constrained by the conditions and circumstances under which the information was encoded. Many variables that influence the probability that an event was properly encoded include the eyewitness environment,⁴⁸ observation conditions such as exposure duration,⁴⁹ witness attention,⁵⁰ witness motivation,⁵¹ witness knowledge, interpretation, and expectations.^{52 53} Indeed better levels of illumination and longer exposure to the event witnessed are associated with better eyewitness memory.^{54 55} Other aspects that would influence the information encoded include first, the level of emotions – highly emotionally charged events are more likely to be encoded and in retrospect retrieved from memory than neutral events.⁵⁶ Second, ‘weapon focus’

⁴³ WAGENAAR, W. A. 2008. Enhancing Memory in the Criminal Trial Process. In: ZONNEVELD, L., DIJSTELBLOEM, H. & RINGOIR, D. (eds.) *Reshaping the human condition: exploring human enhancement*. The Hague: Rathenau Institute.pp.65-75.

⁴⁴ MCGAUGH, J. L. 2000. Memory--a Century of Consolidation. *Science*, 287, 248-251.

⁴⁵ HUNTER, I. M. L. 1962. *Memory facts and fallacies*, Harmondsworth, Middlesex, Penguin.p.40.

⁴⁶ WAGENAAR, W. A. 2008. Enhancing Memory in the Criminal Trial Process. In: ZONNEVELD, L., DIJSTELBLOEM, H. & RINGOIR, D. (eds.) *Reshaping the human condition: exploring human enhancement*. The Hague: Rathenau Institute.pp.65-75.

⁴⁷ GHETTI, S., SCHAAF, J. M., QIN, J. & GOODMAN, G. S. 2004. Chapter 22 - Issues in Eyewitness Testimony. In: WILLIAM, T. O. D. & ERIC, R. L. (eds.) *Handbook of Forensic Psychology*. San Diego: Academic Press.

⁴⁸ CUTLER, B. L. & PENROD, S. D. 1995. *Mistaken Identification: The Eyewitness, Psychology and the Law*, Cambridge University Press.p.81.

⁴⁹ Ibid.p.101.

⁵⁰ GHETTI, S., SCHAAF, J. M., QIN, J. & GOODMAN, G. S. 2004. Chapter 22 - Issues in Eyewitness Testimony. In: WILLIAM, T. O. D. & ERIC, R. L. (eds.) *Handbook of Forensic Psychology*. San Diego: Academic Press.

⁵¹ HUNTER, I. M. L. 1962. *Memory facts and fallacies*, Harmondsworth, Middlesex, Penguin.pp.47-48.

⁵² GHETTI, S., SCHAAF, J. M., QIN, J. & GOODMAN, G. S. 2004. Chapter 22 - Issues in Eyewitness Testimony. In: WILLIAM, T. O. D. & ERIC, R. L. (eds.) *Handbook of Forensic Psychology*. San Diego: Academic Press.

⁵³ LOFTUS, E. F. 1996. *Eyewitness Testimony: With a New Preface by the Author*, Harvard University Press.

⁵⁴ GROSS, J. & HAYNE, H. 1996. Eyewitness Identification by 5- to 6-Year-Old Children. *Law and Human Behavior*, 20, 359-373.

⁵⁵ MACLIN, O. H., MACLIN, M. K. & MALPASS, R. S. 2001. Race, arousal, attention, exposure and delay: An examination of factors moderating face recognition. *Psychology, Public Policy, and Law*, 7, 134.

⁵⁶ DE QUERVAIN, D. J. F., AERNI, A., SCHELLING, G. & ROOZENDAAL, B. 2009. Glucocorticoids and the regulation of memory in health and disease. *Frontiers in Neuroendocrinology*, 30, 358-370.

effect – if someone has a gun pointed on another's head, a witness to crime is more likely to focus his attention on the gun and this leads to his reduced ability to recall other details such as what the holder of the gun was wearing, his facial characteristics or the environment.^{57 58} Third, factors such as heightened stress,^{59 60} drugs,⁶¹ age of witnesses, may all have influence on the information encoded.

11.4.1.3 Retention/storage

Retention is the process by which the encoded information is stored in the memory until it is needed for retrieval.⁶² Retention cannot occur in the absence of encoding, for without encoding, there would be nothing to store. Retention is also a necessary condition for retrieval, for you cannot retrieve what has not been successfully encoded and retained in the memory.^{63 64} Retention can be influenced on the one hand by postevent information and on the other hand, retroactive interference. (i) 'Postevent information' – is a concept that signifies that new information can dramatically change old originally retained memories.⁶⁵ For example, when someone witnesses an important event, and then later exposed to new information such as reading from a newspaper, watching TV, or getting some hearsay from other people, this exposure to the new information can considerably affect the memory of the original event.^{66 67} Postevent information can enhance witness's memory but at the same time, it can also create non-existent details in the originally acquired memory.⁶⁸

⁵⁷ LOFTUS, E. F. 1996. *Eyewitness Testimony: With a New Preface by the Author*, Harvard University Press.pp.35, 36.

⁵⁸ LOFTUS, E. F., LOFTUS, G. R. & MESSO, J. 1987. Some Facts about "Weapon Focus". *Law and Human Behavior*, 11, 55-62.

⁵⁹ DEFFENBACHER, K. A., BORNSTEIN, B. H., PENROD, S. D. & MCGORTY, E. K. 2004. A Meta-Analytic Review of the Effects of High Stress on Eyewitness Memory. *Ibid.*28, 687-706.

⁶⁰ MORGAN, C. A., HAZLETT, G., DORAN, A., GARRETT, S., HOYT, G., THOMAS, P., BARANOSKI, M. & SOUTHWICK, S. M. 2004. Accuracy of eyewitness memory for persons encountered during exposure to highly intense stress. *International Journal of Law and Psychiatry*, 27, 265-279.

⁶¹ HUNTER, I. M. L. 1962. *Memory facts and fallacies*, Harmondsworth, Middlesex, Penguin.pp.47-48.

⁶² WAGENAAR, W. A. 2008. Enhancing Memory in the Criminal Trial Process. *In: ZONNEVELD, L., DIJSTELBLOEM, H. & RINGOIR, D. (eds.) Reshaping the human condition: exploring human enhancement*. The Hague: Rathenau Institute.pp.65-75.

⁶³ *Ibid.*pp.65-75.

⁶⁴ HUNTER, I. M. L. 1962. *Memory facts and fallacies*, Harmondsworth, Middlesex, Penguin.p.15.

⁶⁵ LOFTUS, E. F. 1979. The Malleability of Human Memory: Information introduced after we view an incident can transform memory. *American Scientist*, 67, 312-320.

⁶⁶ *Ibid.*

⁶⁷ LOFTUS, E. F. 1996. *Eyewitness Testimony: With a New Preface by the Author*, Harvard University Press.p.55.

⁶⁸ *Ibid.*p.55.

(ii) Retroactive interference – this occurs when a new piece of information disrupts the ability to remember a previously learned piece of information.⁶⁹

11.4.1.4 Retrieval/remembering

Retrieval is the process by which information stored in memory is brought back to consciousness.⁷⁰ Recall is effectuated through the presentation of retrieval cues that are usually in form of questions, but it is also possible to retrieve information through the presentation of a line up of faces, objects, voices, or even by means of smells.⁷¹ Even if information is safely stored and preserved in the memory, retrieval will only succeed if we engage effective retrieval cues.⁷² Three important aspects to this are first, the degree to which the desired information is still uniquely linked to the cues envisaged during the process of encoding. Second, the skill of the interrogator to find such effective cues.⁷³ The skill is important because suggestible tactics during the interviewing of witness can also influence the information retrieved. In some cases, this can lead to misinformation, as demonstrated through experiments that false memories can be implanted where they never existed.⁷⁴ Third, encoding-specificity principle – the ‘encoding specificity principle’ dictates that the extent to which the retrieval environment matches the encoding environment is an important determinant of a person’s ability to provide accurate and complete eyewitness testimony.^{75 76}

⁶⁹ GHETTI, S., SCHAAF, J. M., QIN, J. & GOODMAN, G. S. 2004. Chapter 22 - Issues in Eyewitness Testimony. In: WILLIAM, T. O. D. & ERIC, R. L. (eds.) *Handbook of Forensic Psychology*. San Diego: Academic Press.

⁷⁰ Ibid.

⁷¹ WAGENAAR, W. A. 2008. Enhancing Memory in the Criminal Trial Process. In: ZONNEVELD, L., DIJSTELBLOEM, H. & RINGOIR, D. (eds.) *Reshaping the human condition: exploring human enhancement*. The Hague: Rathenau Institute. pp.65-75.

⁷² Ibid. pp.65-75.

⁷³ Ibid. pp.65-75.

⁷⁴ LOFTUS, E. F. & PICKRELL, J. E. 1995. The formation of false memories. *Psychiatric Annals*; *Psychiatric Annals*.

⁷⁵ GHETTI, S., SCHAAF, J. M., QIN, J. & GOODMAN, G. S. 2004. Chapter 22 - Issues in Eyewitness Testimony. In: WILLIAM, T. O. D. & ERIC, R. L. (eds.) *Handbook of Forensic Psychology*. San Diego: Academic Press.

⁷⁶ TULVING, E. & THOMSON, D. M. 1973. Encoding specificity and retrieval processes in episodic memory. *Psychological review*, 80, 352.

11.4.2 Mistaken identifications/misidentification of witnesses

Identifying a suspect can be the most important eyewitness evidence that is presented at a trial.⁷⁷ This is particularly useful when the eyewitness claims to have seen the suspect commit the act he is accused of. In such a case, ‘the eyewitness-identification testimony is direct evidence of guilt in the sense that the accuracy of the identification has a one-to-one relationship to the ultimate issue of whether the suspect committed the crime.’⁷⁸ However, the reliability or the accuracy of eyewitness identifications has been a cause of disagreement for a long time. Psychologists have demonstrated widely through experiments that eyewitness identifications can be unreliable. An eyewitness can make an absolute and honest positive identification but at the same time be absolutely mistaken.⁷⁹ However, according to Wells and co-authors prior to the DNA exoneration cases, people viewed the results of eyewitness experiments in psychology as mere academic exercises, games played with people's memories that would not apply to real witnesses and real crimes.⁸⁰ There is evidence to suggest that eyewitness misidentification is the single greatest cause of wrongful convictions in the US than all the other factors combined. Misidentification played a role in the nearly 75% of convictions that has been overturned through DNA testing.⁸¹ What then are the causes of mistaken identifications?

Many factors have been demonstrated in literature as influencing the accuracy of eyewitness identifications.^{82 83} The main ones includes: (i) Witness age – correct identifications improve with age. For example preschoolers children are likely to be inaccurate than older children and adults.^{84 85} (ii) Disguises – it is common practice for individuals to don disguises before engaging in criminal acts, for example

⁷⁷ WELLS, G. L., MEMON, A. & PENROD, S. D. 2006. Eyewitness Evidence: Improving Its Probative Value. *Psychological Science in the Public Interest*, 7, 45-75.

⁷⁸ Ibid.

⁷⁹ Ibid.

⁸⁰ Ibid.

⁸¹ INNOCENCE-PROJECT. 2013. *The Innocence Project - Home* [Online]. Available: <http://www.innocenceproject.org/> [Accessed 31/01/ 2013].

⁸² CUTLER, B. L. & PENROD, S. D. 1995. *Mistaken Identification: The Eyewitness, Psychology and the Law*, Cambridge University Press.pp.79-112.

⁸³ LOFTUS, E. F. 1996. *Eyewitness Testimony: With a New Preface by the Author*, Harvard University Press.

⁸⁴ POZZULO, J. D. & LINDSAY, R. C. L. 1998. Identification accuracy of children versus adults: A meta-analysis. *Law and Human Behavior*, 22, 549-570.

⁸⁵ CHANCE, J. E. & GOLDSTEIN, A. G. 1984. Face-Recognition Memory: Implications for Children's Eyewitness Testimony. *Journal of Social Issues*, 40, 69-85.

wearing full masks, stocking, gloves, hats, etc. This affects subsequent identification by witnesses.^{86 87 88} (iii) Facial distinctiveness.⁸⁹ (iv) Aspects of eyewitness environment: firstly, exposure time or duration – the more time the witness has for viewing a perpetrator influences his ability to subsequently identify the perpetrator.⁹⁰ Secondly, presence of a weapon – a weapon during crime attracts attention of the witness to the weapon, and less attention to other details for example the facial and physical characteristics of the perpetrator.^{91 92} (v) Cross race identifications – own race identifications are more accurate than other-race identifications.^{93 94} (vi) Postevent factors: firstly, retention interval – memory declines over time.⁹⁵ The longer one stays before identifying the perpetrator, the more prone one is to misidentification. Secondly, experiential context – criminal identifications involve a change in context as well as changes in appearance such as clothing,⁹⁶ which complicates the identification of the perpetrator. (vii) Alcohol intoxication – alcohol intoxication while witnessing the event has been associated with a lower rate of correct identifications.⁹⁷ (viii) Stress – it has been established that stress interferes with the ability of eyewitnesses to identify a central person in a stressful situation.⁹⁸

⁸⁶ CUTLER, B. L., PENROD, S. D. & MARTENS, T. K. 1987a. IMPROVING THE RELIABILITY OF EYEWITNESS IDENTIFICATION - PUTTING CONTEXT INTO CONTEXT. *Journal of Applied Psychology*, 72.

⁸⁷ CUTLER, B. L., PENROD, S. D. & MARTENS, T. K. Ibid. Improving the reliability of eyewitness identification: Putting context into context. 629.

⁸⁸ CUTLER, B. L. & PENROD, S. D. 1995. *Mistaken Identification: The Eyewitness, Psychology and the Law*, Cambridge University Press.

⁸⁹ SHAPIRO, P. N. & PENROD, S. 1986. Meta-analysis of facial identification studies. *Psychological Bulletin; Psychological Bulletin*, 100, 139.

⁹⁰ CUTLER, B. L. & PENROD, S. D. 1995. *Mistaken Identification: The Eyewitness, Psychology and the Law*, Cambridge University Press. p.101.

⁹¹ LOFTUS, E. F. 1996. *Eyewitness Testimony: With a New Preface by the Author*, Harvard University Press. pp.35-36.

⁹² LOFTUS, E. F., LOFTUS, G. R. & MESSO, J. 1987. Some Facts about "Weapon Focus". *Law and Human Behavior*, 11, 55-62.

⁹³ MEISSNER, C. A. & BRIGHAM, J. C. 2001. Thirty years of investigating the own-race bias in memory for faces: A meta-analytic review. *Psychology, Public Policy, and Law*, 7, 3.

⁹⁴ SHAPIRO, P. N. & PENROD, S. 1986. Meta-analysis of facial identification studies. *Psychological Bulletin; Psychological Bulletin*, 100, 139.

⁹⁵ Ibid.

⁹⁶ CUTLER, B. L. & PENROD, S. D. 1995. *Mistaken Identification: The Eyewitness, Psychology and the Law*, Cambridge University Press. p.106.

⁹⁷ READ, J. D., YUILLE, J. C. & TOLLESTRUP, P. 1992. RECOLLECTIONS OF A ROBBERY - EFFECTS OF AROUSAL AND ALCOHOL UPON RECALL AND PERSON IDENTIFICATION. *Law and Human Behavior*, 16, 425-446.

⁹⁸ DEFFENBACHER, K. A., BORNSTEIN, B. H., PENROD, S. D. & MCGORTY, E. K. 2004. A Meta-Analytic Review of the Effects of High Stress on Eyewitness Memory. Ibid. 28, 687-706.

⁹⁹ All these and other factors described above on the discussion of memory processes are important predictors that influence the accuracy of the identification. The problems of eyewitness memory lead to further problems of the eyewitness testimony/evidence that is given in courts.

11.5 What are the problems with eyewitness evidence?

Wells et al,¹⁰⁰ have identified three problems with eyewitness evidence. First, that it involves the fallacy of assuming that interwitness agreement is necessarily strong evidence of accuracy.¹⁰¹ Second, that profound level of proof is required for exonerating evidence to trump eyewitness identification.¹⁰² Even when there is other evidence like exoneration through DNA, some people still find it difficult to believe that the accused is innocent, and it is necessary to prove that someone else had actually committed the crime they are accused of with the newly provided evidence, that is contra the eyewitness evidence.¹⁰³ Third, mistaken identifications lead to a dual problem, on the one hand wrongful convictions of the innocent and on the other hand acquittals of the guilty, and as a result, the latter remain free to reoffend.¹⁰⁴

11.5.1 Wrongful convictions and wrongful acquittals

Eyewitness evidence can lead to a catastrophic dual problem whereby the guilty are acquitted and consequently remain free to re-offend, whereas the innocent are locked up. Unfortunately, prior to the advent of forensic DNA testing this was just a far too common scenario. As already highlighted above, misidentification was the single greatest cause of wrongful convictions that have been overturned through DNA testing in the US.¹⁰⁵ It is only recently in the 1990's through the development of forensic DNA testing that has permitted definitive cases of the conviction of innocent people to be uncovered.¹⁰⁶ As of this writing, over 300 people have been

⁹⁹MORGAN, C. A., HAZLETT, G., DORAN, A., GARRETT, S., HOYT, G., THOMAS, P., BARANOSKI, M. & SOUTHWICK, S. M. 2004. Accuracy of eyewitness memory for persons encountered during exposure to highly intense stress. *International Journal of Law and Psychiatry*, 27, 265-279.

¹⁰⁰ WELLS, G. L., MEMON, A. & PENROD, S. D. 2006. Eyewitness Evidence: Improving Its Probative Value. *Psychological Science in the Public Interest*, 7, 45-75.

¹⁰¹ Ibid.

¹⁰² Ibid.

¹⁰³ Ibid.

¹⁰⁴ Ibid.

¹⁰⁵ Ibid.

¹⁰⁶ Ibid.

exonerated in the United States based on DNA evidence.¹⁰⁷ In the majority of these cases, an eyewitness had mistakenly identified the convicted. While forensic DNA has been a major player in overturning wrongful convictions and acquittals decisions, there is still a need for continued research to complement it, thus, further improving eyewitness memory and evidence.

11.6 Can we enhance eyewitnesses' memory during memory processes?

Some of the problems with eyewitness evidence can be addressed by improving the way the evidence is collected and preserved.¹⁰⁸ ME for eyewitnesses can be enhanced in any of the memory processes discussed above: encoding, retention and retrieval. In encoding, enhancement could be by improving the perception of witnesses, by increasing their attention, or by refining their encoding strategy.¹⁰⁹ In retention, enhancement could be by protecting eyewitnesses against interfering post-event information. This can be achieved effectively by acquiring eyewitness's evidence, wherever possible immediately after the crime. The other way is by rehearsal, although, this can also produce a negative effect, if witnesses collaborate and rehearse together, consequently creating new memories, which may be conformed to the group and may not necessarily be accurate.^{110 111} In retrieval, a more promising approach has been the cognitive interview technique, which aims at providing a wider assortment of retrieval cues that guide witnesses back to the time closely preceding the to-be-remembered event. For example, an eyewitness could be asked to remember the course of that day: the weather, the environment, other people, and other events.¹¹² However, as Klaming and Vedder, have identified, although, psychological research has improved the collection of eyewitness evidence

¹⁰⁷ INNOCENCE-PROJECT. 2013. *The Innocence Project - Home* [Online]. Available: <http://www.innocenceproject.org/> [Accessed 31/01/ 2013].

¹⁰⁸ WELLS, G. L., MEMON, A. & PENROD, S. D. 2006. Eyewitness Evidence: Improving Its Probative Value. *Psychological Science in the Public Interest*, 7, 45-75.

¹⁰⁹ WAGENAAR, W. A. 2008. Enhancing Memory in the Criminal Trial Process. In: ZONNEVELD, L., DIJSTELBLOEM, H. & RINGOIR, D. (eds.) *Reshaping the human condition: exploring human enhancement*. The Hague: Rathenau Institute.pp.65-75.

¹¹⁰ Ibid.pp.65-75.

¹¹¹ WRIGHT, D. B., MEMON, A., SKAGERBERG, E. M. & GABBERT, F. 2009. When Eyewitnesses Talk. *Current Directions in Psychological Science*, 18, 174-178.

¹¹² WAGENAAR, W. A. 2008. Enhancing Memory in the Criminal Trial Process. In: ZONNEVELD, L., DIJSTELBLOEM, H. & RINGOIR, D. (eds.) *Reshaping the human condition: exploring human enhancement*. The Hague: Rathenau Institute.pp.65-75.

over the past years, the majority of methods aiming at an enhancement of eyewitness memory, such as hypnosis and the cognitive interview, have been found to have limited or to have no potential in leading to more reliable evidence.^{113 114} Given this, Klaming and Vedder have assessed the potential for how neurotechnologies such as DBS and TMS, could be used to enhance the eyewitness memory.¹¹⁵ Other means that could be used to enhance eyewitness memory are pharmacological¹¹⁶ and technological lifelogging devices respectively.¹¹⁷ Researchers have demonstrated recently that lifelogging devices such as SenseCam can be used to enhance our autobiographic memories.^{118 119 120}

11.6.1 Overcoming some hurdles

However, pharmacological and technological enhancement of eyewitness memory is not straightforward and we would need to overcome some obstacles that may compromise the quality of eyewitness memory and the consequent testimony in court. First, that setting of eyewitness memory is not like a learning environment for example in a classroom whereby one has to prepare for a lesson or an exam. Quite often, an eyewitness will see or experience certain events without any preparation or even expectation that they will later testify in court.¹²¹ Second, health and safety of eyewitnesses is paramount – some suggests that eyewitnesses are not patients and exposure to even the smallest risks either through pharmacological or technological means would be of no benefit to them.¹²² Third, where an eyewitness may choose to

¹¹³ KLAMING, L. & VEDDER, A. 2009. Brushing Up our Memories: Can we use Neurotechnologies to Improve Eyewitness Memory? *Law, Innovation and Technology*, 1, 203-221.

¹¹⁴ VEDDER, A. & KLAMING, L. 2010. Human Enhancement for the Common Good—Using Neurotechnologies to Improve Eyewitness Memory. *AJOB Neuroscience*, 1, 22-33.

¹¹⁵ KLAMING, L. & VEDDER, A. 2009. Brushing Up our Memories: Can we use Neurotechnologies to Improve Eyewitness Memory? *Law, Innovation and Technology*, 1, 203-221.

¹¹⁶ TT, 5.

¹¹⁷ TT, 4.3.2.

¹¹⁸ BERRY, E., KAPUR, N., WILLIAMS, L., HODGES, S., WATSON, P., SMYTH, G., SRINIVASAN, J., SMITH, R., WILSON, B. & WOOD, K. 2007. The use of a wearable camera, SenseCam, as a pictorial diary to improve autobiographical memory in a patient with limbic encephalitis: a preliminary report. *Neuropsychol Rehabil.* England.

¹¹⁹ HODGES, S., BERRY, E. & WOOD, K. 2011. SenseCam: a wearable camera that stimulates and rehabilitates autobiographical memory. *Memory*, 19, 685-96.

¹²⁰ HODGES, S., WILLIAMS, L., BERRY, E., IZADI, S., SRINIVASAN, J., BUTLER, A., SMYTH, G., KAPUR, N. & WOOD, K. 2006. SenseCam: A retrospective memory aid. *UbiComp 2006: Ubiquitous Computing*. Springer.

¹²¹ WAGENAAR, W. A. 2008. Enhancing Memory in the Criminal Trial Process. In: ZONNEVELD, L., DIJSTELBLOEM, H. & RINGOIR, D. (eds.) *Reshaping the human condition: exploring human enhancement*. The Hague: Rathenau Institute. pp.65-75.

¹²² NUNN, R. 2010. Stimulating Eyewitness Testimony: Not Even Neuroscience Can Just Stick to the Facts. *AJOB Neuroscience*, 1, 44-46.

lie and give false evidence, in such cases, ME will do nothing to increase the accuracy of his evidence.¹²³

Could such problems be resolved? I propose that an optimum memory would overcome some of the problems. One advantage of an optimum memory is that it need not to target specific purposes like learning but should aim at general health and well-being which is the ultimate prize for memory manipulation as I have argued elsewhere.¹²⁴ If an optimum memory is achieved, all things being equal, then it could help on the eyewitness evidence. For the eyewitness has already an optimum memory and thus he can consolidate, store and retrieve his memories as required, regardless of whether he will testify in court or not. If the need arise for testifying or giving evidence in court, then, an optimum memory will have mitigated the problem highlighted above that eyewitnesses never know beforehand that their memories will be required for evidence and it is not similar to a learning setting or preparing for an exam. Of course, this does not resolve the third problem highlighted above whereby an eyewitness may choose to lie and give false evidence. In such cases, ME will do nothing to increase the accuracy of his evidence.¹²⁵ Furthermore, one could argue that an optimum memory could even make his lies more nuanced and difficult to detect in such cases. However, the question of lies/false evidence is rather a separate moral issue as opposed to an argument against ME. Hence, if we set aside the issue of lies, then, the goal is to have an optimum memory and from there other benefits will flow. This leads me to assess the implications of optimum memory on eyewitness evidence.

11.7 What would be the impact of an optimum memory on eyewitness testimony?

The key implications of an optimum memory to eyewitness testimony are in cases of MD – which refers to the technological and pharmacological possibilities that enable us to modify what we remember and how we remember it. As opposed to processes that target increment of the memory, MD is a form of decrement. It thus involves

¹²³ HAUSKELLER, M. Ibid. Human Enhancement and the Common Good. 37-39.

¹²⁴ TT, 8.

¹²⁵ HAUSKELLER, M. 2010. Human Enhancement and the Common Good. *AJOB Neuroscience*, 1, 37-39.

forgetting processes through the application of memory drugs such as propranolol,¹²⁶ mifepristone,¹²⁷ zeta inhibitory peptide (ZIP),^{128 129} and propofol,^{130 131} amongst the many others suggested in literature. Pursuit of ME including MD could lead to an individual having an optimum memory, which would in turn influence eyewitness testimony, as already argued. However, what impact would MD have on the testimony given in courts by claimants, defendants, or witnesses? What impact could it have on the juries and the judges? Aoki has claimed that MD will have an overall negative effect on the testimony given by both claimants and defendants.¹³² She alleges that the recall or accuracy of one's testimony after MD could be questioned and upon calling expert witnesses to explain the mechanisms of dampening agents to the courts, his testimony could be rendered unreliable.¹³³ However, though this is a possibility, it is not unique to MD. The accuracy and reliability of eyewitness memory has already been a cause of disagreement in courts, even prior to the possibility of MD through pharmaceutical agents. Eyewitness statements based on eyewitness memories have led to wrongful convictions and wrongful acquittals.¹³⁴ ¹³⁵ Indeed, it is evident through analyses of DNA exoneration cases that mistaken eyewitness identification has in the past accounted for vast majority of wrongful convictions than all other factors combined.^{136 137} Similarly, prior to MD drugs, it was still common for the accused to allege forgetfulness in courts, in an attempt to escape their legal responsibilities.^{138 139 140 141}

¹²⁶ PITMAN, R. K., SANDERS, K. M., ZUSMAN, R. M., HEALY, A. R., CHEEMA, F., LASKO, N. B., CAHILL, L. & ORR, S. P. 2002. Pilot study of secondary prevention of posttraumatic stress disorder with propranolol. *Biological Psychiatry*, 51, 189-192.

¹²⁷ WILLYARD, C. 2012. Remembered for Forgetting. *Nat Med*, 18, 482-484.

¹²⁸ Ibid.

¹²⁹ KOLBER, A. 2011. Neuroethics: Give memory-altering drugs a chance. *Nature*, 476, 275-276.

¹³⁰ Ibid.

¹³¹ SCOTT, H. 15/10/2007. *The Ethics of Erasing a Bad Memory* [Online]. Available: <http://www.time.com/time/health/article/0,8599,1671492,00.html> [Accessed 01/01/ 2011].

¹³² AOKI, C. R. A. 2008. Rewriting My Autobiography. *Bulletin of Science, Technology & Society*, 28, 349-359.

¹³³ Ibid.

¹³⁴ VEDDER, A. & KLAMING, L. 2010. Human Enhancement for the Common Good—Using Neurotechnologies to Improve Eyewitness Memory. *AJOB Neuroscience*, 1, 22-33.

¹³⁵ KLAMING, L. & VEDDER, A. 2009. Brushing Up our Memories: Can we use Neurotechnologies to Improve Eyewitness Memory? *Law, Innovation and Technology*, 1, 203-221.

¹³⁶ Ibid.

¹³⁷ WELLS, G. L., MEMON, A. & PENROD, S. D. 2006. Eyewitness Evidence: Improving Its Probative Value. *Psychological Science in the Public Interest*, 7, 45-75.

¹³⁸ *R. v Creighton (Paul Benjamin)* [2012] EWCA Crim 388. The accused claimed to have no recollection of the offences concerned, having been very drunk at the time. Note that this claim was rejected.

Moreover, it is debatable altogether, whether MD has a negative or positive effect on witnesses as Aoki alleges. MD is a form of enhancement and if carried out properly and for the right reasons, it should aim and could lead to an optimum memory, which is vital for the well-being of the individual.¹⁴² Nevertheless, even if it had a negative effect as Aoki alleges, and on that ground that dampening one's memory could exacerbate 'the unreliability of memories', it seems to me that this is a separate issue altogether and not per se an argument that could successfully be raised against MD for witnesses.

Other suggestions are that use of MD especially by perpetrators could fool juries and judges, making the perpetrators look as if they are innocent, as it enables them to dampen their emotional connectedness, their guilt and shame feelings.¹⁴³ ¹⁴⁴ However, this is just a mere possibility and it is not by itself a sufficient reason to object the pursuit of MD. Furthermore, without even MD agents, it is common for some criminals in courts not to show any remorse of whatever they have done. I do not suppose that this fools or convinces the juries and the judges that they are innocent. It is difficult to comprehend why the judges and juries would be convinced if these criminals had dampened their memories. A similar, but slightly different worry is that MD could be misused by criminals and thus affect not only the evidence later in court but the entire criminal justice system. While I am not in favour of criminals using such dampening agents to pervert the course of justice, as I have proposed above, questions of misuse of MD agents or any other drugs/technologies are not unique to MD and altogether they are separate issues requiring different justifications. Moreover, even if they were not, it would be doubtful justice to deny or prohibit beneficial therapies and/or enhancing

¹³⁹ *Caves v Revenue and Customs Commissioners* [2012] UKFTT 508. Mrs Caves had invoked a defence of forgetting to challenge a penalty for failing to file her tax returns in time. The Judge upholding the penalty said that Mrs. Caves had not advanced a reasonable excuse for her late filing of the return.

¹⁴⁰ *AST Systems Limited v The Commissioners for Her Majesty's Revenue and Customs (Income tax)* [2011] UKFTT 802 (TC), 2011 WL 6328987. Note the Judges accepted the appeal.

¹⁴¹ *Kinlet Properties Limited v The Commissioners for Her Majesty's Revenue and Customs* [2011] UKFTT 403 (TC), 2011 WL 2649509. The Judge confirmed the penalty issued.

¹⁴² TT, 8.

¹⁴³ AOKI, C. R. A. 2008. Rewriting My Autobiography. *Bulletin of Science, Technology & Society*, 28, 349-359.

¹⁴⁴ KOLBER, A. 2006. Therapeutic Forgetting: The Legal and Ethical Implications of Memory Dampening. *Vanderbilt Law Review*, 59, pp.1561- 1626.

technologies to individuals on the bases that they will be misused. Furthermore, we do not prohibit people from owning some things for example guns, despite the fact they are often misused and cause greater harm to both individuals and the society at large. Additionally, ‘people become addicted to any pleasurable activity: eating, drinking alcohol, sex, gambling, exercise, and so on. The fact that one can abuse any of these activities is not a reason to criminalize their supply.’¹⁴⁵ The possibility of misusing MD drugs as well as any other pharmaceutical drugs and technology will always co-exist with them. The questions that remain then are what we can and what we should do to mitigate and/or avert such misuse or abuse by criminals.

Besides the above implications, enhancement of eyewitness memory through pharmacological and technological lifelogging devices do raise some ethical and social issues. These could range from issues of privacy, autonomy, and sharing of data;¹⁴⁶ issues of safety, issues related to manipulated/implanted memories, which could lead to false memories,^{147 148} and so forth. However, due to limitations of this paper, I have not addressed these issues here but I will do so elsewhere.

11.8 Conclusion

In this paper, I have assessed the implications of optimum memory on eyewitness testimony. I have discussed the role of memory in eyewitness testimony and in doing so assessed the difficulties that ensue in eyewitness memory. The most notable difficulties are malleability of memory and mistaken identifications of witnesses. I have further assessed the critical dual problems of wrongful convictions and wrongful acquittals that result from erred eyewitness evidence. I have looked at the possibility of enhancing eyewitness memory during the memory processes: encoding, retention and retrieval. I suggested that psychopharmacological drugs and technological lifelogging devices such as SenseCam would contribute to optimum memory. With optimum memory, we are likely to contribute to better/improved

¹⁴⁵ SAVULESCU, J. 2013. A Liberal Consequentialist Approach to Regulation of Cognitive Enhancers. *The American Journal of Bioethics*, 13, 53-55.

¹⁴⁶ SELLEN, A. J. & WHITTAKER, S. 2010. Beyond total capture: a constructive critique of lifelogging. *Communications of the ACM*, 53, 70-77.

¹⁴⁷ LANEY, C. & LOFTUS, E. F. 2005. Traumatic memories are not necessarily accurate memories. *Can J Psychiatry*, 50, 823-8.

¹⁴⁸ LOFTUS, E. F. 2005. Planting misinformation in the human mind: A 30-year investigation of the malleability of memory. *Learning & Memory*, 12, 361-366.

eyewitness evidence, while mitigating/averting the problems of malleability of memory and mistaken identifications of witnesses.

Part IV Conclusion and future directions

Chapter 12

12 Concluding comments

In this concluding chapter, I summarize the main purposes of this thesis, my contribution to the ME debate and suggest some future directions. To recapitulate, the primary goal for this thesis has been twofold: first, to investigate the key multidisciplinary ethical, social, legal and policy arguments that would support a case for ME. This has involved on the one hand, providing arguments for ME, and on the other hand, assessing critically and consequently rejecting arguments that would act as barriers or hindrances to ME. Second, to evaluate critically some implications (which could as well be used as reasons to reject ME) that would arise in cases of ME. Thus, this thesis is about ESLP arguments for and against ME.

To fulfil the primary objectives for this thesis, I have argued that ME should be acceptable and permissible from an ESLP perspective. At the same time, I have critically assessed some implications arising from ME.¹ I have demonstrated why such implications are unpersuasive to warrant prohibition of ME. In what follows, I will recap and amalgamate these main and other arguments from various parts of the thesis.

In chapter one of this thesis, I have briefly introduced my reader to the general problem in the ME debate and I set out the objectives for this thesis. Rather than making any fully-fledged argument on this short chapter, I have made my reader aware of the problem and pointed out how I will address it in the forthcoming chapters of the thesis. To reiterate, the problem is that, in the past, most of the commentators have largely addressed ESLP issues in human enhancements as a whole as opposed to specific enhancements. However, this has been found to be problematic and various commentators have called for a contextualized case-by-case analysis to human enhancements. The overarching principle being that the reasons

¹ I have used eyewitness testimony as an example. See TT, 11. This is because there are varieties of implications arising from ME, and I could not possibly address all of them on such a thesis.

for accepting/rejecting a particular enhancement vary depending on the enhancement itself. Given this enormous variation, moral and legal generalizations about all enhancement processes and technologies are unwise and they should instead be evaluated individually.²

Taking this as a point of departure, in this thesis, I have focussed specifically on making a case for ME and in doing so I have assessed some of the ESLP implications arising from ME. Although my analysis is an exploration of the existing and emerging arguments for and against human enhancement, it has been novel in providing a much more in-depth analysis of the ESLP issues in ME.

In chapter two, I have briefly enlisted some research questions that inform the remaining part of the thesis and I have offered a detailed account of what is included in each chapter. Mainly, in this chapter, I offer my philosophical and legal approach that I use in the remaining part of the thesis. I discuss the various options that have been used in the human enhancement debates ranging from consequentialist, utilitarian to virtue ethics approach. I settle for ‘a Harrisian approach’. From this approach, enhancement is defined as clearly anything that makes life better.³

In chapter three, I have clarified what the memory is and elucidated why the memory is important. To understand the memory, one has to face head-on some fundamental facts about the memory. First, the memory refers not to static entities; it is not like any other recording such as videos or audio recordings. Memory is not a record of the events themselves but rather a record of people’s experiences of events. Second, that memory is not a singular phenomenon or unitary system, neither is it mediated by a single biological or psychological system. Third, that memory is not stored in any single location in the brain as some researchers used to believe, but that different kinds of information are processed and stored in different parts of the brain. Fourth, that memory is constructive and reconstructive in nature – an array of interacting systems and a vast number of interrelated activities or processes each capable of encoding or registering information, storing it and making it available for retrieval.⁴

² TT, 1.

³ TT, 2.11.

⁴ TT, 3.

I have also discussed the main memory processes,⁵ and the central types of memory.⁶ Since the studies of memory are extensive and span across different academic disciplines, I have acknowledged in this chapter that it is impossible to cover all the types of memories. Attempts to do so, on such a thesis, might end up being fruitless. Furthermore, human memory looks different when viewed from various human perspectives.⁷

Additionally, in this chapter, I have clarified my usage of the terms ME and optimum memory. ME refers to memory processes, various types of memory and brain systems that supports them. From this perspective, ME in this thesis, refers not only to the processes that make the memory better through positive increment but also those processes that influence the memory through some form of decrement for example by MD, thus influencing what and how we remember.⁸ I have used the words ‘optimum memory,’ to refer to the best possible memory that an individual can attain through the processes of ME. Optimum memory can be achieved either through increment or through some form of decrement in the memory, and at their best these instances of ME is what I have referred throughout the thesis as an optimum memory. From this perspective, MD is a typical example of ME.⁹ Unlike other forms of human enhancements where it is presumed that the more of a good thing the better, I have argued that what is at stake in the ME debate is not necessarily more memory but rather an optimum memory that would enable the beholder to lead a better life.¹⁰

At the end of this chapter, I have discussed the importance of the memory. This is essential, for it answers the question why we would want to enhance the memory. I have stressed that the memory is vital in bridging the gap between the past, through the present to the future. I have highlighted some fundamental role of memory in our general health and well-being namely: first, the role of memory in the formation of one’s identity. Second, the role of memory in the pursuit of our well-being. Third,

⁵ TT, 3.1.1, 3.1.2, 3.1.3.

⁶ TT, 3.2.

⁷ TT, 3.2.

⁸ TT, 3.3.

⁹ TT, 3.3.1.

¹⁰ TT, 8.6.

the role that loss of the memory plays not only on the individual's life but also to that of his society. Fourth, the many benefits that can be accrued intellectually, socially and economically from an enhanced memory, and which are all crucial to our well-being.¹¹

In chapters four and five of this thesis, I have responded to the question how do we enhance the memory? In replying to the question, I have explored the different methods and means that have been and continue to be used for ME. I have subdivided these modes of enhancements into two main categories: non-pharmacological and pharmacological, which I have explored in chapter four and five respectively.

In chapter four, I commence by briefly arguing that individuals have been enhancing their memory since time immemorial. To support this claim, I have reviewed some non-pharmacological means that individuals have been using to enhance their memory. This non-pharmacological means range from the traditional, conventional and up to the latest in the technological arena which includes brain stimulation methods.¹² There are many non-pharmacological means that could be used for ME and thus what I have discussed here is only a scratch to the surface. However, despite this limitation, this chapter suffices to demonstrate that enhancing the memory in attempts to improve individual's well-being is an ancient desire. This chapter, although quite descriptive, contributes to the ME debate through its scrutiny of these non-pharmacological means. While most of the research has focussed on pharmacological and technological enhancement such as brain stimulation, it is vital to review traditional and conventional means as well, assess their effectiveness and as already stated, to study them as 'enhancements proper'.¹³

In chapter five, I have reviewed some of the pharmacological means that could be used to enhance the memory.¹⁴ While some of these pharmacological means may not work directly in enhancing the memory, they do so indirectly in one way or another. Thus, drugs that would help an individual to keep awake and concentrate, though

¹¹ TT, 3.4.

¹² TT, 4.

¹³ TT, 4.1, 4.4.

¹⁴ TT, 5.

they are not enhancing the memory directly, they are promoting the faculties, or preparing the environment in which ME takes place, for example, during the processes of encoding/learning and storage/consolidation. This has further consequences on other memory processes like retrieval/remembering. For you cannot remember what has not been encoded and stored in the memory in the first place. The two processes are necessary for any remembering to take place. A similar principle could apply too on some of non-pharmacological means.

Overall, in part one of this thesis, I offer a clearer analysis of the problem; a detailed account of what is addressed by each chapter; a meaningful discussion of what the memory is and why it is important; and finally the means that are employed when we talk of ME ranging from non-pharmacological to pharmacological means. This further enlightens the debate and the assessment of the ESLP issues related to ME.

In chapter six, I have assessed the ethical and social arguments for and against human enhancements with a focus on ME.¹⁵ I begin by exploring a brief background on the distinction between treatment and enhancement, before proceeding to the arguments for and against human enhancement. This distinction is significant in the human enhancement debate especially for the role it played in the evolving and shaping of the debate in the early days.

In support of human enhancements, I have explored three main arguments: consistency argument, the inevitability thesis arguments, and the argument that enhancements are good for they make people's lives better. On arguments against, I have focused on the following: (i) The attitude of mastery and the openness to the unbidden. (ii) That to enhance is to use 'unnatural' means, and this is inauthentic. (iii) Should not enhance for health and safety reasons. (iv) Slippery slope, precautionary principle, or precautionary approach arguments. (v) Loss of human nature, loss of human dignity, loss of human diversity, change of personality and change of person identity arguments. (vi) Violation of sole authorship of one's life and equality. The arguments I have explored for and against human enhancement on this chapter are not exhaustive, but I have opted for those arguments that are relevant

¹⁵ TT, 6.

to ME. I have also highlighted other specific ethical and social issues related to specific ME, and I have dealt with them on part three of the thesis. Overall, this chapter argues for the acceptability of ME.

In chapter seven, I have assessed the legal and policy issues that lean more on the questions of regulatory framework. The questions of whether we should regulate ME and what form of regulation that would be are some of the pertinent issues I have considered in this chapter. I have explored various policy and regulatory options while at the same time responding briefly to some more nuanced legal issues such as privacy and confidentiality; coercion to use enhancing technologies; and discrimination of the unenhanced.¹⁶ Although, my analysis on this part has drawn heavily on the already existing literature for and against enhancement, I have been novel in providing a much more in-depth analysis of ME as opposed to human enhancements in general. Altogether, this chapter addresses underlying legal and policy principles that relate to permissibility of ME.

Overall, the common theme of these two chapters, which form part two of the thesis, is to draw from the existing and emerging literature the overarching principles that would support a case for ME. This involves too a critical assessment of the objections that could be raised upon ME, and consequently evaluating whether they would be sufficient to warrant the rejection of ME from an ESLP perspective. Largely from these chapters, I have provisionally concluded that the objections I have examined would not persuasively pose as an obstacle to ME.

Part three of this thesis consists of four independent papers. In this part, I assess some particular ESLP issues that further reinforce my ongoing case for ME that commenced in part two of this thesis. At the same time, I examine some implications that would arise through ME, by assessing eyewitness testimony as an example. Central in these four papers are the ideas of optimum memory and MD. To reiterate, in this thesis, on the one hand, optimum memory is the best possible memory that an individual can attain through ME. On the other hand, MD is a form of ME, which entails a form of decrement in the memory. It refers to the technological and

¹⁶ TT, 7.1.2, 7.1.3, 7.1.4.

pharmacological possibility of modifying what we remember and how we remember it.

In chapter eight, I argue that optimum memory is the ultimate prize for ME. I argue that ME should aim for optimum memory, for this is good for the individual's general health and well-being. In making this argument, I explore some pertinent ethical and social issues that could hinder the pursuit of optimum memory. I commence by assessing the treatment/enhancement distinction¹⁷ that critics have appealed to in their objections of ME and other types of human enhancement. Although I had already addressed this distinction in chapter six of this thesis,¹⁸ I have restated the argument in chapter eight, because part III of this thesis forms independent papers that target to be published in academic journals.

I further explore briefly two interesting philosophical arguments that could lead to the rejection of the pursuit to optimum memory. On the one hand, that MD results in the loss of epistemic access;¹⁹ and on the other hand, that MD results in a change of personal identity and personality.²⁰ Finally, I explore the presumption that the more of a good thing the better.²¹ Overall, I conceive that these four main arguments in chapter eight do not convincingly warrant the rejection of MD.

In chapter nine, I ask and respond to the question as to whether there is a duty to remember or an obligation not to forget. To facilitate the response and assessment to this question, I analyse other significant questions, such as, what is it to remember? What is the nature of the obligation to remember? Is remembering voluntary or involuntary? Are we obligated to remember people, information, and events from the past?²²

I further explore the case for a duty to remember. Those who support it, do so for some of the following reasons. These are, first, that society has some interest in

¹⁷ TT, 8.3.

¹⁸ TT, 6.1.

¹⁹ TT, 8.4.

²⁰ TT, 8.5.

²¹ TT, 8.6.

²² TT, 9.6.

preserving memories for the greater good.²³ Second, that we need to live authentically – and this involves remembering fitly and truly.²⁴ Third, MD would make us become less sensitive and un-empathetic.²⁵ Fourth, that we owe a debt to our predecessors / justice issues.²⁶ I argue that a duty to remember would rule out MD, and this would put severe constraints on those suffering from traumatic memories. I argue that advocating for a duty to remember is tantamount to advocating for a duty to suffer and this is indefensible even from a human rights perspective.²⁷

In foresight, my reader or critic may wonder why I have a paper that argues against a duty to remember or an obligation not to forget on a thesis that makes a case for ME. Is this not a contradiction? To answer back, although in the first instance it may appear as if this is against the thesis, paradoxically it is not. As argued, a duty to remember or an obligation not to forget, would rule out cases of MD. Therefore, altogether, such a duty or obligation would be against an overall case for ME, and indeed optimum memory as argued in this thesis. For in this thesis, both processes of remembering and/or forgetting can each in its own way lead to optimum memory – the best possible memory achievable through ME. Contrary, a duty to remember would logically entail a duty not to forget, and likewise a duty not to forget would logically entail a duty to remember.

In chapter ten, I examine some of the legal issues that the pursuit of optimum memory raises. These include consent and informed consent;²⁸ obstruction of justice/perverting the course of justice;²⁹ mitigation of emotional distress damages / duty to mitigate loss/damages;³⁰ negligence and other possible claims for failure to treat traumatic memories;³¹ and finally, individual versus society interests issues.³²

²³ TT, 9.7.1.

²⁴ TT, 9.7.2.

²⁵ TT, 9.7.3.

²⁶ TT, 9.7.4.

²⁷ TT, 9.8.

²⁸ TT, 10.2.1.

²⁹ TT, 10.3, 10.3.1.

³⁰ TT, 10.4.

³¹ TT, 10.5.

³² TT, 10.6.

In chapter eleven, I respond to the question what are the implications of optimum memory on eyewitness testimony? I explore the role of memory in eyewitness testimony,³³ while there may be many other ESLP implications for enhancing the memory, I have chosen implications on eyewitness testimony because it illustrates a lucid picture of what would be the effects of ME in this important aspect of law and daily life.

I have considered the indispensable role that memory plays in eyewitness testimony. This includes gathering memories through witness statement, trial testimony, police investigations, line-ups, and more to help establish the essential facts that set the entitlements of disputing parties. Eyewitness testimony plays a significant role in the apprehension, prosecution, and adjudication of criminals. In some cases, the success of the criminal justice system relies critically on the accuracy of eyewitness testimony. I have assessed two main problems that affect eyewitness memory that in turn influences the accuracy or the reliability of the eyewitness testimony given in court. Firstly, malleability of memory and secondly, mistaken identifications. Mistaken identifications lead to a dual problem, on the one hand wrongful convictions of the innocent and on the other hand acquittals of the guilty, and as a result, the latter remain free to reoffend.

In addition, I have scrutinized what impact would MD have on the testimony given in courts by claimants, defendants, or witnesses. I have responded briefly to the qualms that use of MD could firstly fool the judges and juries and secondly, that criminals could misuse MD, and thus affecting not only the evidence later in court but also the entire criminal justice system.

While in this paper I am concerned primarily with the individual's ME, and the ensuing implications in eyewitness testimony, there could be many other implications as well to other people, society and indeed to the entire planet that I have not explored in this paper and indeed in this thesis. This brings me to other limitations of this thesis.

³³ TT, 11.3.

12.1 Limitations

As already emphasized, while in this thesis I have focussed on making a case for ME from an individual based perspective, for his general health and well-being, this does not presume that the individual's general health and well-being are the only question of value here. Other possible theses exist: for example, ME³⁴ for the well-being of non-humans, ME for the greater good of the society, ME for the good of the entire planet, and so forth. Contemplating about non-humans, in a society where many animals such as dogs and cats die as result of being forgotten in cars during extreme hot weather conditions, they would benefit, if their owners had an optimum memory. This assumes ideally that with optimum memory, the owners would not forget such animals in cars, and at the same time, it excludes cases where the owners may choose to leave such animals deliberately and/or negligently.

The means and methods discussed in part one of this thesis are not exhaustive; however, they still contribute to the debate and demonstrate the gist of the available non-pharmacological and pharmacological means for ME.

Overall, while my discussion on this thesis has focussed on ESLP issues and implications arising from ME, they are not the only issues of significance. As already elucidated in this thesis, the memory is tremendously important and there exists vast multidisciplinary subjects addressing it. Given this, first, it is unlikely that any single study on ESLP will be exhaustive. Second, other discipline studying the memory might come up with different issues of value and implications than what I have discussed on this thesis. Thus, there could be religious, theological, cultural, anthropological, and numerous other reasons that could be made in support and against ME. However, my thesis is in bioethics and medical jurisprudence. Remaining faithful to this field, I have endeavoured to address the *raison d'être* ESLP in ME. At the same time, since I acknowledge the academic multidisciplinary nature and approach to the study of memory, I have borrowed heavily from other fields especially from psychology, neuroscience, and pharmacology, in order to address adequately the means and methods used for ME. This is evidenced in part one of this thesis. Without such reliability on other academic disciplines already mentioned, it would be impossible to address faithfully the questions what is the

³⁴ Note this refers to ME of human beings not ME of other non-human beings.

memory and how do we enhance the memory?³⁵ Thirdly, although I have considered ESLP issues relating to ME from an individual perspective, one could also address these issues based on a communal perspective – thus ESLP implications of communal / collective memory.

12.2 Future directions

The debate on ME is not going away; indeed, it will be on the increase, given the current huge interests in the human brain. The claim that there are currently huge interests in the understanding of the human brain is supported by the amount of recent funding rising up to €1billion allocated by the European Union for the Human Brain Project (HBP)^{36 37} as well as the US \$100million allocated by the US government for the initiative dubbed Brain Research Through Advancing Innovative Neurotechnologies (BRAIN).³⁸ The more we understand the way the human brain works, the more we will understand the memory structures/systems in the brain. This will increase not only interests but also the knowledge of how to enhance the memory, especially through pharmaceutical and technological means.

Some future work that could be amalgamated with the ME debate advanced in this thesis have already begun. For example, Thomas Douglas through the ‘*Wellcome Trust New Investigator Award*’³⁹ is examining the questions about when, if ever, the state may permissibly offer or impose pharmaceutical and other technological interventions that act directly on the brain. This could relate to the current debate by reflecting on some ‘ifs’:

³⁵ TT, 3, 4, 5.

³⁶ HBP. 2013. *Human Brain Project* [Online]. Available: <http://www.humanbrainproject.eu> [Accessed 01/08/ 2013].

³⁷ KROES, N. 2013. *EUROPA - PRESS RELEASES - Press Release - Graphene and Human Brain Project win largest research excellence award in history, as battle for sustained science funding continues* [Online]. Available: http://europa.eu/rapid/press-release_IP-13-54_en.htm [Accessed 29/05/ 2013].

³⁸ MOONEY, A. 2013. *Obama seeks \$100M to unlock mysteries of the brain* [Online]. Available: <http://www.cnn.com/2013/04/02/health/obama-brain-research/index.html> [Accessed 29/05/ 2013].

³⁹ OCN. 2013. *The Oxford Centre for Neuroethics News - Wellcome Trust New Investigator Award* [Online]. Available: http://www.neuroethics.ox.ac.uk/latest_news/wellcome_trust_new_investigator_award2 [Accessed 07/07/ 2013].

- (i) if ME is good for the general health and well-being of the individual as argued in this thesis
- (ii) if it could be argued that ME is good for the general health of other non-human beings⁴⁰
- (iii) if it could be argued that ME is good for the society
- (iv) if it could be argued that ME is indeed good for the entire planet
- (v) as proposed (ii, iii, and iv) but not argued in this thesis, should it not be reasonable in some instances to coerce or manipulate people to use such pharmacological and technological means to enhance their memory? Some examples: First, reflecting on MD, should it be permissible for the state to dampen a soldier's severe traumatic memory, if it was demonstrated that this soldier's severe traumatic memory could lead not only to harming himself but also to causing greater harm/damage to other people? Second, PTSD costs to the society are in billions of dollars every year. If PTSD could be treated cost-effectively through MD, should it be permissible for the state to encourage or enforce such a treatment?

Overall, ME through pharmacology and other brain stimulation methods is still in its infancy. While I have endeavoured in this thesis to discuss the ESLP issues and implications arising from ME, as different means and methods of ME continue to emerge and develop exponentially, research on the ESLP principles will need to keep up to meet any risks/challenges posed by this progress.

⁴⁰ Note this refers to ME of human beings not ME of other non-human beings.

13 Bibliography

All URL's are accurate as of 1st of August 2013 unless otherwise stated.

*Catechism of the Catholic Church - PART 2 SECTION 2 CHAPTER 2 ARTICLE 4
THE SACRAMENT OF PENANCE AND RECONCILIATION* [Online].

Available: <http://www.scborromeo.org/ccc/p2s2c2a4.htm#1471> [Accessed 01/08/ 2013].

Consumer Protection Act 1987 [Online]. Available:

http://www.legislation.gov.uk/ukpga/1987/43/pdfs/ukpga_19870043_en.pdf
[Accessed 01/01/ 2012].

Female Genital Mutilation Act 2003 - ukpgaen_20030031_en.pdf [Online].

Available:

http://www.legislation.gov.uk/ukpga/2003/31/pdfs/ukpgaen_20030031_en.pdf
f [Accessed 07/07/ 2013].

Medicines Act 1968 [Online]. Available:

http://www.legislation.gov.uk/ukpga/1968/67/pdfs/ukpga_19680067_en.pdf
[Accessed 01/01/ 2012].

Mental Capacity Act 2005 [Online]. Available:

http://www.legislation.gov.uk/ukpga/2005/9/pdfs/ukpga_20050009_en.pdf
[Accessed 12/05/ 2011].

Mental Health Act 2007 [Online]. Available:

http://www.legislation.gov.uk/ukpga/2007/12/pdfs/ukpga_20070012_en.pdf
[Accessed 01/01/ 2012].

ABAD, S. & TURON, X. 2012. Valorization of biodiesel derived glycerol as a carbon source to obtain added-value metabolites: Focus on polyunsaturated fatty acids. *Biotechnology Advances*, 30, 733-741.

ACEVEDO, A. & LOEWENSTEIN, D. A. 2007. Nonpharmacological Cognitive Interventions in Aging and Dementia. *Journal of Geriatric Psychiatry and Neurology*, 20, 239-249.

AGAR, N. 2004. *Liberal eugenics: in defence of human enhancement*, Oxford, Blackwell Publishing.

AGAR, N. 2010. Thoughts about our species' future: themes from Humanity's End: Why We Should Reject Radical Enhancement. *Journal of Evolution and Technology*, 21, 23-31.

ALDRIDGE, D., FACHNER, J., DIJKSTRA, I., ERKKIL, J. & FROMMER, J. 2010. *Music Therapy and Addictions*, Jessica Kingsley Publishers.

ALKIRE, M. T., VAZDARJANOVA, A., DICKINSON-ANSON, H., WHITE, N. S. & CAHILL, L. 2001. Lesions of the Basolateral Amygdala Complex Block Propofol-induced Amnesia for Inhibitory Avoidance Learning in Rats. *Anesthesiology*, 95.

ALLEN, A. L. 2008. Dredging up the past: Lifelogging, Memory, and Surveillance. *The University of Chicago Law Review*, 75, 47-74.

- ALLHOFF, F., LIN, P., MOOR, J. & AND WECKERT, J. 2010. Ethics of Human Enhancement: 25 Questions & Answers. *Studies in Ethics, Law, and Technology*, 4:1:4.
- ALLOWAY, T. P. & ALLOWAY, R. G. 2012. The impact of engagement with social networking sites (SNSs) on cognitive skills. *Computers in Human Behavior*, 28, 1748-1754.
- ALLOWAY, T. P., BIBILE, V. & LAU, G. 2013a. Computerized working memory training: Can it lead to gains in cognitive skills in students? *Computers in Human Behavior*, 29, 632-638.
- ALLOWAY, T. P., HORTON, J., ALLOWAY, R. G. & DAWSON, C. 2013b. Social networking sites and cognitive abilities: Do they make you smarter? *Computers & Education*, 63, 10-16.
- ANONYMOUS. 2013. *List of virtual communities with more than 100 million active users - Wikipedia, the free encyclopedia* [Online]. Available: http://en.wikipedia.org/wiki/List_of_virtual_communities_with_more_than_100_million_users [Accessed 07/07/ 2013].
- AOKI, C. R. A. 2008. Rewriting My Autobiography. *Bulletin of Science, Technology & Society*, 28, 349-359.
- APPEL, J. M. 2008. When the boss turns pusher: a proposal for employee protections in the age of cosmetic neurology. *Journal of Medical Ethics*, 34, 616-618.
- ARISTOTLE 2004. *The Nicomachean Ethics*, Translated by J.A.K Thomson, Revised with Notes and Appendices by Hugh Tredennick, Introduction and Further Reading by Jonathan Barnes: London, Penguin Books.
- AWAN, N. R., LOZANO, A. & HAMANI, C. 2009. Deep brain stimulation: current and future perspectives. *Neurosurgical Focus*, 27, E2.
- BABCOCK, Q. & BYRNE, T. 2000. Student Perceptions of Methylphenidate Abuse at a Public Liberal Arts College. *Journal of American College Health*, 49, 143-145.
- BADDELEY, A. D. 1999. *Essentials of Human Memory*, Psychology Press.
- BAIRD, A. & SAMSON, S. 2009. Memory for Music in Alzheimer's Disease: Unforgettable? *Neuropsychology review*, 19, 85-101.
- BALCH, W. R. 2005. Elaborations of Introductory Psychology Terms: Effects on Test Performance and Subjective Ratings. *Teaching of Psychology*, 32, 29-34.
- BALSTERS, J. H., O'CONNELL, R. G., MARTIN, M. P., GALLI, A., CASSIDY, S. M., KILCULLEN, S. M., DELMONTE, S., BRENNAN, S., MEANEY, J. F., FAGAN, A. J., BOKDE, A. L., UPTON, N., LAI, R., LARUELLE, M., LAWLOR, B. & ROBERTSON, I. H. 2011. Donepezil impairs memory in healthy older subjects: behavioural, EEG and simultaneous EEG/fMRI biomarkers. *PLoS One*. United States.
- BANJO, O. C., NADLER, R. & REINER, P. B. 2010. Physician attitudes towards pharmacological cognitive enhancement: safety concerns are paramount. *PLoS One*, 5, e14322.
- BARCH, D. 2004. Pharmacological manipulation of human working memory. *Psychopharmacology*, 174, 126-135.
- BARKER, M. J., GREENWOOD, K. M., JACKSON, M. & CROWE, S. F. 2004. Cognitive effects of long-term benzodiazepine use: a meta-analysis. *CNS Drugs*. New Zealand.

- BAYLIS, F. & ROBERT, J. S. 2004. The Inevitability of Genetic Enhancement Technologies. *Bioethics*, 18, 1-26.
- BAYNE, T. I. M. & LEVY, N. 2005. Amputees By Choice: Body Integrity Identity Disorder and the Ethics of Amputation. *Journal of Applied Philosophy*, 22, 75-86.
- BBC 2011. BBC Three - Our War, Series 1.
- BBC-NEWS. 2013. *Surgeon defends amputations* [Online]. Available: <http://news.bbc.co.uk/1/hi/scotland/625680.stm> [Accessed 01/01/ 2012].
- BCA. 2013. *Coffee Facts, Statistics & Coffee News - British Coffee Association* [Online]. Available: <http://www.britishcoffeeassociation.org/home-bca> [Accessed 01/02/ 2013].
- B EGLINGER, L. J., GAYDOS, B. L., KAREKEN, D. A., TANGPHAO-DANIELS, O., SIEMERS, E. R. & MOHS, R. C. 2004. Neuropsychological Test Performance in Healthy Volunteers Before and After Donepezil Administration. *Journal of Psychopharmacology*, 18, 102-108.
- B EGLINGER, L. J., TANGPHAO-DANIELS, O., KAREKEN, D. A., ZHANG, L., MOHS, R. & SIEMERS, E. R. 2005. Neuropsychological test performance in healthy elderly volunteers before and after donepezil administration: a randomized, controlled study. *J Clin Psychopharmacol*. United States.
- BENJAMIN, B. 1983a. 'The singing hospital'--integrated group therapy in the Black mentally ill. *S Afr Med J*, 63, 897-9.
- BENJAMIN, B. 1983b. 'The singing hospital'--integrated group therapy in the Black mentally ill. *South African medical journal= Suid-Afrikaanse tydskrif vir geneeskunde*, 63, 897.
- BENTON, D., OWENS, D. S. & PARKER, P. Y. 1994. Blood glucose influences memory and attention in young adults. *Neuropsychologia*, 32, 595-607.
- BERGER, F., GEVERS, S., SIEP, L. & WELTRING, K. M. 2008. Ethical, legal and social aspects of brain-implants using nano-scale materials and techniques. *NanoEthics*, 2, 241-249.
- BERMAN, S. M., KUCZENSKI, R., MCCracken, J. T. & LONDON, E. D. 2008. Potential adverse effects of amphetamine treatment on brain and behavior: a review. *Mol Psychiatry*, 14, 123-142.
- BERRY, E., KAPUR, N., WILLIAMS, L., HODGES, S., WATSON, P., SMYTH, G., SRINIVASAN, J., SMITH, R., WILSON, B. & WOOD, K. 2007. The use of a wearable camera, SenseCam, as a pictorial diary to improve autobiographical memory in a patient with limbic encephalitis: a preliminary report. *Neuropsychol Rehabil*. England.
- BIENENSTOCK, M. 2010. Is There a Duty of Memory? Reflections on a French Debate. *Modern Judaism*, 30, 332-347.
- BIERMAN, E. J., COMIJS, H. C., GUNDY, C. M., SONNENBERG, C., JONKER, C. & BEEKMAN, A. T. 2007. The effect of chronic benzodiazepine use on cognitive functioning in older persons: good, bad or indifferent? *Int J Geriatr Psychiatry*, 22, 1194-200.
- BIRKS, J. 2006. Cholinesterase inhibitors for Alzheimer's disease. *Cochrane Database Syst Rev*, CD005593.
- BIRKS, J. & GRIMLEY EVANS, J. 2009. Ginkgo biloba for cognitive impairment and dementia. *Cochrane Database Syst Rev*, 1.
- BIRKS, J. & HARVEY, R. J. 2006. Donepezil for dementia due to Alzheimer's disease. *Cochrane Database Syst Rev*, CD001190.

- BMA 2007. Boosting Your Brainpower: Ethical Aspects of Cognitive Enhancement. *British Medical Association*, London.
- BOLT, I. & SCHERMER, M. 2009. Psychopharmaceutical enhancers: Enhancing identity? *Neuroethics*, 2, 103-111.
- BORGES, J. 1964. *Labyrinths: selected stories & other writings*, New Directions Pub. Corp.
- BORN, J., RASCH, B. & GAIS, S. 2006. Sleep to remember. *Neuroscientist*, 12, 410-424.
- BOSTROM, N. 2003a. Astronomical Waste: The Opportunity Cost of Delayed Technological Development. *Utilitas*, 15, 308-314.
- BOSTROM, N. 2003b. Human Genetic Enhancements: A Transhumanist Perspective. *The Journal of Value Inquiry*, 37, 493-506.
- BOSTROM, N. 2005. In Defense of Posthuman Dignity. *Bioethics*, 19, 202-214.
- BOSTROM, N. 2008a. Cognitive Enhancement in the Public Interest. In: ZONNEVELD, L., DIJSTELBLOEM, H. & RINGOIR, D. (eds.) *Reshaping the human condition: exploring human enhancement*. The Hague: Rathenau Institute, in collaboration with the British Embassy, Science and Innovation Network and the Parliamentary Office of Science & Technology.
- BOSTROM, N. 2008b. Drugs can be used to treat more than disease [2]. *Nature*, 451, 520.
- BOSTROM, N. & ORD, T. 2006. The reversal test: Eliminating status quo bias in applied ethics. *Ethics*, 116, 656-679.
- BOSTROM, N. & ROACHE, B. R. 2007. Ethical Issues in Human Enhancement. In: RYBERG, J., PETERSEN, T. & WOLF, C. (eds.) *New Waves in Applied Ethics*. New York: Palgrave Macmillan.
- BOSTROM, N. & SANDBERG, A. 2009. Cognitive enhancement: Methods, ethics, regulatory challenges. *Science and Engineering Ethics*, 15, 311-341.
- BOSTROM, N. & SAVULESCU, J. 2009. Human Enhancement Ethics: The State of the Debate. In: SAVULESCU, J. & BOSTROM, N. (eds.) *Human enhancement*. Oxford: Oxford University Press.
- BOUCHER, O., BURDEN, M. J., MUCKLE, G., SAINT-AMOUR, D., AYOTTE, P., DEWAILLY, E., NELSON, C. A., JACOBSON, S. W. & JACOBSON, J. L. 2011. Neurophysiologic and neurobehavioral evidence of beneficial effects of prenatal omega-3 fatty acid intake on memory function at school age. *The American Journal of Clinical Nutrition*, 93, 1025-1037.
- BPS Revised April 2010. Guidelines on Memory and the Law: Recommendations from the Scientific Study of Human Memory. A Report from the Research Board, *The British Psychological Society*, Leicester.
- BRANSFORD, J. D. & JOHNSON, M. K. 1972. Contextual prerequisites for understanding: Some investigations of comprehension and recall. *Journal of verbal learning and verbal behavior*, 11, 717-726.
- BRICE, C. F. & SMITH, A. P. 2002. Effects of caffeine on mood and performance: A study of realistic consumption. *Psychopharmacology*, 164, 188-192.
- BRINDLEY, R., BATEMAN, A. & GRACEY, F. 2011. Exploration of use of SenseCam to support autobiographical memory retrieval within a cognitive-behavioural therapeutic intervention following acquired brain injury. *Memory*. England.
- BRODATY, H., WOODWARD, M., BOUNDY, K., BARNES, N. & ALLEN, G. 2006. A naturalistic study of galantamine for Alzheimer's disease. *CNS Drugs*. New Zealand.

- BROWN, E. S. 2009. Effects of glucocorticoids on mood, memory, and the hippocampus. Treatment and preventive therapy. *Ann N Y Acad Sci.* United States.
- BROWNE, G., BERRY, E., KAPUR, N., HODGES, S., SMYTH, G., WATSON, P. & WOOD, K. 2011. SenseCam improves memory for recent events and quality of life in a patient with memory retrieval difficulties. *Memory*, 19, 713-22.
- BRUNET, A., ORR, S. P., TREMBLAY, J., ROBERTSON, K., NADER, K. & PITMAN, R. K. 2008. Effect of post-retrieval propranolol on psychophysiologic responding during subsequent script-driven traumatic imagery in post-traumatic stress disorder. *Journal of Psychiatric Research*, 42, 503-506.
- BUCHANAN, A. E. 2011. *Beyond Humanity?: The Ethics of Biomedical Enhancement*, Oxford, Oxford University Press.
- BUCHANAN, A. E., BROCK, D. W., DANIELS, N. & WIKLER, D. 2000. *From chance to choice: genetics and justice*, Cambridge, Cambridge University Press.
- BUDSON, A. E. 2009. Understanding memory dysfunction. *Neurologist*. United States.
- BURGESS, P. W., QUAYLE, A. & FRITH, C. D. 2001. Brain regions involved in prospective memory as determined by positron emission tomography. *Neuropsychologia*, 39, 545-555.
- BUTLER, A. C. 2010. Repeated testing produces superior transfer of learning relative to repeated studying. *J Exp Psychol Learn Mem Cogn*, 36, 1118-33.
- CAHILL, L., PRINS, B., WEBER, M. & MCGAUGH, J. L. 1994. Beta-adrenergic activation and memory for emotional events. *Nature*, 371, 702-4.
- CALDWELL, J. A. & CALDWELL, J. L. 2005. Fatigue in Military Aviation: An Overview of U.S. Military-Approved Pharmacological Countermeasures. *Aviation, Space, and Environmental Medicine*, 76, C39-C51.
- CALDWELL, J. A., JR., CALDWELL, J. L., SMYTHE, N. K., 3RD & HALL, K. K. 2000. A double-blind, placebo-controlled investigation of the efficacy of modafinil for sustaining the alertness and performance of aviators: a helicopter simulator study. *Psychopharmacology (Berl)*, 150, 272-82.
- CAPLAN, A. 2006. Is it wrong to try to improve human nature? In: MILLER, P. & WILSDON, J. (eds.) *Better Humans? The politics of human enhancement and life extension*. Demos, London.
- CAPLAN, A. L. 1984. Is There a Duty to Serve as a Subject in Biomedical Research? *IRB: Ethics and Human Research*, 6, 1-5.
- CARPENTER, L. L. 2006. Neurostimulation in resistant depression. *Journal of Psychopharmacology*, 20, 35-40.
- CHANCE, J. E. & GOLDSTEIN, A. G. 1984. Face-Recognition Memory: Implications for Children's Eyewitness Testimony. *Journal of Social Issues*, 40, 69-85.
- CHATTERJEE, A. 2006. The promise and predicament of cosmetic neurology. *Journal of Medical Ethics*, 32, 110-113.
- CHATTHA, R., NAGARATHNA, R., PADMALATHA, V. & NAGENDRA, H. R. 2008. Effect of yoga on cognitive functions in climacteric syndrome: a randomised control study. *BJOG*. England.
- CHI, R. P., FREGNI, F. & SNYDER, A. W. 2010. Visual memory improved by non-invasive brain stimulation. *Brain Res*, 1353, 168-75.

- CHIESA, A., CALATI, R. & SERRETTI, A. 2011. Does mindfulness training improve cognitive abilities? A systematic review of neuropsychological findings. *Clinical psychology review*, 31, 449-464.
- COLEMAN, C. I., HEBERT, J. H. & REDDY, P. 2003. The effects of Panax ginseng on quality of life. *Journal of Clinical Pharmacy and Therapeutics*, 28, 5-15.
- COLES, K. & TOMPOROWSKI, P. D. 2008. Effects of acute exercise on executive processing, short-term and long-term memory. *Journal of Sports Sciences*, 26, 333-344.
- COORS, M. E. & HUNTER, L. 2005. Evaluation of genetic enhancement: Will human wisdom properly acknowledge the value of evolution? *American Journal of Bioethics*, 5, 21 – 22.
- COTELLI, M., MANENTI, R., ZANETTI, O. & MINIUSSI, C. 2012. Non-pharmacological intervention for memory decline. *Frontiers in human neuroscience*, 6.
- CPS. 2013. *Perverting the course of justice: Administration of justice: Sentencing manual: Legal Guidance: The Crown Prosecution Service* [Online]. Available: http://www.cps.gov.uk/legal/s_to_u/sentencing_manual/perverting_the_course_of_justice/ [Accessed 01/01/ 2013].
- CUDDY, L. L. & DUFFIN, J. 2005. Music, memory, and Alzheimer's disease: is music recognition spared in dementia, and how can it be assessed? *Medical Hypotheses*, 64, 229-235.
- CUTLER, B. L. & PENROD, S. D. 1995. *Mistaken Identification: The Eyewitness, Psychology and the Law*, Cambridge University Press.
- CUTLER, B. L., PENROD, S. D. & MARTENS, T. K. 1987a. IMPROVING THE RELIABILITY OF EYEWITNESS IDENTIFICATION - PUTTING CONTEXT INTO CONTEXT. *Journal of Applied Psychology*, 72.
- CUTLER, B. L., PENROD, S. D. & MARTENS, T. K. 1987b. Improving the reliability of eyewitness identification: Putting context into context. *Journal of Applied Psychology*, 72, 629.
- CZACHESZ, I. 2010. Long-term, explicit memory in rituals. *Journal of Cognition and Culture*, 10, 3-4.
- DANIELS, N. 1985. *Just Health Care*, Cambridge University Press.
- DANIELS, N. 2000. Normal Functioning and the Treatment-Enhancement. *Cambridge Quarterly of Healthcare Ethics*, 309-322.
- DE JONGH, R., BOLT, I., SCHERMER, M. & OLIVIER, B. 2008. Botox for the brain: enhancement of cognition, mood and pro-social behavior and blunting of unwanted memories. *Neuroscience and Biobehavioral Reviews*, 32, 760-776.
- DE KONING, P. P., FIGEE, M., VAN DEN MUNCKHOF, P., SCHUURMAN, P. R. & DENYS, D. 2011. Current status of deep brain stimulation for obsessive-compulsive disorder: a clinical review of different targets. *Current psychiatry reports*, 13, 274-282.
- DE QUERVAIN, D. J. F., AERNI, A., SCHELLING, G. & ROOZENDAAL, B. 2009. Glucocorticoids and the regulation of memory in health and disease. *Frontiers in Neuroendocrinology*, 30, 358-370.
- DE QUERVAIN, D. J. F., ROOZENDAAL, B., NITSCH, R. M., MCGAUGH, J. L. & HOCK, C. 2000. Acute cortisone administration impairs retrieval of long-term declarative memory in humans. *Nat Neurosci*, 3, 313-314.

- DEAKIN, J. B., AITKEN, M. R. F., DOWSON, J. H., ROBBINS, T. W. & SAHAKIAN, B. J. 2004. Diazepam produces disinhibitory cognitive effects in male volunteers. *Psychopharmacology*, 173, 88-97.
- DEASON, R. G., SIMMONS-STERN, N. R., FRUSTACE, B. S., ALLY, B. A. & BUDSON, A. E. 2012. Music as a memory enhancer: Differences between healthy older adults and patients with Alzheimer's disease. *Psychomusicology: Music, Mind, and Brain*, 22, 175.
- DEFFENBACHER, K. A., BORNSTEIN, B. H., PENROD, S. D. & MCGORTY, E. K. 2004. A Meta-Analytic Review of the Effects of High Stress on Eyewitness Memory. *Law and Human Behavior*, 28, 687-706.
- DEGRAZIA, D. 2000. Prozac, Enhancement, and Self-Creation. *The Hastings Center Report*, 30, 34-40.
- DEGRAZIA, D. 2005a. Enhancement technologies and human identity. *Journal of Medicine and Philosophy*, 30, 261-283.
- DEGRAZIA, D. 2005b. *Human Identity and Bioethics*, Cambridge University Press.
- DEKOSKY ST, W. J. D. F. A. L. & ET AL. 2008. Ginkgo biloba for prevention of dementia: A randomized controlled trial. *JAMA*, 300, 2253-2262.
- DESANTIS, A. D. & HANE, A. C. 2010. "Adderall is definitely not a drug": justifications for the illegal use of ADHD stimulants. *Subst Use Misuse*, 45, 31-46.
- DEVISCH, R. & VERVAECK, B. 1986. Doors and thresholds: Jeddi's approach to psychiatric disorders. *Social Science & Medicine*, 22, 541-551.
- DHAND, R. & SOHAL, H. 2006. Good sleep, bad sleep! The role of daytime naps in healthy adults. *Curr Opin Pulm Med*. United States.
- DIEKELMANN, S. & BORN, J. 2010. The memory function of sleep. *Nat Rev Neurosci*, 11, 114-126.
- DIETZ, P., STRIEGEL, H., FRANKE, A. G., LIEB, K., SIMON, P. & ULRICH, R. 2013. Randomized Response Estimates for the 12-Month Prevalence of Cognitive-Enhancing Drug Use in University Students. *Pharmacotherapy: The Journal of Human Pharmacology and Drug Therapy*, 33, 44-50.
- DONOVAN, E. 2010. Propranolol use in the prevention and treatment of posttraumatic stress disorder in military veterans: Forgetting therapy revisited. *Perspectives in Biology and Medicine*, 53, 61-74.
- DOUGLAS, A. 1987. *Dirk Gently's Holistic Detective Agency*, Pan Books LTD.
- DOUGLAS, S., JAMES, I. & BALLARD, C. 2004. Non-pharmacological interventions in dementia. *Advances in Psychiatric Treatment*, 10, 171-177.
- DOUGLAS, T. 2008. Moral Enhancement. *Journal of Applied Philosophy*, 25, 228-245.
- DRESLER, M., SANDBERG, A., OHLA, K., BUBLITZ, C., TRENADO, C., MROCZKO-WĄSOWICZ, A., KÜHN, S. & REPANTIS, D. 2013. Non-pharmacological cognitive enhancement. *Neuropharmacology*, 64, 529-543.
- DUDAI, Y. 2004. The Neurobiology of Consolidations, Or, How Stable is the Engram? *Annual Review of Psychology*, 55, 51-86.
- DWORKIN, R. 1993. *Life's dominion: an argument about abortion, euthanasia, and individual freedom*, Knopf.
- DÜZEL, E., HUFNAGEL, A., HELMSTAEDTER, C. & ELGER, C. 1996. Verbal working memory components can be selectively influenced by transcranial magnetic stimulation in patients with left temporal lobe epilepsy. *Neuropsychologia*, 34, 775-783.

- EBERTH, J. & SEDLMEIER, P. 2012. The effects of mindfulness meditation: a meta-analysis. *Mindfulness*, 3, 174-189.
- ECHR. 1950. *European Convention on Human Rights and its Five Protocols* [Online]. Available: <http://www.hri.org/docs/ECHR50.html#C.Art3> [Accessed 05/12/ 2012].
- EINÖTHER, S. J. L. & GIESBRECHT, T. 2013. Caffeine as an attention enhancer: Reviewing existing assumptions. *Psychopharmacology*, 225, 251-274.
- EL HAJ, M., POSTAL, V. & ALLAIN, P. 2011. Music Enhances Autobiographical Memory in Mild Alzheimer's Disease. *Educational Gerontology*, 38, 30-41.
- ELIYAHU, U., BERLIN, S., HADAD, E., HELED, Y. & MORAN, D. S. 2007. Psychostimulants and military operations. *Mil Med*, 172, 383-7.
- ELLIOTT, C. 1998. The Tyranny of Happiness: Ethics and Cosmetic Psychopharmacology. In: PARENS, E. (ed.) *Enhancing Human Traits: Ethical and Social Implications*. Washington: Georgetown University Press.
- ELLIOTT, C. 2007. Against happiness. *Medicine, health care, and philosophy*, 10, 167-171.
- ELLIOTT, C. & KRAMER, P. D. 2004. *Better Than Well: American Medicine Meets the American Dream*, W. W. Norton.
- ELLIOTT, R., SAHAKIAN, B. J., MATTHEWS, K., BANNERJEA, A., RIMMER, J. & ROBBINS, T. W. 1997. Effects of methylphenidate on spatial working memory and planning in healthy young adults. *Psychopharmacology (Berl)*, 131, 196-206.
- ELLIOTT, T. 2009. Body Dysmorphic Disorder, Radical Surgery and the Limits of Consent. *Medical Law Review*, 17, 149-182.
- ELMAN, M. J., SUGAR, J., FISCELLA, R., DEUTSCH, T. A., NOTH, J., NYBERG, M., PACKO, K. & ANDERSON, R. J. 1998. The effect of propranolol versus placebo on resident surgical performance. *Trans Am Ophthalmol Soc*, 96, 283-91; discussion 291-4.
- ERLER, A. 2010. Does Memory Modification Threaten Our Authenticity? *Neuroethics*, 235-249.
- ESTRADA, A., KELLEY, A. M., WEBB, C. M., ATHY, J. R. & CROWLEY, J. S. 2012. Modafinil as a replacement for dextroamphetamine for sustaining alertness in military helicopter pilots. *Aviat Space Environ Med*, 83, 556-64.
- EUROPEAN-COMMISSION. 2012. *Proposal for a regulation of the European Parliament and of the Council on the protection of individuals with regard to the processing of personal data and on the free movement of such data* [Online]. Available: http://ec.europa.eu/justice/data-protection/document/review2012/com_2012_11_en.pdf [Accessed 01/06/ 2012].
- FACEBOOK-NEWSROOM. 2013. *Facebook's latest news, announcements and media resources* [Online]. Available: <http://newsroom.fb.com/Key-Facts> [Accessed 01/06/ 2013].
- FARAH, M. J., ILLES, J., COOK-DEEGAN, R., GARDNER, H., KANDEL, E., KING, P., PARENS, E., SAHAKIAN, B. & WOLPE, P. R. 2004. Neurocognitive enhancement: What can we do and what should we do? *Nature Reviews Neuroscience*, 5, 421-425.
- FARRELLY, C. 2007. Virtue Ethics and Prenatal Genetic Enhancement. *Studies in Ethics, Law, and Technology*, 1:1:4.

- FDA. 2013. *Provigil® (modafinil) Tablets [C-IV]* [Online]. Available: http://www.accessdata.fda.gov/drugsatfda_docs/label/2010/020717s030s034s036lbl.pdf [Accessed 01/01/ 2013].
- FERRIS, S., SCHNEIDER, L., FARMER, M., KAY, G. & CROOK, T. 2007. A double-blind, placebo-controlled trial of memantine in age-associated memory impairment (memantine in AAMI). *Int J Geriatr Psychiatry*, 22, 448-55.
- FERRÉ, S. 2008. An update on the mechanisms of the psychostimulant effects of caffeine. *Journal of Neurochemistry*, 105, 1067-1079.
- FINK, M. 2001. Convulsive therapy: a review of the first 55 years. *Journal of Affective Disorders*, 63, 1-15.
- FISHER, J., HIRSHMAN, E., HENTHORN, T., ARNDT, J. & PASSANNANTE, A. 2006. Midazolam amnesia and short-term/working memory processes. *Consciousness and Cognition*, 15, 54-63.
- FITZGERALD, D. B., CRUCIAN, G. P., MIELKE, J. B., SHENAL, B. V., BURKS, D., WOMACK, K. B., GHACIBEH, G., DRAGO, V., FOSTER, P. S., VALENSTEIN, E. & HEILMAN, K. M. 2008. Effects of Donepezil on Verbal Memory After Semantic Processing in Healthy Older Adults. *Cognitive and Behavioral Neurology*, 21.
- FLECKENSTEIN, A. E., VOLZ, T. J., RIDDLE, E. L., GIBB, J. W. & HANSON, G. R. 2007. New Insights into the Mechanism of Action of Amphetamines. *Annual Review of Pharmacology and Toxicology*, 47, 681-698.
- FOTUHI, M., MOHASSEL, P. & YAFFE, K. 2009. Fish consumption, long-chain omega-3 fatty acids and risk of cognitive decline or Alzheimer disease: a complex association. *NATURE CLINICAL PRACTICE NEUROLOGY*, 5.
- FRANKFORT, S. V., APPELS, B. A., DE BOER, A., TULNER, L. R., VAN CAMPEN, J. P., KOKS, C. H. & BEIJNEN, J. H. 2006. Treatment effects of rivastigmine on cognition, performance of daily living activities and behaviour in Alzheimer's disease in an outpatient geriatric setting. *Int J Clin Pract.* England.
- FRANKFURT, H. G. 1988. *The Importance of What We Care About: Philosophical Essays*, Cambridge, Cambridge University Press.
- FREGNI, F., BOGGIO, P. S., NITSCHKE, M., BERMPOHL, F., ANTAL, A., FEREDOES, E., MARCOLIN, M. A., RIGONATTI, S. P., SILVA, M. T., PAULUS, W. & PASCUAL-LEONE, A. 2005. Anodal transcranial direct current stimulation of prefrontal cortex enhances. *Exp Brain Res*, 166, 23-30.
- FREUND, H.-J. 2005. Long-term effects of Deep Brain Stimulation in Parkinson's Disease. *Brain*, 128, 2222-2223.
- FUKUYAMA, F. 2002. *Our posthuman future: consequences of the biotechnology revolution*, London, Profile Books Ltd.
- FUKUYAMA, F., FURGER, F. & JOHNS HOPKINS UNIVERSITY. SCHOOL OF ADVANCED INTERNATIONAL, S. 2006. *Beyond bioethics: a proposal for modernizing the regulation of human biotechnologies*, Washington, D.C., Paul H. Nitze School of Advanced International Studies, Johns Hopkins University.
- GABBERT, F., HOPE, L. & FISHER, R. P. 2009. Protecting Eyewitness Evidence: Examining the Efficacy of a Self-Administered Interview Tool. *Law and Human Behavior*, 33, 298-307.

- GARRY, M., STRANGE, D., BERNSTEIN, D. M. & KINZETT, T. 2007. Photographs can distort memory for the news. *Applied Cognitive Psychology*, 21, 995-1004.
- GARVEY, J. 2010. *BBC Radio 4 - Woman's Hour, 31/08/2010, The Future of the HFEA* [Online]. Available: <http://www.bbc.co.uk/programmes/p009r0jw> [Accessed 30/11/ 2010].
- GEMS, D. 2003. Is More Life Always Better? The New Biology of Aging and the Meaning of Life. *The Hastings Center Report*, 33, 31-39.
- GHETTI, S., SCHAAF, J. M., QIN, J. & GOODMAN, G. S. 2004. Chapter 22 - Issues in Eyewitness Testimony. In: WILLIAM, T. O. D. & ERIC, R. L. (eds.) *Handbook of Forensic Psychology*. San Diego: Academic Press.
- GILES, J. 2005. Could a drug wipe out the horror of posttraumatic stress disorder? *Nature*, 436, 448-449.
- GILLETTE-GUYONNET, S., SECHER, M. & VELLAS, B. 2013. Nutrition and neurodegeneration: epidemiological evidence and challenges for future research. *British Journal of Clinical Pharmacology*, 75, 738-755.
- GIORDANO, S., COGGON, J. & CAPPATO, M. 2012. *Scientific Freedom*, Bloomsbury Publishing.
- GLANNON, W. 2006. Psychopharmacology and memory. *Journal of Medical Ethics*, 32, 74-78.
- GLOVER, J. 2007. *Choosing children: genes, disability, and design*, Oxford, Clarendon Press.
- GLUCKSTEIN, C. E. 2013. *The Duty To Mitigate: Does The Claimant Have A Duty To "Get Better"?* [Online]. Available: <http://www.gluckstein.com/uploads/pdfs/TheDutyToMitigate.pdf> [Accessed 12/03/ 2013].
- GOSTIN, L. O. 2000. Public Health Law in a New Century. *JAMA: The Journal of the American Medical Association*, 283, 2837-2841.
- GOTHE, N., PONTIFEX, M. B., HILLMAN, C. & MCAULEY, E. 2012. The Acute Effects of Yoga on Executive Function. *J Phys Act Health*.
- GREELY, H., SAHAKIAN, B., HARRIS, J., KESSLER, R. C., GAZZANIGA, M., CAMPBELL, P. & FARAH, M. J. 2008. Towards responsible use of cognitive-enhancing drugs by the healthy. *Nature*, 456, 702-705.
- GREELY, H. T. 2006. The social effects of advances in neuroscience: legal problems, legal perspectives. In: ILLES, J. (ed.) *Neuroethics: defining the issues in theory, practice, and policy*. Oxford: Oxford University Press.
- GREENE, C. M., BAHRI, P. & SOTO, D. 2010. Interplay between Affect and Arousal in Recognition Memory. *PLoS ONE*, 5, e11739.
- GROSS, J. & HAYNE, H. 1996. Eyewitness Identification by 5- to 6-Year-Old Children. *Law and Human Behavior*, 20, 359-373.
- GRÖN, G., KIRSTEIN, M., THIELSCHER, A., RIEPE, M. & SPITZER, M. 2005. Cholinergic enhancement of episodic memory in healthy young adults. *Psychopharmacology*, 182, 170-179.
- GÜNTHER, V. K., SCHÄFER, P., HOLZNER, B. J. & KEMMLER, G. W. 2003. Long-term improvements in cognitive performance through computer-assisted cognitive training: A pilot study in a residential home for older people. *Aging & Mental Health*, 7, 200-206.
- HABERMAS, J. R. 2003. *The future of human nature*, Cambridge, UK, Polity.

- HALL, K. M., IRWIN, M. M., BOWMAN, K. A., FRANKENBERGER, W. & JEWETT, D. C. 2005. Illicit use of prescribed stimulant medication among college students. *J Am Coll Health*, 53, 167-74.
- HAMANI, C., MCANDREWS, M. P., COHN, M., OH, M., ZUMSTEG, D., SHAPIRO, C. M., WENNERBERG, R. A. & LOZANO, A. M. 2008. Memory enhancement induced by hypothalamic/fornix deep brain stimulation. *Annals of Neurology*, 63, 119-123.
- HAMPSON, R. E., ROGERS, G., LYNCH, G. & DEADWYLER, S. A. 1998. Facilitative effects of the ampakine CX516 on short-term memory in rats: enhancement of delayed-nonmatch-to-sample performance. *J Neurosci*, 18, 2740-7.
- HANSEN, R. A., GARTLEHNER, G., WEBB, A. P., MORGAN, L. C., MOORE, C. G. & JONAS, D. E. 2008. Efficacy and safety of donepezil, galantamine, and rivastigmine for the treatment of Alzheimer's disease: a systematic review and meta-analysis. *Clin Interv Aging*, 3, 211-25.
- HARRIS, J. 2007. *Enhancing evolution: the ethical case for making better people*, Princeton, N.J., Princeton University Press.
- HARRIS, J. 2009. Enhancements are a moral obligation. In: SAVULESCU, J. & BOSTROM, N. (eds.) *Human Enhancements*. Oxford: Oxford University Press.
- HARRIS, J. 2011. MORAL ENHANCEMENT AND FREEDOM. *Bioethics*, 25, 102-111.
- HAUER, D., RATANO, P., MORENA, M., SCACCIAOCE, S., BRIEGEL, I., PALMERY, M., CUOMO, V., ROOZENDAAL, B., SCHELLING, G. & CAMPOLONGO, P. 2011. Propofol Enhances Memory Formation via an Interaction with the Endocannabinoid System. *Anesthesiology*, 114.
- HAUSKELLER, M. 2010. Human Enhancement and the Common Good. *AJOB Neuroscience*, 1, 37-39.
- HBP. 2013. *Human Brain Project* [Online]. Available: <http://www.humanbrainproject.eu> [Accessed 01/08/ 2013].
- HE, K., SONG, Y., DAVIGLUS, M. L., LIU, K., VAN HORN, L., DYER, A. R., GOLDBOURT, U. & GREENLAND, P. 2004. Fish Consumption and Incidence of Stroke A Meta-Analysis of Cohort Studies. *Stroke*, 35, 1538-1542.
- HECKMAN, M. A., WEIL, J. & DE MEJIA, E. G. 2010. Caffeine (1, 3, 7-trimethylxanthine) in Foods: A Comprehensive Review on Consumption, Functionality, Safety, and Regulatory Matters. *Journal of Food Science*, 75, R77-R87.
- HENDEL, J. Feb 3 2011. In Europe, a Right to Be Forgotten Trumps the Memory of the Internet. *The Atlantic Technology* [Online]. Available: <http://www.theatlantic.com/technology/archive/2011/02/in-europe-a-right-to-be-forgotten-trumps-the-memory-of-the-internet/70643/> [Accessed 22/05/2013].
- HENIG, R. M. April 4 2004. The Quest to Forget. *New York Times* [Online]. Available: <http://www.nytimes.com/2004/04/04/magazine/the-quest-to-forget.html?pagewanted=all&src=pm> [Accessed 01/01/2010].
- HENNESSY, M., KIRKBY, K. & MONTGOMERY, I. 1991. Comparison of the amnesic effects of midazolam and diazepam. *Psychopharmacology*, 103, 545-550.

- HENRY, M., FISHMAN, J. R. & YOUNGNER, S. J. 2007. Propranolol and the prevention of post-traumatic stress disorder: Is it wrong to erase the "sting" of bad memories? *American Journal of Bioethics*, 7, 12-20.
- HERRMANN, N., CHAU, S. A., KIRCANSKI, I. & LANCTOT, K. L. 2011a. Current and emerging drug treatment options for Alzheimer's disease: a systematic review. *Drugs*. New Zealand.
- HERRMANN, N., LI, A. & LANCTÔT, K. 2011b. Memantine in dementia: a review of the current evidence. *Expert Opinion on Pharmacotherapy*, 12, 787-800.
- HEWLETT, P. & SMITH, A. 2007. Effects of repeated doses of caffeine on performance and alertness: New data and secondary analyses. *Human Psychopharmacology*, 22, 339-350.
- HFEA. 2013. *About the HFEA - Human Fertilisation & Embryology Authority* [Online]. HFEA, Finsbury Tower 103-105, Bunhill Row, London, EC1Y 8HF. Available: <http://www.hfea.gov.uk/25.html> [Accessed 24/06/ 2013].
- HILLMAN, C. H., ERICKSON, K. I. & KRAMER, A. F. 2008. Be smart, exercise your heart: exercise effects on brain and cognition. *Nat Rev Neurosci*, 9, 58-65.
- HIRSCH, C. 2013. Ginkgo biloba extract did not reduce risk for Alzheimer disease in elderly patients with memory complaints. *Ann Intern Med*. United States.
- HODGES, S., BERRY, E. & WOOD, K. 2011. SenseCam: a wearable camera that stimulates and rehabilitates autobiographical memory. *Memory*, 19, 685-96.
- HODGES, S., WILLIAMS, L., BERRY, E., IZADI, S., SRINIVASAN, J., BUTLER, A., SMYTH, G., KAPUR, N. & WOOD, K. 2006. SenseCam: A retrospective memory aid. *UbiComp 2006: Ubiquitous Computing*. Springer.
- HORNBY, A. S., WEHMEIER, S. & ASHBY, M. 2002. *Oxford advanced learner's dictionary of current English*, Oxford, Oxford University Press.
- HOWARD, R., MCSHANE, R., LINDESAY, J., RITCHIE, C., BALDWIN, A., BARBER, R., BURNS, A., DENING, T., FINDLAY, D., HOLMES, C., HUGHES, A., JACOBY, R., JONES, R., JONES, R., MCKEITH, I., MACHAROUTHU, A., O'BRIEN, J., PASSMORE, P., SHEEHAN, B., JUSZCZAK, E., KATONA, C., HILLS, R., KNAPP, M., BALLARD, C., BROWN, R., BANERJEE, S., ONIONS, C., GRIFFIN, M., ADAMS, J., GRAY, R., JOHNSON, T., BENTHAM, P. & PHILLIPS, P. 2012. Donepezil and Memantine for Moderate-to-Severe Alzheimer's Disease. *New England Journal of Medicine*, 366, 893-903.
- HOY, K. E. & FITZGERALD, P. B. 2010. Brain stimulation in psychiatry and its effects on cognition. *Nat Rev Neurol*, 6, 267-275.
- HSIEH, S., HORNBERGER, M., PIGUET, O. & HODGES, J. R. 2011. Neural basis of music knowledge: evidence from the dementias. *Brain*. England.
- HU, R., ESKANDAR, E. & WILLIAMS, Z. 2009. Role of deep brain stimulation in modulating memory formation and recall. *Neurosurg Focus*, 27, E3.
- HUNTER, I. M. L. 1962. *Memory facts and fallacies*, Harmondsworth, Middlesex, Penguin.
- HUOLMAN, S., HAMALAINEN, P., VOROBYEV, V., RUUTIAINEN, J., PARKKOLA, R., LAINE, T. & HAMALAINEN, H. 2011. The effects of rivastigmine on processing speed and brain activation in patients with multiple sclerosis and subjective cognitive fatigue. *Mult Scler*. England.
- HURLEY, E. A. 2007. The moral costs of prophylactic propranolol. *American Journal of Bioethics*, 7, 35-36.

- HURLEY, E. A. 2010. Combat Trauma and the moral risks of memory manipulating drugs. *Journal of Applied Philosophy*, 27, 221-245.
- HYUN HWANG, J. & SCOTT KRETCHMAR, R. 2010. Aristotle's Golden Mean: Its Implications for the Doping Debate. *Journal of the Philosophy of Sport*, 37, 102-121.
- HÄYRY, M. 2008. The Historical Idea of a Better Race. *Studies in Ethics, Law, and Technology*, 2:1:11, 1-28.
- IHL, R., BACHINSKAYA, N., KORCZYN, A. D., VAKHAPOVA, V., TRIBANEK, M., HOERR, R. & NAPRYEYENKO, O. 2011. Efficacy and safety of a once-daily formulation of Ginkgo biloba extract EGb 761 in dementia with neuropsychiatric features: a randomized controlled trial. *International Journal of Geriatric Psychiatry*, 26, 1186-1194.
- ILIEVA, I., BOLAND, J. & FARAH, M. J. 2013. Objective and subjective cognitive enhancing effects of mixed amphetamine salts in healthy people. *Neuropharmacology*, 64, 496-505.
- INGVAR, M., AMBROS-INGERSON, J., DAVIS, M., GRANGER, R., KESSLER, M., ROGERS, G. A., SCHEHR, R. S. & LYNCH, G. 1997. Enhancement by an ampakine of memory encoding in humans. *Exp Neurol*. United States.
- INNOCENCE-PROJECT. 2013. *The Innocence Project - Home* [Online]. Available: <http://www.innocenceproject.org/> [Accessed 31/01/ 2013].
- IRISH, M., CUNNINGHAM, C. J., WALSH, J. B., COAKLEY, D., LAWLOR, B. A., ROBERTSON, I. H. & COEN, R. F. 2006. Investigating the Enhancing Effect of Music on Autobiographical Memory in Mild Alzheimer's Disease. *Dementia and Geriatric Cognitive Disorders*, 22, 108-120.
- IUCULANO, T. & COHEN KADOSH, R. 2013. The Mental Cost of Cognitive Enhancement. *The Journal of Neuroscience*, 33, 4482-4486.
- IYER, M. B., MATTU, U., GRAFMAN, J., LOMAREV, M., SATO, S. & WASSERMANN, E. M. 2005. Safety and cognitive effect of frontal DC brain polarization in healthy. *Neurology*, 64, 872-5.
- JACKSON, E. 2010. *Medical law: text, cases, and materials*, Oxford, Oxford University Press.
- JAEGGI, S. M., BUSCHKUEHL, M., JONIDES, J. & PERRIG, W. J. 2008. Improving fluid intelligence with training on working memory. *Proceedings of the National Academy of Sciences*, 105, 6829-6833.
- JARVIS, M. J. 1993. Does caffeine intake enhance absolute levels of cognitive performance? *Psychopharmacology*, 110, 45-52.
- JENKINS, J. G. & DALLENBACH, K. M. 1924. Obliviscence during Sleep and Waking. *The American Journal of Psychology*, 35, 605-612.
- JIAO, X., VELEZ, S., RINGSTAD, J., EYMA, V., MILLER, D. & BLEIBERG, M. 2009. Myocardial infarction associated with adderall XR and alcohol use in a young man. *J Am Board Fam Med*. United States.
- JO, J. M., KIM, Y. H., KO, M. H., OHN, S. H., JOEN, B. & LEE, K. H. 2009. Enhancing the working memory of stroke patients using tDCS. *Am J Phys Med Rehabil*, 88, 404-9.
- JOHN, C., MARGARET, B., PAUL, M., DAVID, P. & MUIREANN, Q. 2008. Best interests and potential organ donors. *BMJ*, 336.
- JOHN, H. 2009. Is it acceptable for people to take methylphenidate to enhance performance? Yes. *BMJ*, 338.

- JONES, E. K., SÜNRAM-LEA, S. I. & WESNES, K. A. 2012. Acute ingestion of different macronutrients differentially enhances aspects of memory and attention in healthy young adults. *Biological Psychology*, 89, 477-486.
- JUNCO, R. 2012. Too much face and not enough books: The relationship between multiple indices of Facebook use and academic performance. *Computers in Human Behavior*, 28, 187-198.
- JUSLIN, P. N. & LAUKKA, P. 2004. Expression, Perception, and Induction of Musical Emotions: A Review and a Questionnaire Study of Everyday Listening. *Journal of New Music Research*, 33, 217-238.
- KABASENCHE, W. P. 2007. Emotions, memory suppression, and identity. *American Journal of Bioethics*, 7, 33-34.
- KADUSZKIEWICZ, H., ZIMMERMANN, T., BECK-BORNHOLDT, H.-P. & BUSSCHE, H. V. D. 2005. Cholinesterase Inhibitors For Patients With Alzheimer's Disease: Systematic Review Of Randomised Clinical Trials. *BMJ: British Medical Journal*, 331, 321-323.
- KAHANE, G. U. Y. 2011. Mastery Without Mystery: Why there is no Promethean Sin in Enhancement. *Journal of Applied Philosophy*, 28, 355-368.
- KAISER, P. R., VALKO, P. O., WERTH, E., THOMANN, J., MEIER, J., STOCKER, R., BASSETTI, C. L. & BAUMANN, C. R. 2010. Modafinil ameliorates excessive daytime sleepiness after traumatic brain injury. *Neurology*, 75, 1780-1785.
- KALECHSTEIN, A. D., MAHONEY III, J. J., YOON, J. H., BENNETT, R. & DE LA GARZA II, R. 2013. Modafinil, but not escitalopram, improves working memory and sustained attention in long-term, high-dose cocaine users. *Neuropharmacology*, 64, 472-478.
- KAMM, F. M. 2005. Is there a problem with enhancement? *American Journal of Bioethics*, 5, 5 – 14.
- KANDEL, E. R. 2009. The Biology of Memory: A Forty-Year Perspective. *The Journal of Neuroscience*, 29, 12748-12756.
- KAPUR, N., GLISKY, E. L. & WILSON, B. A. 2004. Technological memory aids for people with memory deficits. *Neuropsychological Rehabilitation*, 14, 41-60.
- KASCHEL, R. 2009. Ginkgo biloba: specificity of neuropsychological improvement—a selective review in search of differential effects. *Human Psychopharmacology: Clinical and Experimental*, 24, 345-370.
- KASCHEL, R. 2011. Specific memory effects of Ginkgo biloba extract EGb 761 in middle-aged healthy volunteers. *Phytomedicine*, 18, 1202-1207.
- KASS, L. Beyond Therapy: Biotechnology and the Pursuit of Human Improvement. Paper presented to *The President's Council on Bioethics*, 2003 Washington, DC.
- KASS, L. 2008. Why Bioethics Must Care about Human Dignity: Old and New Concerns. *The President's Council on Bioethics: Human Dignity and Bioethics: Essays Commissioned by the President's Council on Bioethics*, 297-331.
- KELLY, P., MARSHALL, S. J., BADLAND, H., KERR, J., OLIVER, M., DOHERTY, A. R. & FOSTER, C. 2013. An Ethical Framework for Automated, Wearable Cameras in Health Behavior Research. *American Journal of Preventive Medicine*, 44, 314-319.

- KENNEDY, D. O. & SCHOLEY, A. B. 2003. Ginseng: potential for the enhancement of cognitive performance and mood. *Pharmacology Biochemistry and Behavior*, 75, 687-700.
- KINDT, M., SOETER, M. & VERVLIET, B. 2009. Beyond extinction: Erasing human fear responses and preventing the return of fear. *Nature Neuroscience*, 12, 256-258.
- KIRSCHNER, P. A. & KARPINSKI, A. C. 2010. Facebook® and academic performance. *Computers in Human Behavior*, 26, 1237-1245.
- KLAASSEN, E. B., DE GROOT, R. H. M., EVERS, E. A. T., SNEL, J., VEERMAN, E. C. I., LIGTENBERG, A. J. M., JOLLES, J. & VELTMAN, D. J. 2013. The effect of caffeine on working memory load-related brain activation in middle-aged males. *Neuropharmacology*, 64, 160-167.
- KLAMING, L. & VEDDER, A. 2009. Brushing Up our Memories: Can we use Neurotechnologies to Improve Eyewitness Memory? *Law, Innovation and Technology*, 1, 203-221.
- KLIMESCH, W., SAUSENG, P. & GERLOFF, C. 2003. Enhancing cognitive performance with repetitive transcranial magnetic stimulation at human individual alpha frequency. *Eur J Neurosci*. France.
- KLINGBERG, T. 2010. Training and plasticity of working memory. *Trends in Cognitive Sciences*, 14, 317-324.
- KOLBER, A. 2006. Therapeutic Forgetting: The Legal and Ethical Implications of Memory Dampening. *Vanderbilt Law Review*, 59, pp.1561- 1626.
- KOLBER, A. 2011. Neuroethics: Give memory-altering drugs a chance. *Nature*, 476, 275-276.
- KOPPELSTAETTER, F., POEPPPEL, T. D., SIEDENTOPF, C. M., ISCHEBECK, A., VERIUS, M., HAALA, I., MOTTAGHY, F. M., RHOMBERG, P., GOLASZEWSKI, S., GOTWALD, T., LORENZ, I. H., KOLBITSCH, C., FELBER, S. & KRAUSE, B. J. 2008. Does caffeine modulate verbal working memory processes? An fMRI study. *NeuroImage*, 39, 492-499.
- KRAMER, P. D. 1997. *Listening to Prozac*, New York, Penguin Books.
- KRIS-ETHERTON, P. M., HARRIS, W. S., APPEL, L. J. & FOR THE NUTRITION, C. 2002. Fish Consumption, Fish Oil, Omega-3 Fatty Acids, and Cardiovascular Disease. *Circulation*, 106, 2747-2757.
- KROES, N. 2013. *EUROPA - PRESS RELEASES - Press Release - Graphene and Human Brain Project win largest research excellence award in history, as battle for sustained science funding continues* [Online]. Available: http://europa.eu/rapid/press-release_IP-13-54_en.htm [Accessed 29/05/2013].
- KRUPP, L. B., CHRISTODOULOU, C., MELVILLE, P., SCHERL, W. F., MACALLISTER, W. S. & ELKINS, L. E. 2004. Donepezil improved memory in multiple sclerosis in a randomized clinical trial. *Neurology*, 63, 1579-1585.
- KUO, M.-F. & NITSCHKE, M. A. 2012. Effects of Transcranial Electrical Stimulation on Cognition. *Clinical EEG and Neuroscience*, 43, 192-199.
- LAGARDE, D. & BATEJAT, D. 1995. Disrupted Sleep-Wake Rhythm and Performance: Advantages of Modafinil. *Military Psychology*, 7, 165-191.
- LAHL, O., WISPEL, C., WILLIGENS, B. & PIETROWSKY, R. 2008. An ultra short episode of sleep is sufficient to promote declarative memory performance. *Journal of Sleep Research*, 17, 3-10.

- LANEY, C. & LOFTUS, E. F. 2005. Traumatic memories are not necessarily accurate memories. *Can J Psychiatry*, 50, 823-8.
- LAWS, K. R., SWEETNAM, H. & KONDEL, T. K. 2012. Is Ginkgo biloba a cognitive enhancer in healthy individuals? A meta-analysis. *Human Psychopharmacology: Clinical and Experimental*, 27, 527-533.
- LEE, I. H., CULLEY, D. J., BAXTER, M. G., XIE, Z., TANZI, R. E. & CROSBY, G. 2008. Spatial memory is intact in aged rats after propofol anesthesia. *Anesth Analg*. United States.
- LEVESON-INQUIRY. 2012. *An inquiry into the culture, practices and ethics of the press: report [Leveson]* [Online]. Stationery Office. Available: <http://www.official-documents.gov.uk/document/hc1213/hc07/0780/0780.asp> [Accessed 29/05/2013].
- LIAO, S. M. & WASSERMAN, D. T. 2007. Neuroethical concerns about moderating traumatic memories. *American Journal of Bioethics*, 7, 38-40.
- LIM, W., GAMMACK, J., VAN NIEKERK, J. & DANGOUR, A. 2006. Omega 3 fatty acid for the prevention of dementia.
- LINDSAY, R. C. L., ROSS, D. F., TOGLIA, M. P. & READ, J. D. 2007. *The Handbook of Eyewitness Psychology: Volume II: Memory for People*, Lawrence Erlbaum Associates.
- LINDSAY, S. E., GUDELSKY, G. A. & HEATON, P. C. 2006. Use of Modafinil for the Treatment of Attention Deficit/Hyperactivity Disorder. *The Annals of Pharmacotherapy*, 40, 1829-1833.
- LIPSMAN, N., WOODSIDE, D. B., GIACOBBE, P., HAMANI, C., CARTER, J. C., NORWOOD, S. J., SUTANDAR, K., STAAB, R., ELIAS, G., LYMAN, C. H., SMITH, G. S. & LOZANO, A. M. 2013. Subcallosal cingulate deep brain stimulation for treatment-refractory anorexia nervosa: a phase 1 pilot trial. *The Lancet*.
- LISANBY, S. H., MADDOX, J. H., PRUDIC, J., DEVANAND, D. P. & SACKeim, H. A. 2000. The effects of electroconvulsive therapy on memory of autobiographical and public. *Arch Gen Psychiatry*, 57, 581-90.
- LODE, E. 1999. Slippery Slope Arguments and Legal Reasoning. *California Law Review*, 87, 1469-1543.
- LOFTUS, E. F. 1979. The Malleability of Human Memory: Information introduced after we view an incident can transform memory. *American Scientist*, 67, 312-320.
- LOFTUS, E. F. 1996. *Eyewitness Testimony: With a New Preface by the Author*, Harvard University Press.
- LOFTUS, E. F. 2005. Planting misinformation in the human mind: A 30-year investigation of the malleability of memory. *Learning & Memory*, 12, 361-366.
- LOFTUS, E. F., LOFTUS, G. R. & MESSO, J. 1987. Some Facts about "Weapon Focus". *Law and Human Behavior*, 11, 55-62.
- LOFTUS, E. F. & PICKRELL, J. E. 1995. The formation of false memories. *Psychiatric Annals; Psychiatric Annals*.
- LUCHTMAN, D. W. & SONG, C. 2013. Cognitive enhancement by omega-3 fatty acids from child-hood to old age: Findings from animal and clinical studies. *Neuropharmacology*, 64, 550-565.
- LUCKE, J. C., BELL, S. K., PARTRIDGE, B. J. & HALL, W. D. 2011. Academic doping or Viagra for the brain? The history of recreational drug use and

- pharmacological enhancement can provide insight into these uses of neuropharmaceuticals. *EMBO Rep.* England.
- LUTZ, A., SLAGTER, H. A., DUNNE, J. D. & DAVIDSON, R. J. 2008. Attention regulation and monitoring in meditation. *Trends Cogn Sci.* England.
- LYNCH, G. & GALL, C. M. 2006. Ampakines and the threefold path to cognitive enhancement. *Trends in Neurosciences*, 29, 554-562.
- LYNCH, G., GRANGER, R., AMBROS-INGERSON, J., DAVIS, C. M., KESSLER, M. & SCHEHR, R. 1997. Evidence That a Positive Modulator of AMPA-Type Glutamate Receptors Improves Delayed Recall in Aged Humans. *Experimental Neurology*, 145, 89-92.
- LYNCH, G., PALMER, L. C. & GALL, C. M. 2011. The likelihood of cognitive enhancement. *Pharmacology Biochemistry and Behavior*, 99, 116-129.
- LYONS, M. K. 2011. Deep brain stimulation: current and future clinical applications. *Mayo Clin Proc.* United States.
- MACLEAN, A. 2009. *Autonomy, Informed Consent and Medical Law: A Relational Challenge*, Cambridge University Press.
- MACLIN, O. H., MACLIN, M. K. & MALPASS, R. S. 2001. Race, arousal, attention, exposure and delay: An examination of factors moderating face recognition. *Psychology, Public Policy, and Law*, 7, 134.
- MAGUIRE, E. A., VALENTINE, E. R., WILDING, J. M. & KAPUR, N. 2003. Routes to remembering: the brains behind superior memory. *Nat Neurosci*, 6, 90-95.
- MAHER, B. 2008. Poll results: Look who's doping. *Nature*, 452, 674-675.
- MAHNCKE, H. W., CONNOR, B. B., APPELMAN, J., AHSANUDDIN, O. N., HARDY, J. L., WOOD, R. A., JOYCE, N. M., BONISKE, T., ATKINS, S. M. & MERZENICH, M. M. 2006. Memory enhancement in healthy older adults using a brain plasticity-based training program: A randomized, controlled study. *Proceedings of the National Academy of Sciences*, 103, 12523-12528.
- MAK, J. N. & WOLPAW, J. R. 2009. Clinical Applications of Brain-Computer Interfaces: Current State and Future Prospects. *Biomedical Engineering, IEEE Reviews in*, 2, 187-199.
- MANNING, C. A., STONE, W. S., KOROL, D. L. & GOLD, P. E. 1998. Glucose enhancement of 24-h memory retrieval in healthy elderly humans. *Behavioural brain research*, 93, 71-76.
- MARGALIT, A. 2002. *The ethics of memory*, Cambridge, MA, Harvard University Press.
- MARSHALL, L. & BORN, J. 2007. The contribution of sleep to hippocampus-dependent memory consolidation. *Trends in Cognitive Sciences*, 11, 442-450.
- MARSHALL, L., MÖLLE, M., HALLSCHMID, M. & BORN, J. 2004. Transcranial Direct Current Stimulation during Sleep Improves Declarative Memory. *The Journal of Neuroscience*, 24, 9985-9992.
- MASON, J. K. & MCCALL SMITH, A. 1991. *Law and medical ethics*, London, Butterworths.
- MATTILA, M., SEPPALA, T. & MATTILA, M. J. 1986. Combined effects of buspirone and diazepam on objective and subjective tests of performance in healthy volunteers. *Clin. Pharm. Ther.*, 40, 620-626.
- MAYER, R. E. & GALLINI, J. K. 1990. When Is an Illustration Worth Ten Thousand Words? *Journal of Educational Psychology*, 82.

- MAYER-SCHÖNBERGER, V. 2009. *Delete: the virtue of forgetting in the digital age*, Princeton, N.J, Princeton University Press.
- MCCABE, S. E., KNIGHT, J. R., TETER, C. J. & WECHSLER, H. 2005. Non-medical use of prescription stimulants among US college students: prevalence and correlates from a national survey. *Addiction*, 100, 96-106.
- MCCAULEY, R. N. & LAWSON, E. T. 2002. *Bringing Ritual to Mind: Psychological Foundations of Cultural Forms*, Cambridge University Press.
- MCDANIEL, M. A., ANDERSON, J. L., DERBISH, M. H. & MORRISETTE, N. 2007. Testing the testing effect in the classroom. *European Journal of Cognitive Psychology*, 19, 494-513.
- MCENTEE, W. & CROOK, T. 1993. Glutamate: its role in learning, memory, and the aging brain. *Psychopharmacology*, 111, 391-401.
- MCGAUGH, J. L. 1966. Time-dependent processes in memory storage. *Science*, 153, 1351-8.
- MCGAUGH, J. L. 2000. Memory--a Century of Consolidation. *Science*, 287, 248-251.
- MCGLEENON, DYNAN & PASSMORE 1999. Acetylcholinesterase inhibitors in Alzheimer's disease. *British Journal of Clinical Pharmacology*, 48, 471-480.
- MCKIBBEN, B. 2004. *Enough: genetic engineering and the end of human nature*, London, Bloomsbury.
- MEDNICK, S., NAKAYAMA, K. & STICKGOLD, R. 2003. Sleep-dependent learning: a nap is as good as a night. *Nat Neurosci*, 6, 697-698.
- MEHLMAN, M. J. 2005. Genetic enhancement: plan now to act later. *Kennedy Inst Ethics J*, 15, 77-82.
- MEHLMAN, M. J. 2009a. Genetic Enhancement in Sport, Ethical, Legal and Policy Concerns. In: MURRAY, T. H., MASCHKE, K. J. & WASUNNA, A. A. (eds.) *Performance-enhancing technologies in sports: ethical, conceptual, and scientific issues*. Baltimore: Johns Hopkins University Press.
- MEHLMAN, M. J. 2009b. *The price of perfection: individualism and society in the era of biomedical enhancement*, Baltimore, Md., Johns Hopkins University Press.
- MEHTA, M. A., OWEN, A. M., SAHAKIAN, B. J., MAVADDAT, N., PICKARD, J. D. & ROBBINS, T. W. 2000. Methylphenidate enhances working memory by modulating discrete frontal and parietal lobe regions in the human brain. *J Neurosci*, 20, RC65.
- MEIKLE, A., RIBY, L. M. & STOLLERY, B. 2005. Memory processing and the glucose facilitation effect: The effects of stimulus difficulty and memory load. *Nutritional Neuroscience*, 8, 227-232.
- MEILAENDER, G. 2003. Why Remember? *First Things*. [Accessed 01/01/2010] Online ed. <http://www.firstthings.com/article/2007/03/why-remember-46>.
- MEISSNER, C. A. & BRIGHAM, J. C. 2001. Thirty years of investigating the own-race bias in memory for faces: A meta-analytic review. *Psychology, Public Policy, and Law*, 7, 3.
- MENUZ, V., HURLIMANN, T. & GODARD, B. 2013. Is human enhancement also a personal matter? *Sci Eng Ethics*, 19, 161-77.
- MEROLA, A., ZIBETTI, M., ANGRISANO, S., RIZZI, L., RICCHI, V., ARTUSI, C. A., LANOTTE, M., RIZZONE, M. G. & LOPIANO, L. 2011. Parkinson's disease progression at 30 years: a study of subthalamic deep brain-stimulated patients. *Brain*, 134, 2074-2084.

- MESSIER, C. 2004. Glucose improvement of memory: a review. *European Journal of Pharmacology*, 490, 33-57.
- MILLER, G. 2004. Learning to Forget. *Science*, 304, 34-36.
- MILLER, G. & SENJEN, R. 2006. *The social impacts of nanotechnology - Issue Summary (Friends of the Earth)* [Online]. Available: <http://nano.foe.org.au/sites/default/files/The%20social%20impacts%20of%20nanotechnology%20-%20Issue%20Summary%20September%202006.pdf> [Accessed 05/12/ 2010].
- MINZENBERG, M. J. & CARTER, C. S. 2007. Modafinil: A Review of Neurochemical Actions and Effects on Cognition. *Neuropsychopharmacology*, 33, 1477-1502.
- MNOOKIN, J. & WEST, N. 2001. Theaters of proof: Visual evidence and the law in Call Northside 777. *Yale Journal of Law & the Humanities*, Summer.
- MOONEY, A. 2013. *Obama seeks \$100M to unlock mysteries of the brain* [Online]. Available: <http://www.cnn.com/2013/04/02/health/obama-brain-research/index.html> [Accessed 29/05/ 2013].
- MORGAN, C. A., HAZLETT, G., DORAN, A., GARRETT, S., HOYT, G., THOMAS, P., BARANOSKI, M. & SOUTHWICK, S. M. 2004. Accuracy of eyewitness memory for persons encountered during exposure to highly intense stress. *International Journal of Law and Psychiatry*, 27, 265-279.
- MORRIS, M. C., SACKS, F. & ROSNER, B. 1993. Does fish oil lower blood pressure? A meta-analysis of controlled trials. *Circulation*, 88, 523-533.
- MOZAFFARIAN, D. & WU, J. H. Y. 2011. Omega-3 Fatty Acids and Cardiovascular Disease Effects on Risk Factors, Molecular Pathways, and Clinical Events. *Journal of the American College of Cardiology*, 58, 2047-2067.
- MURPHY, S. E., DOWNHAM, C., COWEN, P. J. & HARMER, C. J. 2008. Direct effects of diazepam on emotional processing in healthy volunteers. *Psychopharmacology (Berl)*, 199, 503-13.
- MÜLLER, U., ROWE, J. B., RITTMAN, T., LEWIS, C., ROBBINS, T. W. & SAHAKIAN, B. J. 2013. Effects of modafinil on non-verbal cognition, task enjoyment and creative thinking in healthy volunteers. *Neuropharmacology*, 64, 490-495.
- MŪRĪTHI, P. M. 2011. Does the rejection of wrongful life claims rely on a conceptual error? *Journal of Medical Ethics*, 37, 433-436.
- NAAM, R. 2005. *More than human: embracing the promise of biological enhancement*, New York, Broadway Books.
- NASH, R. A., WADE, K. A. & LINDSAY, D. S. 2009. Digitally manipulating memory: Effects of doctored videos and imagination in distorting beliefs and memories. *Memory & cognition*, 37, 414-424.
- NCA. 2013. *The History Of Coffee - National Coffee Association USA* [Online]. Available: <http://www.ncausa.org/i4a/pages/index.cfm?pageid=68> [Accessed 01/01/ 2013].
- NEALE, C., CAMFIELD, D., REAY, J., STOUGH, C. & SCHOLEY, A. 2013. Cognitive effects of two nutraceuticals Ginseng and Bacopa benchmarked against modafinil: a review and comparison of effect sizes. *British Journal of Clinical Pharmacology*, 75, 728-737.
- NEHLIG, A. 2010. Is caffeine a cognitive enhancer? *Journal of Alzheimer's Disease*, 20, S85-S94.

- NITSCHKE, M. A., COHEN, L. G., WASSERMANN, E. M., PRIORI, A., LANG, N., ANTAL, A., PAULUS, W., HUMMEL, F., BOGGIO, P. S., FREGNI, F. & PASCUAL-LEONE, A. 2008. Transcranial direct current stimulation: State of the art 2008. *Brain Stimulation*, 1, 206-223.
- NOUCHI, R., TAKI, Y., TAKEUCHI, H., HASHIZUME, H., AKITSUKI, Y., SHIGEMUNE, Y., SEKIGUCHI, A., KOTOZAKI, Y., TSUKIURA, T., YOMOGIDA, Y. & KAWASHIMA, R. 2012. Brain Training Game Improves Executive Functions and Processing Speed in the Elderly: A Randomized Controlled Trial. *PLoS ONE*, 7, e29676.
- NOZICK, R. 1974. *Anarchy, state and Utopia*, Oxford, Basil Blackwell.
- NUNN, R. 2010. Stimulating Eyewitness Testimony: Not Even Neuroscience Can Just Stick to the Facts. *AJOB Neuroscience*, 1, 44-46.
- OCN. 2013. *The Oxford Centre for Neuroethics News - Wellcome Trust New Investigator Award* [Online]. Available: http://www.neuroethics.ox.ac.uk/latest_news/wellcome_trust_new_investigator_or_award2 [Accessed 07/07/ 2013].
- OVERALL, C. 2009. Life Enhancement Technologies. In: SAVULESCU, J. & BOSTROM, N. (eds.) *Human Enhancements*. Oxford: Oxford University Press.
- OWEN, L., SCHOLEY, A., FINNEGAN, Y., HU, H. & SÜNNRAM-LEA, S. 2012. The effect of glucose dose and fasting interval on cognitive function: a double-blind, placebo-controlled, six-way crossover study. *Psychopharmacology*, 220, 577-589.
- OWENS, D. S. & BENTON, D. 1994. The Impact of Raising Blood Glucose on Reaction Times. *Neuropsychobiology*, 30, 106-113.
- PALMER, J. 20/05/2011. *Amondawa tribe lacks abstract idea of time, study says* [Online]. BBC-NEWS. Available: <http://www.bbc.co.uk/news/science-environment-13452711> [Accessed 27/08/ 2012].
- PARENS, E. 1998. Special Supplement: Is Better Always Good? The Enhancement Project. *The Hastings Center Report*, 28, S1-S17.
- PARENS, E. 2005. Authenticity and Ambivalence: Toward Understanding the Enhancement Debate. *The Hastings Center Report*, 35, 34-41.
- PARENS, E. 2010. The ethics of memory blunting and the narcissism of small differences. *Neuroethics*, 3, 99-107.
- PARKER, E. S., CAHILL, L. & MCGAUGH, J. L. 2006. Case of Unusual Autobiographical Remembering. *Neurocase*, 12, 35-49.
- PARSONS, T. D., ROGERS, S. A., BRAATEN, A. J., WOODS, S. P. & TRÖSTER, A. I. 2006. Cognitive sequelae of subthalamic nucleus deep brain stimulation in Parkinson's disease: a meta-analysis. *The Lancet Neurology*, 5, 578-588.
- PAUL, J. 2003. Encyclical Letter Ecclesia de Eucharistia. 2012. Available: http://www.vatican.va/holy_father/special_features/encyclicals/documents/hf_jp-ii_enc_20030417_ecclesia_eucharistia_en.html.
- PCBE 2003. Beyond Therapy: Biotechnology and the Pursuit of Happiness. *The President's Council on Bioethics*. Washington, D.C.
- PCBE-STAFF. March 7, 2003. *Better Memories? The Promise and Perils of Pharmacological Interventions* [Online]. Washington DC: The President's Council on Bioethics. Available: <http://bioethics.georgetown.edu/pcbe/transcripts/march03/session4.html> [Accessed 02/07 2010].

- PERLMUTTER, J. S. & MINK, J. W. 2006. Deep brain stimulation. *Annu Rev Neurosci*, 29, 229-57.
- PETERS, T. 2003. *Playing God?: genetic determinism and human freedom*, New York, Routledge.
- PICCIONE, F., CAVINATO, M., MANGANOTTI, P., FORMAGGIO, E., STORTI, S. F., BATTISTIN, L., CAGNIN, A., TONIN, P. & DAM, M. 2011. Behavioral and Neurophysiological Effects of Repetitive Transcranial Magnetic Stimulation on the Minimally Conscious State: A Case Study. *Neurorehabilitation and Neural Repair*, 25, 98-102.
- PITMAN, R. K. & DELAHANTY, D. L. 2005. Conceptually driven pharmacologic approaches to acute trauma. *CNS Spectrums*, 10, 99-106.
- PITMAN, R. K., SANDERS, K. M., ZUSMAN, R. M., HEALY, A. R., CHEEMA, F., LASKO, N. B., CAHILL, L. & ORR, S. P. 2002. Pilot study of secondary prevention of posttraumatic stress disorder with propranolol. *Biological Psychiatry*, 51, 189-192.
- PORTER, G. 2009. CCTV images as evidence. *Australian Journal of Forensic Sciences*, 41, 11-25.
- PORTER, G. & KENNEDY, M. 2012. Photographic truth and evidence. *Australian Journal of Forensic Sciences*, 44, 183-192.
- POZZULO, J. D. & LINDSAY, R. C. L. 1998. Identification accuracy of children versus adults: A meta-analysis. *Law and Human Behavior*, 22, 549-570.
- PRAYLE, D. & BRAZIER, M. 1998. Supply of medicines: paternalism, autonomy and reality. *Journal of Medical Ethics*, 24, 93-98.
- PUTNAM, R. D. 2001. *Bowling Alone*, Simon & Schuster.
- QUIGLEY, M. 2008. Enhancing Me, Enhancing You: Academic Enhancement as a Moral Duty. *Expositions: Interdisciplinary Studies in the Humanities*, 2, 157-162.
- QURAISHI, S. A., GIRDHARRY, T. D., XU, S.-G. & ORKIN, F. K. 2007. Prolonged retrograde amnesia following sedation with propofol in a 12-year-old boy. *Pediatric Anesthesia*, 17, 375-379.
- RAINA, P., SANTAGUIDA, P., ISMAILA, A., PATTERSON, C., COWAN, D., LEVINE, M., BOOKER, L. & OREMUS, M. 2008. Effectiveness of cholinesterase inhibitors and memantine for treating dementia: evidence review for a clinical practice guideline. *Ann Intern Med*. United States.
- RAMMES, G., DANYSZ, W. & PARSONS, C. 2008. Pharmacodynamics of memantine: an update. *Current neuropharmacology*, 6, 55.
- RAMMSAYER, T. H., RODEWALD, S. & GROH, D. 2000. Dopamine-antagonistic, anticholinergic, and GABAergic effects on declarative and procedural memory functions. *Cognitive brain research*, 9, 61-71.
- RANDALL, D. C., SHNEERSON, J. M. & FILE, S. E. 2005. Cognitive effects of modafinil in student volunteers may depend on IQ. *Pharmacology Biochemistry and Behavior*, 82, 133-139.
- RANGAN, R., NAGENDRA, H. & BHAT, G. R. 2009. Effect of yogic education system and modern education system on memory. *Int J Yoga*, 2, 55-61.
- RAUGH, M. R. & ATKINSON, R. C. 1975. A Mnemonic Method for Learning a Second-Language Vocabulary. *Journal of Educational Psychology*, 67, 1-16.
- RAWLS, J. 2005. *A theory of justice*, Cambridge, Massachusetts, Belknap Press.
- RAZ, A., PACKARD, M. G., ALEXANDER, G. M., BUHLE, J. T., ZHU, H., YU, S. & PETERSON, B. S. 2009. A slice of π : An exploratory neuroimaging

- study of digit encoding and retrieval in a superior memorist. *Neurocase*, 15, 361-372.
- READ, J. D., YUILLE, J. C. & TOLLESTRUP, P. 1992. RECOLLECTIONS OF A ROBBERY - EFFECTS OF AROUSAL AND ALCOHOL UPON RECALL AND PERSON IDENTIFICATION. *Law and Human Behavior*, 16, 425-446.
- REPANTIS, D., SCHLATTMANN, P., LAISNEY, O. & HEUSER, I. 2010. Modafinil and methylphenidate for neuroenhancement in healthy individuals: A systematic review. *Pharmacological Research*, 62, 187-206.
- REYNER, L. A. & HORNE, J. A. 1997. Suppression of sleepiness in drivers: Combination of caffeine with a short nap. *Psychophysiology*, 34, 721-725.
- RICHERT, R. A., WHITEHOUSE, H. & STEWART, E. 2005. Memory and analogical thinking in high-arousal rituals. *Mind and religion: Psychological and cognitive foundations of religiosity*, 127-145.
- RICOEUR, P., BLAMEY, K. & PELLAUER, D. 2006. *Memory, History, Forgetting*, University of Chicago Press.
- RIEDEL, G., PLATT, B. & MICHEAU, J. 2003. Glutamate receptor function in learning and memory. *Behavioural Brain Research*, 140, 1-47.
- ROBERTSON, J. A. 1994. *Children of choice: freedom and the new reproductive technologies*, Princeton, Princeton University Press.
- RODRIGUEZ-OROZ, M. C., OBESO, J. A., LANG, A. E., HOUETO, J. L., POLLAK, P., REHNCRONA, S., KULISEVSKY, J., ALBANESE, A., VOLKMANN, J., HARIZ, M. I., QUINN, N. P., SPEELMAN, J. D., GURIDI, J., ZAMARBIDE, I., GIRONELL, A., MOLET, J., PASCUAL-SEDANO, B., PIDOUX, B., BONNET, A. M., AGID, Y., XIE, J., BENABID, A. L., LOZANO, A. M., SAINT-CYR, J., ROMITO, L., CONTARINO, M. F., SCERRATI, M., FRAIX, V. & VAN BLERCOM, N. 2005. Bilateral deep brain stimulation in Parkinson's disease: a multicentre study with 4 years follow-up. *Brain*, 128, 2240-2249.
- ROEDIGER III, H. L. & BUTLER, A. C. 2011. The critical role of retrieval practice in long-term retention. *Trends in Cognitive Sciences*, 15, 20-27.
- ROLDAN-VALADEZ, E., GARCÍA-LÁZARO, H., RAMIREZ-CARMONA, R. & LARA-ROMERO, R. 2012. Neuroanatomy of episodic and semantic memory in humans: A brief review of neuroimaging studies. *Neurology India*, 60, 613-617.
- ROOZENDAAL, B. 2003. Systems mediating acute glucocorticoid effects on memory consolidation and retrieval. *Prog Neuropsychopharmacol Biol Psychiatry*. England.
- ROSE, S. P. R. 2002. 'Smart Drugs': Do they work? Are they ethical? Will they be legal? *Nature Reviews Neuroscience*, 3, 975-979.
- ROSEN, J. 2012. The Right to Be Forgotten. *Stanford Law Review Online*, 64, 88.
- ROSENBERG, L. B. 2007. Necessary forgetting: On the use of propranolol in post-traumatic stress disorder management. *American Journal of Bioethics*, 7, 27-28.
- ROSSANO, M. J. 2009. Ritual behaviour and the origins of modern cognition. *Cambridge Archaeological Journal*, 19, 243-56.
- SAARIKALLIO, S. 2011. Music as emotional self-regulation throughout adulthood. *Psychology of Music*, 39, 307-327.
- SAHAKIAN, B. & MOREIN-ZAMIR, S. 2007. Professor's little helper. *Nature*, 450, 1157-1159.

- SANDEL, M. J. 2004. The Case Against Perfection. *The Atlantic Monthly*, 293, 251-263.
- SANDEL, M. J. 2007. *The case against perfection: ethics in the age of genetic engineering*, Cambridge, Massachusetts, Belknap Press of Harvard University Press.
- SANDI, C. 1998. The role and mechanisms of action of glucocorticoid involvement in memory storage. *Neural Plast*, 6, 41-52.
- SANDI, C. 2011. Glucocorticoids act on glutamatergic pathways to affect memory processes. *Trends Neurosci*. England: 2011 Elsevier Ltd.
- SAUNDERS, B. 2008. The equality of lotteries. *Philosophy*, 83, 359-372.
- SAVULESCU, J. 2005. New breeds of humans: The moral obligation to enhance. *Reproductive BioMedicine Online*, 10, 36-39.
- SAVULESCU, J. 2006. Justice, Fairness, and Enhancement. *Annals of the New York Academy of Sciences*, 1093, 321-338.
- SAVULESCU, J. 2007. Genetic Interventions and the Ethics of Enhancement of Human Beings. In: STEINBOCK, B. (ed.) *The Oxford Handbook of Bioethics*. Oxford: Oxford University Press.
- SAVULESCU, J. 2008. Autonomy, the Good Life, and Controversial Choices. In: RHODES, R., FRANCIS, L. P. & SILVERS, A. (eds.) *The Blackwell Guide to Medical Ethics*. Blackwell Publishing Ltd, Oxford, UK.
- SAVULESCU, J. 2013. A Liberal Consequentialist Approach to Regulation of Cognitive Enhancers. *The American Journal of Bioethics*, 13, 53-55.
- SAVULESCU, J., SANDBERG, A. & KAHANE, G. 2011. Well-Being and Enhancement. In: SAVULESCU, J., MEULEN, R. & KAHANE, G. (eds.) *Enhancing Human Capacities*. Wiley.
- SCHACTER, D. 17/10/2002. *Session 4: Remembering and Forgetting: Psychological Aspects* [Online]. The President's Council on Bioethics. Available: <http://bioethics.georgetown.edu/pcbe/transcripts/oct02/session4.html> [Accessed 01/02/ 2010].
- SCHACTER, D. L. 1996. *Searching for memory: the brain, the mind, and the past*, New York, Basic Books.
- SCHECHTMAN, M. 2004. Self-Expression and Self-Control. *Ratio*, 17, 409-427.
- SCHELLING, G., ROOZENDAAL, B. & DE QUERVAIN, D. J. F. 2004. Can Posttraumatic Stress Disorder Be Prevented with Glucocorticoids? *Annals of the New York Academy of Sciences*, 1032, 158-166.
- SCHERMER, M., BOLT, I., DE JONGH, R. & OLIVIER, B. 2009. The future of psychopharmacological enhancements: Expectations and policies. *Neuroethics*, 2, 75-87.
- SCHMITT, J. & FERRO, A. 2013. Nutraceuticals: is there good science behind the hype? *British Journal of Clinical Pharmacology*, 75, 585-587.
- SCHUEPBACH, W. M. M., RAU, J., KNUDSEN, K., VOLKMANN, J., KRACK, P., TIMMERMAN, L., HÄLBIG, T. D., HESEKAMP, H., NAVARRO, S. M., MEIER, N., FALK, D., MEHDORN, M., PASCHEN, S., MAAROUF, M., BARBE, M. T., FINK, G. R., KUPSCH, A., GRUBER, D., SCHNEIDER, G. H., SEIGNEURET, E., KISTNER, A., CHAYNES, P., ORY-MAGNE, F., BREFEL COURBON, C., VESPER, J., SCHNITZLER, A., WOJTECKI, L., HOUETO, J. L., BATAILLE, B., MALTÊTE, D., DAMIER, P., RAOUL, S., SIXEL-DOERING, F., HELLWIG, D., GHARABAGHI, A., KRÜGER, R., PINSKER, M. O., AMTAGE, F.,

- RÉGIS, J. M., WITJAS, T., THOBOIS, S., MERTENS, P., KLOSS, M., HARTMANN, A., OERTEL, W. H., POST, B., SPEELMAN, H., AGID, Y., SCHADE-BRITTINGER, C. & DEUSCHL, G. 2013. Neurostimulation for Parkinson's Disease with Early Motor Complications. *New England Journal of Medicine*, 368, 610-622.
- SCHUIJFF, M., SMITS, M., COENEN, C., KLAASSEN, P., HENNEN, L., RADER, M. & WOLBRING, G. 2009. European Parliament Science and Technology Options Assessment (STOA) - Human Enhancement Study. Brussels: *European Parliament STOA*.
- SCHWARTZ, R. H., MILTEER, R. & LEBEAU, M. A. 2000. Drug-facilitated sexual assault ('date rape'). *Southern Medical Journal*, 93, 558-561.
- SCOTT, H. 15/10/2007. *The Ethics of Erasing a Bad Memory* [Online]. Available: <http://www.time.com/time/health/article/0,8599,1671492,00.html> [Accessed 01/01/ 2011].
- SELGELID, M. J. 2007. An Argument against Arguments for Enhancement. *Studies in Ethics, Law, and Technology*, 1:1:12.
- SELLEN, A. J. & WHITTAKER, S. 2010. Beyond total capture: a constructive critique of lifelogging. *Communications of the ACM*, 53, 70-77.
- SHADMEHR, R. & HOLCOMB, H. H. 1997. Neural Correlates of Motor Memory Consolidation. *Science*, 277, 821-825.
- SHAPIRO, P. N. & PENROD, S. 1986. Meta-analysis of facial identification studies. *Psychological Bulletin; Psychological Bulletin*, 100, 139.
- SHIMAMOTO, K. 2008. Glutamate transporter blockers for elucidation of the function of excitatory neurotransmission systems. *The Chemical Record*, 8, 182-199.
- SHIPSTEAD, Z., HICKS, K. L. & ENGLE, R. W. 2012a. Cogmed working memory training: Does the evidence support the claims? *Journal of Applied Research in Memory and Cognition*, 1, 185-193.
- SHIPSTEAD, Z., REDICK, T. S. & ENGLE, R. W. 2010. Does working memory training generalize? *Psychologica Belgica*, 50, 245-276.
- SHIPSTEAD, Z., REDICK, T. S. & ENGLE, R. W. 2012b. Is working memory training effective? *Psychological bulletin*, 138, 628-654.
- SIMMONS-STERN, N. R., BUDSON, A. E. & ALLY, B. A. 2010. Music as a memory enhancer in patients with Alzheimer's disease. *Neuropsychologia*, 48, 3164-3167.
- SIRONI, V. A. 2011. Origin and evolution of deep brain stimulation. *Front Integr Neurosci*, 5, 42.
- SMITH, A., BRICE, C., NASH, J., RICH, N. & NUTT, D. J. 2003. Caffeine and Central Noradrenaline: Effects on Mood, Cognitive Performance, Eye Movements and Cardiovascular Function. *Journal of Psychopharmacology*, 17, 283-292.
- SMITH, A. P. 2005. Caffeine at work. *Human Psychopharmacology: Clinical and Experimental*, 20, 441-445.
- SMITH, G. E., HOUSEN, P., YAFFE, K., RUFF, R., KENNISON, R. F., MAHNCKE, H. W. & ZELINSKI, E. M. 2009. A Cognitive Training Program Based on Principles of Brain Plasticity: Results from the Improvement in Memory with Plasticity-based Adaptive Cognitive Training (IMPACT) Study. *Journal of the American Geriatrics Society*, 57, 594-603.
- SMITH, M. A., RIBY, L. M., EEKELEN, J. A. M. V. & FOSTER, J. K. 2011. Glucose enhancement of human memory: A comprehensive research review

- of the glucose memory facilitation effect. *Neuroscience & Biobehavioral Reviews*, 35, 770-783.
- SMITH, M. E. & FARAH, M. J. 2011. Are prescription stimulants "smart pills"? The epidemiology and cognitive neuroscience of prescription stimulant use by normal healthy individuals. *Psychol Bull.* United States: (PsycINFO Database Record 2011 APA, all rights reserved).
- SMITH, P. J., BLUMENTHAL, J. A., HOFFMAN, B. M., COOPER, H., STRAUMAN, T. A., WELSH-BOHMER, K., BROWNDYKE, J. N. & SHERWOOD, A. 2010. Aerobic Exercise and Neurocognitive Performance: A Meta-Analytic Review of Randomized Controlled Trials. *Psychosomatic Medicine*, 72, 239-252.
- SNITZ BE, O. M. E. S. C. M. C. & ET AL. 2009. Ginkgo biloba for preventing cognitive decline in older adults: A randomized trial. *JAMA*, 302, 2663-2670.
- SOETENS, E., CASAER, S., DHOOGHE, R. & HUETING, J. E. 1995. EFFECT OF AMPHETAMINE ON LONG-TERM RETENTION OF VERBAL MATERIAL. *Psychopharmacology*, 119, 155-162.
- SOETENS, E., D'HOOGE, R. & HUETING, J. E. 1993. Amphetamine enhances human-memory consolidation. *Neurosci Lett.* Ireland.
- SOETER, M. & KINDT, M. 2010. Dissociating response systems: Erasing fear from memory. *Neurobiology of Learning and Memory*, 94, 30-41.
- SOETER, M. & KINDT, M. 2011. Disrupting reconsolidation: pharmacological and behavioral manipulations. *Learn Mem.* United States.
- SOETER, M. & KINDT, M. 2012. Erasing fear for an imagined threat event. *Psychoneuroendocrinology*, 37, 1769-79.
- SOFUOGLU, M., DEVITO, E. E., WATERS, A. J. & CARROLL, K. M. 2013. Cognitive enhancement as a treatment for drug addictions. *Neuropharmacology*, 64, 452-463.
- SOFUOGLU, M., WATERS, A. J., POLING, J. & CARROLL, K. M. 2011. Galantamine improves sustained attention in chronic cocaine users. *Exp Clin Psychopharmacol.* United States: 2011 APA, all rights reserved.
- SPARROW, R. 2010. Better than men? Sex and the therapy/enhancement distinction. *Kennedy Inst Ethics J*, 20, 115-44.
- SPARROW, R. 2012. Human enhancement and sexual dimorphism. *Bioethics*, 26, 464-75.
- SQUIRE, L. R. 1992. Declarative and Nondeclarative Memory: Multiple Brain Systems Supporting Learning and Memory. *Journal of Cognitive Neuroscience*, 4, 232-243.
- SQUIRE, L. R., KNOWLTON, B. & MUSEN, G. 1993. The structure and organization of memory. *Annual review of psychology*, 44, 453-495.
- SQUIRE, L. R. & ZOLA-MORGAN, S. 1991. The medial temporal lobe memory system. *Science*, 253, 1380-6.
- STERNBERG, R. J. 2008. Increasing fluid intelligence is possible after all. *Proceedings of the National Academy of Sciences*, 105, 6791-6792.
- STEWART, S. A. 2005. The effects of benzodiazepines on cognition. *J Clin Psychiatry*, 66 Suppl 2, 9-13.
- STICKGOLD, R. 2005. Sleep-dependent memory consolidation. *Nature*, 437, 1272-1278.
- STRANGE, B. A., HURLEMANN, R. & DOLAN, R. J. 2003. An emotion-induced retrograde amnesia in humans is amygdala- and β -adrenergic-dependent.

- Proceedings of the National Academy of Sciences of the United States of America*, 100, 13626-13631.
- STROTH, S., HILLE, K., SPITZER, M. & REINHARDT, R. 2009. Aerobic endurance exercise benefits memory and affect in young adults. *Neuropsychological Rehabilitation*, 19, 223-243.
- STRYJER, R., OPHIR, D., BAR, F., SPIVAK, B., WEIZMAN, A. & STROUS, R. D. 2012. Rivastigmine treatment for the prevention of electroconvulsive therapy-induced memory deficits in patients with schizophrenia. *Clin Neuropharmacol*, 35, 161-4.
- SUBRAMANYA, P. & TELLES, S. 2009. Effect of two yoga-based relaxation techniques on memory scores and state anxiety. *Biopsychosoc Med*. England.
- SUGDEN, C., HOUSDEN, C. R., AGGARWAL, R., SAHAKIAN, B. J. & DARZI, A. 2012. Effect of pharmacological enhancement on the cognitive and clinical psychomotor performance of sleep-deprived doctors: a randomized controlled trial. *Ann Surg*, 255, 222-7.
- SULZER, D., SONDEERS, M. S., POULSEN, N. W. & GALLI, A. 2005. Mechanisms of neurotransmitter release by amphetamines: A review. *Progress in Neurobiology*, 75, 406-433.
- SUTHANA, N., HANEEF, Z., STERN, J., MUKAMEL, R., BEHNKE, E., KNOWLTON, B. & FRIED, I. 2012. Memory Enhancement and Deep-Brain Stimulation of the Entorhinal Area. *New England Journal of Medicine*, 366, 502-510.
- SYDENHAM, E., DANGOUR, A. D. & LIM, W. S. 2012. Omega 3 fatty acid for the prevention of cognitive decline and dementia. *Cochrane Database of Systematic Reviews*.
- SYNOFZIK, M. 2009. Ethically Justified, Clinically Applicable Criteria for Physician Decision-Making in Psychopharmacological Enhancement. *Neuroethics*, 2, 89-102.
- SÄRKÄMÖ, T. & SOTO, D. 2012. Music listening after stroke: beneficial effects and potential neural mechanisms. *Annals of the New York Academy of Sciences*, 1252, 266-281.
- SÜNRAM-LEA, S. I., FOSTER, J. K., DURLACH, P. & PEREZ, C. 2002. The effect of retrograde and anterograde glucose administration on memory performance in healthy young adults. *Behavioural Brain Research*, 134, 505-516.
- TAVERNI, J. P., SELIGER, G. & LICHTMAN, S. W. 1998. Donepezil mediated memory improvement in traumatic brain injury during post acute rehabilitation. *Brain Inj*, 12, 77-80.
- TAYEB, H. O., YANG, H. D., PRICE, B. H. & TARAZI, F. I. 2012. Pharmacotherapies for Alzheimer's disease: Beyond cholinesterase inhibitors. *Pharmacology & Therapeutics*, 134, 8-25.
- TELEGRAPH-REPORTERS. 2012. *BBC to broadcast soldiers being fatally wounded in Afghanistan* [Online]. Available: <http://www.telegraph.co.uk/news/uknews/defence/9487172/BBC-to-broadcast-soldiers-being-fatally-wounded-in-Afghanistan.html> [Accessed 20/08/ 2012].
- TENENBAUM, E. M. & REESE, B. 2007. Memory-altering drugs: Shifting the paradigm of informed consent. *American Journal of Bioethics*, 7, 40-42.

- TETER, C. J., MCCABE, S. E., CRANFORD, J. A., BOYD, C. J. & GUTHRIE, S. K. 2005. Prevalence and motives for illicit use of prescription stimulants in an undergraduate student sample. *J Am Coll Health*, 53, 253-62.
- THOMPSON, R. G., MOULIN, C. J. A., HAYRE, S. & JONES, R. W. 2005. Music Enhances Category Fluency In Healthy Older Adults And Alzheimer's Disease Patients. *Experimental Aging Research*, 31, 91-99.
- THORELL, L. B., LINDQVIST, S., BERGMAN NUTLEY, S., BOHLIN, G. & KLINGBERG, T. 2009. Training and transfer effects of executive functions in preschool children. *Developmental Science*, 12, 106-113.
- TIAN, S. Y., ZOU, L., QUAN, X., ZHANG, Y., XUE, F. S. & YE, T. H. 2010. Effect of midazolam on memory: a study of process dissociation procedure and functional magnetic resonance imaging. *Anaesthesia*. England.
- TINDALL-FORD, S., CHANDLER, P. & SWELLER, J. 1997. When two sensory modes are better than one. *Journal of Experimental Psychology: Applied*, 3, 257.
- TOGLIA, M. P., READ, J. D., ROSS, D. F. & LINDSAY, R. C. L. 2006. *Handbook of Eyewitness Psychology: Memory for events*, Lawrence Erlbaum Associates.
- TULVING, E. 1985. How many memory systems are there? *American Psychologist*, 40, 385.
- TULVING, E. & THOMSON, D. M. 1973. Encoding specificity and retrieval processes in episodic memory. *Psychological review*, 80, 352.
- TURNER, D. C., CLARK, L., DOWSON, J., ROBBINS, T. W. & SAHAKIAN, B. J. 2004. Modafinil improves cognition and response inhibition in adult attention-deficit/hyperactivity disorder. *Biological Psychiatry*, 55, 1031-1040.
- TURNER, D. C., ROBBINS, T. W., CLARK, L., ARON, A. R., DOWSON, J. & SAHAKIAN, B. J. 2003. Cognitive enhancing effects of modafinil in healthy volunteers. *Psychopharmacology*, 165, 260-269.
- TURNER, D. C. & SAHAKIAN, B. J. 2008. The Cognition-enhanced Classroom. In: ZONNEVELD, L., DIJSTELBLOEM, H. & RINGOIR, D. (eds.) *Reshaping the human condition: exploring human enhancement*. The Hague: Rathenau Institute, in collaboration with the British Embassy, Science and Innovation Network and the Parliamentary Office of Science & Technology.
- TWERSKY, R. S., HARTUNG, J., BERGER, B. J., MCCLAIN, J. & BEATON, C. 1993. Midazolam enhances anterograde but not retrograde amnesia in pediatric patients. *Anesthesiology*, 78, 51-5.
- UN. 1948. *The Universal Declaration of Human Rights* [Online]. Available: <http://www.un.org/en/documents/udhr/index.shtml> [Accessed 01/04/ 2010].
- VAIVA, G., DUCROCQ, F., JEZEQUEL, K., AVERLAND, B., LESTAVEL, P., BRUNET, A. & MARMAR, C. R. 2003. Immediate treatment with propranolol decreases posttraumatic stress disorder two months after trauma. *Biological Psychiatry*, 54, 947-949.
- VALENTINO, R. M. & FOLDVARY-SCHAEFER, N. 2007. Modafinil in the treatment of excessive daytime sleepiness. *Cleve Clin J Med*, 74, 561-6, 568-71.
- VARGA, M. D. 2012. Adderall Abuse on College Campuses: A Comprehensive Literature Review. *Journal of Evidence-Based Social Work*, 9, 293-313.

- VEDDER, A. & KLAMING, L. 2010. Human Enhancement for the Common Good—Using Neurotechnologies to Improve Eyewitness Memory. *AJOB Neuroscience*, 1, 22-33.
- VESELIS, R. A. 2006. The remarkable memory effects of propofol. *British Journal of Anaesthesia*, 96, 289-291.
- VESELIS, R. A., PRYOR, K. O., REINSEL, R. A., LI, Y., MEHTA, M. & JOHNSON, R., JR. 2009. Propofol and Midazolam Inhibit Conscious Memory Processes Very Soon after Encoding: An Event-related Potential Study of Familiarity and Recollection in Volunteers. *Anesthesiology*, 110.
- VIGNAL, J.-P., MAILLARD, L., MCGONIGAL, A. & CHAUVEL, P. 2007. The dreamy state: hallucinations of autobiographic memory evoked by temporal lobe stimulations and seizures. *Brain*, 130, 88-99.
- VOLKOW, N. D., WANG, G. J., FOWLER, J. S., TELANG, F., MAYNARD, L., LOGAN, J., GATLEY, S. J., PAPPAS, N., WONG, C., VASKA, P., ZHU, W. & SWANSON, J. M. 2004. Evidence that methylphenidate enhances the saliency of a mathematical task by increasing dopamine in the human brain. *Am J Psychiatry*, 161, 1173-80.
- VOLOKH, E. 2003. The Mechanisms of the Slippery Slope. *Harvard Law Review*, 116, 1026-1137.
- WADDILL, P. J. & MCDANIEL, M. A. 1992. Pictorial enhancement of text memory: limitations imposed by picture type and comprehension skill. *Mem Cognit*, 20, 472-82.
- WAGENAAR, W. A. 2008. Enhancing Memory in the Criminal Trial Process. In: ZONNEVELD, L., DIJSTELBLOEM, H. & RINGOIR, D. (eds.) *Reshaping the human condition: exploring human enhancement*. The Hague: Rathenau Institute.
- WALKER, M. P. & STICKGOLD, R. 2004. Sleep-Dependent Learning and Memory Consolidation. *Neuron*, 44, 121-133.
- WASSERMAN, D. 2004. Making memory lose its sting. *Journal of Philosophy and Public Affairs Quarterly*, 24, 12-18.
- WEAVER, F. M., FOLLETT, K. A., STERN, M., LUO, P., HARRIS, C. L., HUR, K., MARKS, W. J., JR., ROTHLIND, J., SAGHER, O., MOY, C., PAHWA, R., BURCHIEL, K., HOGARTH, P., LAI, E. C., DUDA, J. E., HOLLOWAY, K., SAMII, A., HORN, S., BRONSTEIN, J. M., STONER, G., STARR, P. A., SIMPSON, R., BALTUCH, G., DE SALLES, A., HUANG, G. D. & REDA, D. J. 2012. Randomized trial of deep brain stimulation for Parkinson disease: thirty-six-month outcomes. *Neurology*. United States.
- WEINMANN, S., ROLL, S., SCHWARZBACH, C., VAUTH, C. & WILLICH, S. 2010. Effects of Ginkgo biloba in dementia: systematic review and meta-analysis. *BMC Geriatrics*, 10, 14.
- WELLS, G. L., MEMON, A. & PENROD, S. D. 2006. Eyewitness Evidence: Improving Its Probative Value. *Psychological Science in the Public Interest*, 7, 45-75.
- WHITEHOUSE, H. 2005. Emotion, Memory and Religious Rituals: An Assessment of Two Theories. In: MILTON, K. & SVASEK, M. (eds.) *Mixed Emotions: Anthropological Studies of Feeling*. Bloomsbury Academic.
- WILKINSON, D. 2012. A review of the effects of memantine on clinical progression in Alzheimer's disease. *Int J Geriatr Psychiatry*, 27, 769-76.

- WILLIAMS, E. A. 2006. Good, Better, Best: The Human Quest for Enhancement. In: FRANKEL, M. S. (ed.). American Association for the Advancement of Science.
- WILLIS, S. L., TENNSTEDT, S. L., MARSISKE, M., BALL, K., ELIAS, J., KOEPKE, K. M., MORRIS, J. N., REBOK, G. W., UNVERZAGT, F. W. & STODDARD, A. M. 2006. Long-term effects of cognitive training on everyday functional outcomes in older adults. *JAMA: the journal of the American Medical Association*, 296, 2805-2814.
- WILLYARD, C. 2012. Remembered for Forgetting. *Nat Med*, 18, 482-484.
- WINTER, B., BREITENSTEIN, C., MOOREN, F. C., VOELKER, K., FOBKER, M., LECHTERMANN, A., KRUEGER, K., FROMME, A., KORSUKEWITZ, C. & FLOEL, A. 2007. High impact running improves learning. *Neurobiology of Learning and Memory*, 87, 597-609.
- WOLPE, P. R. 2002. Treatment, enhancement, and the ethics of neurotherapeutics. *Brain and Cognition*, 50, 387-395.
- WOOLNOUGH, P. S. & MACLEOD, M. D. 2001. Watching the birdie watching you: eyewitness memory for actions using CCTV recordings of actual crimes. *Applied Cognitive Psychology*, 15, 395-411.
- WORTHEN, J. B. & HUNT, R. R. 2011. *Mnemonology: Mnemonics for the 21st Century*, Psychology Press.
- WRIGHT, D. B., MEMON, A., SKAGERBERG, E. M. & GABBERT, F. 2009. When Eyewitnesses Talk. *Current Directions in Psychological Science*, 18, 174-178.
- YATES, F. A. 2011. *The Art Of Memory*, Random House.
- YBARRA, O., BURNSTEIN, E., WINKIELMAN, P., KELLER, M. C., MANIS, M., CHAN, E. & RODRIGUEZ, J. 2008. Mental Exercising Through Simple Socializing: Social Interaction Promotes General Cognitive Functioning. *Personality and Social Psychology Bulletin*, 34, 248-259.
- YBARRA, O., WINKIELMAN, P., YEH, I., BURNSTEIN, E. & KAVANAGH, L. 2011. Friends (and Sometimes Enemies) With Cognitive Benefits: What Types of Social Interactions Boost Executive Functioning? *Social Psychological and Personality Science*, 2, 253-261.
- YESAVAGE, J. A., MUMENTHALER, M. S., TAYLOR, J. L., FRIEDMAN, L., O'HARA, R., SHEIKH, J., TINKLENBERG, J. & WHITEHOUSE, P. J. 2002. Donepezil and flight simulator performance: Effects on retention of complex skills. *Neurology*, 59, 123-125.
- ZAHODNE, L. B., OKUN, M. S., FOOTE, K. D., FERNANDEZ, H. H., RODRIGUEZ, R. L., KIRSCH-DARROW, L. & BOWERS, D. 2009. Cognitive declines one year after unilateral deep brain stimulation surgery in parkinson's disease: A controlled study using reliable change. *The Clinical Neuropsychologist*, 23, 385-405.
- ZEEUWS, I., DEROST, N. & SOETENS, E. 2010. Effect of an acute d-amphetamine administration on context information memory in healthy volunteers: evidence from a source memory task. *Hum Psychopharmacol*, 25, 326-34.
- ZEEUWS, I. & SOETENS, E. 2007. Verbal memory performance improved via an acute administration of D-amphetamine. *Human Psychopharmacology: Clinical and Experimental*, 22, 279-287.

- ZEIDAN, F., JOHNSON, S. K., DIAMOND, B. J., DAVID, Z. & GOOLKASIAN, P. 2010. Mindfulness meditation improves cognition: evidence of brief mental training. *Conscious Cogn.* United States: 2010 Elsevier Inc.
- ZELINSKI, E. M., SPINA, L. M., YAFFE, K., RUFF, R., KENNISON, R. F., MAHNCKE, H. W. & SMITH, G. E. 2011. Improvement in Memory with Plasticity-Based Adaptive Cognitive Training: Results of the 3-Month Follow-Up. *Journal of the American Geriatrics Society*, 59, 258-265.

List of Cases

- Airedale NHS Trust v Bland* [1993] HL.
- Alver v Estonia* [2006] 43 E.H.R.R. 40.
- AST Systems Limited v The Commissioners for Her Majesty's Revenue and Customs (Income tax)* [2011] UKFTT 802 (TC), 2011 WL 6328987.
- Attorney General's Reference (No 6 of 1980)* EWCA Crim 1, [1981] QB 715.
- Bolam v Friern Hospital Management Committee* [1957] 1 WLR 582.
- Bolitho v City and Hackney Health Authority* [1997] 4 All ER 771.
- Caves v Revenue and Customs Commissioners* [2012] UKFTT 508.
- Chatterton v Gerson* [1981] 1 All ER 257.
- Chester v Afshar* [2004] UKHL 41.
- D v United Kingdom* (30240/96) [1997] 24 E.H.R.R. 423 (ECtHR).
- Dougoz v Greece* [2002] 34 E.H.R.R. 61.
- Gillick v West Norfolk & Wisbech Area Health Authority* [1985] UKHL.
- Janiak v Ippolito* [1985] 1 S.C.R. 146.
- Keenan v United Kingdom* [2001] 33 EHRR.
- Kinlet Properties Limited v The Commissioners for Her Majesty's Revenue and Customs* [2011] UKFTT 403 (TC), 2011 WL 2649509.
- Mayzit v Russia* [2006] 43 E.H.R.R. 38.
- McGlinchey v United Kingdom* [2003] 37 EHRR. 41.
- Moiseyev v Russia* [2011] 53 E.H.R.R.
- Morris v Richards* [2003] EWCA Civ 232.
- Mouisel v France* [2004] 38 E.H.R.R. 34.
- Napier v The Scottish Ministers* [2002] UKHRR 308.
- Nevmerzhitsky v Ukraine* [2006] 43 E.H.R.R. 32.
- Novoselov v Russia* [2007] 44 E.H.R.R. 1.
- Pearce v United Bristol Healthcare NHS Trust* [1998] 48 BMLR 118.
- Peers v Greece* [2001] 33 E.H.R.R. 5.
- Poltoratskiy v Ukraine* [2004] 39 E.H.R.R. 43.

R v Brown [1994] 1 AC 212.

R v Hurrell [2004] 2 Cr. App. R. (S.) 23.

R v Tabbassum [2000] 2 Cr App Rep 328 CA.

R. v Creighton (Paul Benjamin) [2012] EWCA Crim 388.

Re S (Adult Patient: Sterilisation) [2001] Fam 15.

Re T (Adult Refusal of Treatment) [1993] Fam CA.