# NEUROETHICS ELUCIDATES THE ROLE OF EMOTIONS THEREBY ENLIGHTENING OUR UNDERSTANDING OF MENTAL ILLNESS

A thesis submitted to the Caspersen School of Graduate Studies

Drew University in partial fulfillment of

the requirements for the degree,

Masters of Medical Humanities

Isabel Mendelsohn

Drew University

Madison, New Jersey

August 2018

*For my four loved children,*
*Dominic, Oliver, Beatrice and Evelyne,*
*whose laughter and joy I could not live without,*
*they are my source of endless inspiration and hope.*

*With deepest gratitude,*
*I thank Professor Kathryn Ott,*
*for her kind, intelligent, and insightful,*
*direction and advice,*
*in the completion of my thesis.*

## Table of Contents

# INTRODUCTION

In this thesis, I postulate that through psychotherapy, an improved recognition and reflection of the physical dysfunction of emotions that derive from psychological trauma, resulting in psychiatric disorders, can be used for self-determination to redirect emotions and belief systems in order to improve states of mental illness in many individuals. According to the National Institute of Mental Health, one in six U.S. adults live with mental illness (44.7 million people in 2016).[1] Two broad categories describe mental illness according to varied degrees of severity, including Any Mental Illness (AMI) and Serious Mental Illness (SMI).[2] These cover: mental, behavioral or emotional disorders ranging from no impairment, to mild, moderate and severe impairment as well as those that include impairment that substantially interferes with or limits one or more major life activities.[3]

The new field of Neuroethics informs our understanding of morality through the study of conscious and nonconscious emotions in the development of mental functioning. The study of emotions that lead to our understanding of morality are central to improving, preventing and treating mental illness. In this thesis, I describe this new field of neuroethics in order to bring to light neuroscience research that reveals the significance of emotions in the development of healthy brains as well as in the

[1] The National Institute of Mental Health Information Resource Center, http://www.nimh.nih.gov/health/statistics/mental-illness.shtml.
[2] Ibid.
[3] Ibid.

development of those compromised by physical or psychological damage. From a naturalistic standpoint, I suggest that neuroscience demonstrates that humans, and to a lesser degree, some animals, have an innate capacity for moral understanding. Furthermore, I will show that this phenomenology, while not previously predominant, had been proposed by philosophy and science before the advent of our recent technologic advancements. Additionally, in describing a brief overview of morality and ethics, I will include some of the influences and contributions that religion has had toward the creation of ethical frameworks that define and illustrate the nature of moral beliefs. With this in mind it becomes clear that the theory of emotions and feelings as the origins and basis for moral understanding show that emotional experiences lead to the development of balanced or imbalanced mental functioning. In essence, I argue that humans are instinctively driven to make sense of their emotional experiences, and that this occurs within an inherent, developing understanding of morality.

Despite religious doctrine and traditional conceptualizations of morality, I demonstrate that the current philosophy of mind is now being driven by the neural substrate of experience, demonstrated by discoveries led in neuroscience and neuroimaging. This perspective advances the union of mind-body as one, in contrast to the mind-body dualism proposed by Descartes and infused across many Western religious traditions, and furthermore, significantly underscores the importance of proper neural development in understanding the origins of mental illness. Along with the discoveries being uncovered by technological advancements in neuroimaging, this hypothesis is being further driven by the advancement of computational theory, which

allows for the quick processing of large quantities of neuroimaging data. The implications are far reaching; I advance that studying psychiatric symptoms in light of new knowledge of brain mechanisms can show that deficits in the proper processing of emotions in early experience lead to brain dysfunction or what we term mental illness.

At present, the sources of mental illness are generally poorly understood. Scientists are learning much about emotional development from genetic and epigenetic studies, but they need to keep in mind that the cascade of molecular mechanisms, does not in and of itself explain the cause that first instigates that chain of molecular events. Furthermore, considering trauma as a source of mental illness does not exclude occasions of the malfunctioning of genes due to random mutations, the interference of viruses or other caustic chemical environmental influences that are the possible causes of molecular change as well.

In order to develop a more effective approach of the study of mental illness it is useful to consider previous philosophical thinking in light of our modern neurotechnologies with which we can clarify the significance of the proper development of emotions. To begin, in this thesis, I shall define what the new field of neuroscience encompasses and describe its various beginnings, definitions, meanings and significance. I will additionally, include a brief description of the history of brain study and of the tools used in neuroimaging, along with some cautious remarks from neuroscientists on this new technology. Furthermore, I will describe some current neuroscience research on emotions that shows its relationship to morality and mental illness, as well as research on childhood adversity which contributes to mental illness. I will describe the views of the

philosopher Spinoza, who had long ago proposed a comparable view of emotions as central to the development of the mind-brain as one.

Unfortunately, the lack of understanding of the causes of mental illness has created a stigma for those individuals who are suffering from an imbalance in mental peace. I propose that the new understanding of the pliable nature of neurology and its relationship to emotions has the potential of reducing the stigma of mental illness. The purpose of this thesis is to broaden our analysis of the origins of mental illness by including new findings from neuroscience that show how external stimuli affects the development of emotions and their relationship to mental health. Neuroethicists are now poised to respond to and address the ethical, theoretical and practical issues relating to these discoveries and what that means for new directions in healing.

# SECTION I – NEUROETHICS AND NEUROIMAGING

This thesis investigates the relationship of brain, body and mind. This section provides a brief description of the development of the study of the physical brain and the elusive mind, suggesting neuroethics is now poised to bridge the gap in our understanding of both. The brain is a fascinating organ. It is with our brains that we develop our minds and thus understand morality in society. The psychological and neurological developments that led to the current knowledge in neuroscience, shows that the brain has been studied from the earliest records; in Egyptian, Greek, Roman, Indian, Chinese, Aztec, and Incan cultures.[4] In the more recent past, most physicians and scientists relied on invasive interventions such as frontal lobotomies, from which to learn about the brain. At that time, frontal lobotomies were considered a major advance. Yet, in *Neuroethics*, Paul Root Wolpe notes that "due to the invasive procedures, thousands of patients were left with irreversible brain damage."[5] Despite resulting brain damage, physically invasive procedures are still performed today albeit in a more precise and sophisticated manner.[6] These procedures include cingulotomy, capsulotomy, DBS and gamma knife surgery (targeted radiation) and are often used as a last resort.[7] In contrast, there have also been

[4] Walter Glannon, *In Defining Right and Wrong Brain Science*, ed. Walter Glannon (New York/Washington, D.C.: Dana Press, 2007).
[5] Paul Root Wolpe, *Neuroethics*, ed. S.G. Post, The Encyclopedia of Bioethics (New York: MacMillan Reference, 2004).
[6] Ruth Fischbach and Janet Mindes, "Why Neuroethicist Are Needed," in *The Oxford Handbook of Neuroethics*, ed. Judy Illes and Barbara J. Sahakian (New York: Oxford University Press, 2011).
[7] Ibid.

some physicians such as Freud who attempted to understand the inner workings of the mind through discussions such as in psychoanalysis.

In parallel, the mindfulness, spirituality or theories, that many religious leaders and philosophers have maintained, has bridged a gap in an understanding of our brains and consciousness as well, albeit in more abstract, theological or theoretical realms. In "Compassion, Ethics, and Neuroscience: Neuroethics Through Buddhist Eyes," Tsomo considers the role of religion, and whether there is a neurological basis for moral appraisal of situations.[8] Tsomo examines the neuroscience of ethics, by wondering if humans can arbitrate what is "moral" or "ethical," and furthermore contemplates how religions enrich the dialogue on neuroethical issues and how neuroscience enrich the dialogue on religion.[9] Neuroethicists should account for different cultural views that may reflect different value systems and moral norms.

## Neuroethics: An Overview of Definitions and Meaning

Advances in technology have led to the examination of the brain through the use of neuroimaging. Amassing and interpreting neuroscience information has led to the emerging field of neuroethics, which seeks to address the many ethical considerations of neuroscience and neuroimaging. William Safire is credited with being the first to define neuroethics; in 2002, he gave a perspicuous definition of "neuroethics" as "the

---

[8] Karam Lekshe Tsomo, "Compassion, Ethics, and Neuroscience: Neuroethics through Buddhist Eyes," *Science and Engineering Ethics* 18 (2012).
[9] Ibid.

examination of what is right and wrong, good or bad, about the treatment of, perfection of, or unwelcome invasion of and worrisome manipulation of the human brain."[10]

Generally, there is a range of ethical challenges posed by neuroethics, yet two main branches have been identified. The official International Neuroethics Society (INS) has defined *neuroethics of science* as, how neuroscience and neurotechnologies are informing our value systems; for example, whether or not consent should be sought for criminal defenders before using direct brain intervention (DBI). The INS defines *neuroscience of ethics* as; for example, when we are discovering brain imaging of someone doing moral decision-making exercises.[11] Under the general term "neuroethics," the former is referred to as the "neuroethics of science" and the latter as the "neuroscience of ethics."[12] In "Neuroethics in a New Era of Neuroimaging," Judy Illes succinctly points out that neuroethics embodies "theoretical and practical issues in the neurological sciences that have moral and social consequences in the laboratory, in health care, and in the public domain."[13] Sophisticated technological advances in neuroimaging, including MRI, fMRI, PET, and CAT scans, in addition to EEGs and TMS, reveal unprecedented insights into the brain and mind, enlightening the understanding of emotions. Interpreting neuroimages is challenging, as the resulting new knowledge

---

[10] Glannon, *In Defining Right and Wrong Brain Science*.
[11] K. Karen Rommelfanger, *Neuroethics: How Neuroscience Challenges Our Values: A Conversation with Dr. Karen Rommelfanger*, podcast audio, Spotlight on Ethics2012, neuroethicswomenleaders.worldpress.com/2012/06/.
[12] Mohita Shrivastava and Madhuri Behari, "Neuroethics: A Moral Approach Towards Neuroscience Research," *Neuroethics* 2, no. 1 (2015).
[13] Judy Illes, "Neuroethics in a New Era of Neuroimaging," *American Journal of Neuroradiology* (2003): 1739.

gained often reframes previous assumptions of the function, capacity and meaning of our brains. In, *The Ethical Brain*, neuroscientist Michael S. Gazzaniga gives this view of neuroethics: "Neuroethics is more than just bioethics for the brain…it is the examination of how we want to deal with the social issues of disease, normality, mortality, life style, and the philosophy of living informed by our understanding of underlying brain mechanisms."[14] In trying to understand how the brain makes the mind, Gazzaniga, has studied the brain mechanisms underlying belief systems.[15] Neuroethicists are in a position to consider what neuroimaging technology can contribute toward the understanding of the relationship between the brain and mind in light of the meaning of morality and ethics.

A detailed perspective is offered by neuroethicist Eric Racine. In *Pragmatic Neuroethics: Improving Treatment and Understanding of the Mind-Brain*, Racine explains four distinct, but overlapping, areas of neuroethics including: research neuroethics; clinical neuroethics; public and cultural neuroethics; and theoretical and reflective neuroethics.[16] Firstly, in research neuroethics, Racine describes the challenges encountered that "relate to the responsible conduct of neuroscience research and the sensitive nature of research on the biological basis of cognition, emotion, and motor function."[17] One example of an issue addressed by research neuroethics includes considering how a patient can provide informed consent after a traumatic brain injury.

---

[14] Michael S. Gazzaniga, *The Ethical Brain* (New York: The Dana Press, 2005), 334.
[15] Ibid.
[16] Eric Racine, *Pragmatic Neuroethics: Improving Treatment and Understanding of the Mind-Brain* (Cambridge, Massachusetts: The MIT Press, 2010).
[17] Ibid., 5.

Another example found in neuroimaging research, might be how a clinician should manage incidental findings in the brain scans of healthy control subjects. This helps to answer questions including: Are the researchers obligated to reveal their findings to the volunteers? If the volunteer does not want to know the results of the incidental findings, do the researchers have a "soft paternalism" obligation to disclose them anyway?[18]

Secondly, Racine describes clinical neuroethics as the "ethical challenges in the delivery of accessible and respectful healthcare to neurological and psychiatric patients."[19] Racine reminds us that healthcare providers are bound through deontological codes, whereby clinical ethical challenges may arise regarding their different responsibilities towards their patients and volunteers.[20] Another clinical neuroethical challenge applies to aiding in the decision-making capacity in psychiatric patient populations, or in persons with advanced Alzheimer's Disease, or Parkinson's Disease.[21] Other examples include cases in which the uncertainty of a prognosis may lead to end-of-life proxy decision-making, such as in the well-publicized case of Terri Schiavo, who was in a persistent vegetative state following anoxic brain injury.[22] These cases can involve clinicians, their patients and their respective families as well as the general public.

Thirdly, Racine explains public and cultural neuroethics as the "ethical challenges in the public understanding of neurological and psychiatric conditions; public

---

[18] Ibid.
[19] Ibid., 5.
[20] Ibid.
[21] Ibid.
[22] Ibid.

engagement and the cultural representations of mental illness."[23] What Racine calls, "public neuroethics" includes topics related to health policy for mental health and neurology.[24] Topics relating to the public understanding of neuroscience research involve allocation decisions, that may include what treatments to offer for chronic illnesses, including HIV-related depression, epilepsy or the management of other brain-related illnesses and disabilities.[25] Racine also notes that given the impact of neuroscience on neurological and mental health, he sees that "it is unavoidable that neuroscience progress will cross paths with broader social and economic issues with international ramifications."[26] Living in a more global society, with varying cultural values, public and cultural neuroethics will likely affect the broader political and international health policy landscape.[27]

Fourthly, as the most comprehensive of the distinct areas of neuroethics, Racine describes theoretical and reflective neuroethics as the "theoretical and epistemological foundation of neuroethics and the impact of neuroscience research on bioethical concepts and principles."[28] This major area of interest examines "the foundation and meaning of the field of neuroethics, and more broadly ethics itself."[29] Racine asks, "could new neuroscience research on the basis of moral reasoning and the role of emotions in decision making change how we view ethics or the approaches and methodologies we use

---

[23] Ibid., 5.
[24] Ibid.
[25] Ibid.
[26] Ibid., 8.
[27] Ibid.
[28] Ibid., 5.
[29] Ibid., 8.

to resolve ethical problems."[30] In light of Racine's arguments, I argue that neuroscience research will furthermore expose the primal nature of ethics derived from emotions and feelings, and that the approaches and methodologies we use to resolve ethical problems parallel human emotional development and mental health. This does not suggest those with mental illness are not ethical! Rather, that for some, their emotional experiences, have not been ethically sound, and that these experiences have affected their emotional development detrimentally.

Theoretical and reflective neuroethics are arguably at the core of all neuroethics scholarship and practice from which we create the basic assumptions of who we are. By reviewing diverging perspectives, Racine provides a view of the field that yields an interactive, theoretical and pragmatic approach of neuroethics. Racine's insight aids researchers who study the basis of emotions in neurology to comprehensively consider how their research impacts issues related to mental illness including understanding the causes, treatment and impact of mental illness within individuals and society.

## Neuroimaging: Neuroscience and Computational Theory

### *Technological Advances in Neuroscience of Mental Health: Neuroimaging*

As sentient beings, humans have had the ability for self-reflection for some time, yet the ephemeral nature of the mind has made it empirically challenging to study it. The history of discoveries from primitive trepanning, to psychology, and most recently, cognitive

[30] Ibid., 8.

neuroscience, have helped scientists to understand brain development and has therefore allowed researchers and clinicians to improve treatment for patients with diseases of the mind.[31] In *Principles of Neuroscience*, neuroscientist Eric Kandel states "A combination from a variety of fields—cell biology, systems neural science, brain imaging, cognitive psychology, behavioral neurology, and computer science—has given rise to a functional approach to the brain called *cognitive neural science.*"[32] In the recent decade, cognitive neuroscience has generally relied heavily on new neuroimaging technology. The dramatic new technological advancements of neuroscience in the last two decades, including neuroimaging techniques such as functional magnetic resonance imaging (fMRI), positron emission tomography (PET), and electoencephalography (EEG), in addition to neurostimulation techniques such as transcranial magnetic stimulation (TMS) have allowed scientists to explore the brain in unprecedented ways, thus raising new questions, by revealing new perspectives, from which to understand the workings of the mind.[33] In order to understand the underlying mechanisms of imaging, I will give a brief description of neuroimaging techniques, in addition to reasons in which to consider them carefully. In particular, I will describe the use of fMRI which is used to study processing or control

---

[31]Glannon, *In Defining Right and Wrong Brain Science*.
[32] Eric R. Kandel, James H. Schwartz, and Thomas M. Jessell, "From Nerve Cells to Cognition: The Internal Cellular Representation Required for Perception and Action," in *In Principles of Neuroscience* (New York: MacGraw Hill, 2000), 382.
[33] Miriam Boleyn-Fitzgerald, *Pictures of the Mind: What the New Neuroscience Tells Us About Who We Are* (Upper Saddle River, New Jersey: FT Press, 2010).

of action from which to draw conclusions about the neural mechanisms of emotions, memory, pondering ethical dilemma and many other cognitive capacities.[34]

MRI technology uses powerful magnetic fields to align excited water molecules with or against the direction of that force.[35] The pattern detected from the water molecules absorbed or the radio waves transmitted can be analyzed by a computer to produce two or three-dimensional images of the brain.[36] MRI is primarily used to produce structural images of organs throughout the body including the central nervous system.[37] In contrast, Functional MRI (fMRI) is primarily used as a technique for measuring hemodynamic changes after enhanced neural activity.[38] fMRI uses an MR signal to measure blood-flow changes by recording blood shift levels in blood-oxygen levels in the brain.[39] As activity in the brain increases so does blood flow, which shows how fMRI technology can reveal which parts of the brain are working and under what circumstances.[40]

In *Cognitive Neuroscience*, Richard Passingham cautions that these images are only indirect measures of brain activity however, and that it is important to understand that these measures should be said to show 'activation' in an area of the brain, rather than

---

[34] Nikos K. Logothetis, "What We Can and Cannot Do with fMRI," *Nature Reviews Neurology* 453, no. 7197 (2008).
[35] Boleyn-Fitzgerald, *Pictures of the Mind: What the New Neuroscience Tells Us About Who We Are*.
[36] Ibid.
[37] Logothetis, "What We Can and Cannot Do with fMRI."
[38] Ibid.
[39] Boleyn-Fitzgerald, *Pictures of the Mind: What the New Neuroscience Tells Us About Who We Are*.
[40] Ibid.

'activity.'[41] Furthermore, to clarify another misunderstanding of neuroimaging, he secondly points out that the specific areas in which there is activation during an experiment, represents the results from a comparison between experimental and control conditions, and that it is this difference that matters.[42] Thirdly, Passingham adds that while it is easy to suppose that the pattern of activation in the brain must be the cause of the mental state or behavior, for example the state of depression, it does not necessarily represent a 'brain disorder' but rather can result from a state affected by either internal or external factors causing the depression.[43] Someone may be in a depressed state due to an inherited gene or they could be depressed because their home life is in turmoil.[44] He further explains that while depressed states are reflected in both the amygdala and the subgenual cingulate cortex, scans showing activity in these areas do not necessarily show that the brain is disordered, but rather that the individual is depressed.[45] In other words, the scans themselves will not tell researchers from which circumstance the depression derives, thus the interpretation of data is complex.[46]

While neuroimaging has advanced dramatically and promises new insights into brain functioning, some however, suggest reports may overrate the ability to explain

---

[41] Richard Passingham, *Cognitive Neuroscience: A Very Short Introduction*, Very Short Intoductions (United Kingdom: Oxford University Press, 2016).
[42] Ibid.
[43] Ibid.
[44] Ibid.
[45] Ibid.
[46] Ibid.

brain activity.[47] In "Neuroethics: Separating the Promise from the Pipe Dreams," Russell A. Poldrack warns that colorful brain images may tempt researchers to make claims that outpace scientific data, which furthermore tempt the public to believe those claims; he believes that neuroimaging can be neither used to diagnose psychiatric disorders, nor show how treatments work.[48] In keeping with a sense of caution, Donald Kennedy suggests neuroimaging gives researchers "an unjustified sense of precision."[49] There are color scans that seem to over simplify the complexities of the mind. These scans are referred to as "blobs," in "Brain Imaging: fMRI 2.0," featured in Nature, as recently as 2012.[50] Furthermore, the interpretation of these scans by researchers, are culturally laden. Concepts such as violence, empathy, moral emotions, and deception are difficult to define authoritatively. In *Pragmatic Neuroethics*, Racine quotes Joseph Dummit remarking "the challenge of deriving meaning from diverse neurophysiologic signals is coupled with perennial philosophical debates about the relationship between the mind and the brain and the various cultural perspectives on this problem."[51] Racine additionally points out that the very questions posed by the researchers themselves are

---

[47] Russell A Poldrack, *Neuroimaging: Separating the Promise from the Pipe Dreams*, podcast audio, The Dana Foundation Podcast2009, http//www.dana.org/printerfriendly.aspx?id=22220.
[48] Ibid.
[49] Donald Kennedy, "Neuroimaging: Revolutionary Research Tool or a Post-Modern Phrenology?," *American Journal of Bioethics* 5, no. 19 (2005), 97.
[50] K. Smith, "Brain Imaging: Fmri 2.0," *Nature* 484, no. 7392 (2012).
[51] Racine, *Pragmatic Neuroethics: Improving Treatment and Understanding of the Mind-Brain*, 98.

shaped by cultural and social context.[52] While these concerns should be addressed, there is enough evidence to show that the mind-brain connection is in fact one.

Might there be enthusiastic overconfidence in new technologies that allow researchers to deduce naïve conclusions? Nikos K. Logothetis, Director of Cognitive Processes and Director of Max Plank Institute for Biological Cybernetics, notes that despite being highlighted in many popular articles, fMRI is not proving to read minds better than direct tests of behavior itself.[53] Logothetis proposes both that, "fMRI is not and will never be a mind reader, as some proponents of decoding-based methods suggest, nor is it a worthless and non-informative 'neophrenology' that is condemned to fail."[54] In "Neuroethics and Neuroimaging: Moving Toward Transparency," Joseph J. Fins, from the Division of Medical Ethics at New York Presbyterian-Weill Cornell Medical Center, states, "Reconciling the discordance between what can be seen on bedside examination and what patients may demonstrate on sophisticated neuroimaging will be essential to our understanding of these conditions and their amelioration."[55]

## *Computational Theory*

In "fMRI in Brain Research in its Historical Context," Oleg Jardetzky, one of the first scientists to work on fMRI, points out that key questions remain, from which to interpret fMRI findings, and that those will only be answered by an extensive correlation of fMRI

---

[52] Ibid.
[53] Logothetis, "What We Can and Cannot Do with fMRI."
[54] Ibid., 869.
[55] J.J. Fins, "Neuroethics and Neuroimaging: Moving toward Transparency," *American Journal of Bioethics* 8, no. 9 (2008), 336.

findings. Currently, computational theory is successfully attempting to do just that.[56] Computational models are helping neuroscientists to understand the biological function of genes, gene products, cells, and brain circuits in normal and abnormal mental function.[57] Through the use of computational theory, The National Institutes of Health's Division of Neuroscience and Basic Behavioral Science (DNBBS), are elucidating "how cognitive, affect, stress, and motivational processes interact and their role(s) in mental disorders through functional studies spanning levels of analysis (genomic, molecular, cellular, circuits, behavior) during development and throughout the lifespan."[58] Furthermore, they are gathering information from "genetic variants, epigenetic mechanisms, and gene-environment interactions that influence vulnerability to mental disorders, endophenotypes, and pharmacologic response profiles."[59] Moreover, a high priority of the DNBBS, is to identify biological markers in model systems and humans, that could be "further validated as methods for diagnosing and/or detecting risk/vulnerability, onset, progress, and/or severity of mental disorders."[60] Additionally, the DNBBS suggests computational theory could be used to identify and validate new molecular targets and tools for drug discovery relevant to the treatment of mental disorders.[61]

---

[56] Oleg Jardetzky, "fMRI in Brain Research in Its Historical Context,".
[57] Linda S. Brady, "NIMH Division of Neuroscience and Basic Behavioral Science," The National Institute of Mental Health, https://www.nimh.nih.gov/about/organization/dnbbs/index.shtml.
[58] Ibid.
[59] Ibid.
[60] Ibid.
[61] Ibid.

At the Max Planck University College London Centre for Computational Psychiatry and Ageing Research, Robb Rutledge is developing computational models to understand decision making, learning, and subjective feelings, by examining the underlying neural mechanisms using fMRI, pharmacology, and electrophysiology in healthy and depressed subjects.[62] Specifically, Rutledge has developed a computational and neural model of happiness that links rewards and expectations to subjective feelings and to dopamine.[63] In addition at Princeton University, computational theory is helping to address the huge amounts of data produced by functional brain imaging. At Princeton, Wang, Cohen, Li and Turk-Brown have discovered a technique to calculate and analyze relationships between regions and functional connectivity with a full correlation matrix analysis (FCMA).[64] The full correlation matrix analysis (FCMA) performs unbiased multivariate analyses of whole-brain functional connectivity.[65] This new technique enables the identification of neural mechanisms that support cognitive processes, that may be invisible to activity-based methods.[66] Computational theory is validating neuroimaging research.

---

[62] Robb Rutledge, "Max Planck Ucl Centre for Computational Psychiatry and Ageing Research," https://www.mps-ucl-centre.mpg.de/en/people/robb-rutledge.
[63] "Robb Rutledge Cognitive and Computational Neuroscientist," https://www.robbrutledge.com.
[64] Yida Wang et al., "Full Correlation Matrix Analysis of Fmri Data," (Princeton University).
[65] Ibid.
[66] Ibid.

## Ethical Implications of Neuroethics

Thus, while researchers now have advanced capabilities in neuroimaging, they should be cautious as to how they understand and handle the new knowledge, power and the unknown.[67] James Giordano notes in "Unpacking Neuroscience and Neurotechnology – Instructions not Included: Neuroethics Required" that this is not an appeal to "impede brain research, but rather to engage neuroethics as a discipline and set of practices."[68] Giordano agrees with Illes, that neuroethics should allow a deeper, understanding of brains and their functions in morality and ethics and that we, as a society, should learn how to engage neuroscientific research and its applications in medicine, public life and the national agenda.[69] This new research is integral for an improved perspective on the meaning of mental illness.

In 2016, Sara Goering and Rafael Yuste, wrote an article in *Cell*, calling for ethical guidelines, similar to the Belmont Report, for novel neurotechnologies, including those that record and manipulate large-scale neuronal activity.[70] They believe we need to integrate the technologies with our core societal and human values. Goering and Yuste emphasize the need to understand the possibilities of substantial changes in the concepts of self, privacy, issues of moral and legal responsibility, and issues of fairness and justice. They stress that the overarching goal of guidelines for novel neurotechnologies should be

---

[67] James Giordano, "Unpacking Neuroscience and Neurotechnology— Instructions Not Included: Neuroethics Required," *Neuroethics* (2013).
[68] Ibid., 411.
[69] Ibid.
[70] Sara Goering and Rafael Yuste, "On the Necessity of Ethical Guidelines for Novel Neurotechnologies," *Cell* 167 (2016).

guided by a common humanistic goal, generally to promote the health of the entire population of the world.[71] Ethicist, Joseph Fins reminds us that "humility, not hubris, should be the virtue that should guide the ethical conduct of research and practice."[72]

Swedish philosopher and bioethicist Kathinka Evers has argued, neuroethics could be an opportunity to integrate philosophical literature on the mind-body problem in biomedical ethics.[73] Evers explains that studies in neuroethics should include "philosophical interpretation of central concepts."[74] Neuroethics is a platform upon which to ask questions such as: What are the assumptions in our philosophy of reality that allow the brain to make the mind? How do our neuroimaging studies of cognitive neural science make sense of our memories and emotions? How does this expand on the understanding of our consciousness and the meaning of who we are in relation to one another? In the next section, I will relate philosopher Spinoza's theory which addresses these concerns and furthers the understandings of the mind in light of what is gained from neuroimaging. In response to these concerns, next I will describe the works of neuroethicists that elucidate the role of emotions in neurological and ethical development.

---

[71] Ibid.
[72] Fins, "Neuroethics and Neuroimaging: Moving toward Transparency.", 46.
[73] Kathinka Evers, "Neuroethics: A Philosophical Challenge " (2005).
[74] Ibid., 31.

# SECTION II – NEUROSCIENCE, EMOTIONS, AND PHILOSOPHY

"*One of the most noticeable peculiarities of human behavior is change of response to a given stimulus*."[75]

*Bertrand Russell*

Previously, studying emotions was dependent upon subjective inference drawn from interviews by researchers, however, neuroscience including neuroimaging has afforded an objective analysis of data retrieved directly from imaging of subjects. Neuroscience shares evidence of the neural correlates used to regulate our emotions. While emotions are complex, neuroimaging the brains of healthy patients in contrast to those who have suffered brain trauma, has revealed significant differences in the outcomes of mental functioning such that scientists have learned which parts of the brain relate to certain emotions and feelings, in order to further the understanding of emotional processes. Therefore, recent advances in the neuroscience of emotion are highlighting connections between emotions and cognition that shed light on the meaning of emotions in moral reasoning, decision making, learning, social functioning and ultimately in the development of human morality and ethics.

## Damasio on Affect: Emotions, Feelings, and Survival

[75] Bertrand Russell, "Analogy," in *Philosophy of Mind: Classical and Contemporary Readings*, ed. David J. Chalmers (New York: Oxford University Press, 2002), 668.

As humans, we know the world through our emotions and our feelings, that help us understand them, in order to survive. Antonio Damasio, professor of neuroscience at the University of Southern California, where he directs the new Brain and Creativity Institute, explains that "Emotions and related phenomena are the foundation for feelings, the mental events that form the bedrock of our minds."[76] Furthermore, in general terms, Damasio tells us that "feelings arose from a series of gradual, body-related processes, bottom up, from simpler chemical and action phenomenon accumulated and maintained over evolution."[77] In his most recent book, *The Strange Order of Things: Life, Feeling, and the Making of Cultures*, Damasio has written extensively on the specific roles of feelings. Damasio recognizes feelings as motivators, monitors and negotiators of the cultural process, whereby he stresses their role in society. Damasio has shown that even bacteria, with no nervous system, nor guided by feelings, can communicate among themselves and demonstrate elaborate social behaviors.[78] The computations performed by the bacteria permit them to assess their situation and, accordingly, afford to live independently or gather together if need be.[79]

It is clear therefore, that emotions exist in the context of a society, and so at the heart of what drives our emotions is what Damasio calls the *homeostatic imperative*.[80] Damasio points out that it is W. B. Cannon who wrote in the earlier twentieth century,

---

[76] Antonio Damasio, *Looking for Spinoza: Joy, Sorrow, and the Feeling Brain* (New York: Houghton Mifflin Harcourt, 2003), 28.
[77] *The Strange Order of Things Life, Feelings, and the Making of Cultures*, First ed. (New York: Pantheon Books, 2018), 161.
[78] Ibid.
[79] Ibid.
[80] Ibid.

about "a biological function he named *homeostasis* and described as 'the coordinated physiological reactions which maintain most of the steady states of the body…and which are so peculiar to the living organism'."[81] It is worth remembering that the states of the body result from interactions with their environment, or society. Thus, the homeostatic imperative defines our tendency towards survival. Damasio adds that play and cooperation are in and of themselves homeostatically favorable activities.[82]

Comprehensively, Damasio offers an analysis of the role of affect as encompassing the processes that includes drives, motivations, emotions and feelings.[83] Through neuroscience, Damasio has demonstrated that in the world of affect humans find feelings which include a) spontaneous or homeostatic feelings; b) the emotive responses triggered by stimuli; c) the emotive response triggered by drives such as hunger, motivations such as lust, or emotions that are action programs activated by confronting complex situations including joy, sadness, fear, anger, envy, jealousy, contempt, compassion and admiration.[84] In turn, Damasio correctly observes that "Emotions play out in the theater of the body. Feelings play out in the theater of the mind."[85]

For example, Damasio explains that pain and pleasure are part of biological design for obviously adaptive purposes, whereby there arise signals that are transmitted

---

[81] *The Feeling of What Happens: Body and Emotion in the Making of Consciousness* (Orlando, Florida: Harcourt, Inc., 1999), 138.
[82] *The Strange Order of Things Life, Feelings, and the Making of Cultures*.
[83] Antonio Damasio and Hanna Damasio, "Antonio & Hanna Damasio, the Strange Order of Things: Homeostasis, Feeling, and the Making of Cultures," Copernicus Center for Interdisciplinary Studies, 2017 https://www.youtube.com/watch?v=CAmkDrVvJ68&t=503s.
[84] Damasio, *The Strange Order of Things Life, Feelings, and the Making of Cultures*.
[85] *Looking for Spinoza: Joy, Sorrow, and the Feeling Brain*, 28.

both chemically and via nerve fibers, and appropriate representations are created in the nervous system.[86] In the example of pain, Damasio states "the organism is designed to respond to the actual or threatened loss of integrity of its tissue with a particular type of signaling. The signaling recruits a host of chemical and neural responses all the way from local reactions of white blood cells, to reflexes involving an entire limb, to a concerted emotional reaction."[87]

In light of the interdependence of the individual and society, Damasio, considers how the mind represents our emotional responses. Damasio points out that initially the mind had to be capable of representing two distinct sets of data in images, including 1) the world exterior to the individual organism, the social, and 2) the state of the individual organism's interior, which is experienced as feelings.[88] Damasio relays that this is possible due to the innovation of the central nervous system and their neural circuitries, in which maps of objects and events that are located outside the neural circuitries are made.[89]

Having reviewed Damasio's theory of affect, including the role of emotions and feelings in the need for survival, in the next section, I will describe how they relate to consciousness and why this is significant.

---

[86] *The Feeling of What Happens: Body and Emotion in the Making of Consciousness*.
[87] Ibid., 76.
[88] *The Strange Order of Things Life, Feelings, and the Making of Cultures*.
[89] Ibid.

## Consciousness and Emotions

Antonio Damasio has studied and written much about the role of consciousness and its relationship to feelings and emotions. Upon reflecting on the neurological and neuropsychological evidence, in *The Feeling of What Happens*, Damasio firstly remarks that aspects of the processes of consciousness can be related to the operation of certain brain systems.[90] Secondly, he shares evidence from his patients that reveal that consciousness and wakefulness, as well as consciousness and low-level attention can be separated.[91] Most interestingly, Damasio thirdly notes that "consciousness and emotion are *not* separable" and therefore that "when consciousness is impaired so is emotion."[92] This is significant for understanding the implications and contributions of consciousness to childhood development.

Damasio further distinguishes the simple and complex kinds of consciousness which he names core consciousness (regarding the here and now) and extended consciousness (which provides for an elaborate sense of self in the past and future).[93] Additionally, Damasio points out that the individual mind uses the representation of the organism's interior and world around it to create a mental perspective, as a critical ingredient of subjectivity, which Damasio conceives as the decisive component of consciousness.[94] Moreover, Damasio shows that these biological phenomena are not

---

[90] *The Feeling of What Happens: Body and Emotion in the Making of Consciousness*.
[91] Ibid.
[92] Ibid., 16.
[93] Ibid.
[94] *The Strange Order of Things Life, Feelings, and the Making of Cultures*.

exclusively human, yet maintains that they are at their most enhanced levels when provided language.[95] This aspect of consciousness contributes to the development of emotional understanding in childhood.

As Damasio states that emotions and consciousness are interrelated, and not exclusively human, one can easily therefore imagine that an infant is capable of processing emotions, which is significant because it reveals that emotions begin their development from our earliest existence as human beings, as they are not dependent on conventional memory, working memory, reasoning or language.[96] In light of this reasoning, the subsequent scientific evidence provided in studies of childhood mistreatment, reflect that early exposure to emotional trauma, affects the emotional development of children regardless of their level of consciousness or their level of language development. Do language and consciousness afford humans the tools to better consider the meaning of emotional trauma?

As Damasio points out, "Consciousness is valuable because it introduces a new means of achieving homeostasis."[97] Though much of our processing is nonconscious, consciousness allows individual organisms to "cope with environmental challenges not predicted in its basic design such that the conditions fundamental for survival can still be met."[98] If so, are infants with underdeveloped language and consciousness, therefore more susceptible to emotional trauma, since they cannot process this stimuli through the

---

[95] *The Feeling of What Happens: Body and Emotion in the Making of Consciousness*.
[96] Ibid.
[97] Ibid., 303.
[98] Ibid., 303.

use of language and higher ordered reason? Damasio suggests that consciousness provides a sophisticated means of generating novel responses to stimuli for which the organism has not normally been designed to match, in terms of automated responses.[99] Thus, as consciousness becomes more sophisticated as children grow, so too does their ability to respond to stimuli in seeking self-preservation. While neuroscience is advancing the understanding of brain science, in order to fully understand the purpose of affect in childhood development, and recognize the detrimental effects of abuse, it is useful to remember the philosophy of Spinoza, which envisioned a meaning of affect that demonstrates the significance of the contributions that emotions and feelings provide for our experience of life. The next section comprises some fundamental perspectives shared by Spinoza in light of the new neuroscientific understandings of emotion that illustrate this point.

## Spinoza: Affective Neuroscience and Ethics

Traditionally, the standard assumptions relating to thinking capacity for bodily determination have stemmed from the idea of a mind-body dualism proposed by René Descartes, a 17th century French philosopher. For Descartes, knowledge derives from the mind in contrast to the biology of reason and its inseparable dependence on emotion.[100] Additionally, Immanuel Kant, an 18th century German philosopher, deduced that reason

---

[99] Ibid.
[100] Heidi Morrison Ravven, "Spinozistic Approaches to Evolutionary Naturalism: Spinoza's Anticipation of Contemporary Affective Neuroscience," *Politics and the Life Sciences* 22, no. 1 (2003).

intervenes and overrides desires and emotions. This philosophy suggests that we attain freedom in the independence of our minds from the determination of nature and thus success in our control of free will. However, in the seventeenth century, a Dutch philosopher, Baruch Spinoza, challenged these assumptions with his own view of the mind-body theory.[101] For Spinoza, the relation of human beings to nature was central. In contrast to Descartes, Spinoza held that ethical life was natural, as opposed to supernatural or trans-natural.[102] Unlike his contemporaries, Spinoza imagined human nature in terms of a shared anatomy and function, in which he held a mind-body theory that reduced neither body to mind nor mind to body. Spinoza anticipated current findings in affective neuroscience and rethought ethics upon that neuroscientific basis.[103] Spinoza's consideration of emotions in ethical theory allow for an interpretation of the cause of mental illness to include the negative effects of emotional abuse. Spinoza's theories are helpful for a modern understanding of childhood emotional development.

In "Spinozistic Approaches to Evolutionary Naturalism," Heidi Morrison Ravven, professor at Hamilton College, reviews naturalistic claims of Spinoza for which there is now substantial evidence from neuroscience or modern emotional theory.[104] Ravven calls this "Spinoza's radical deconstruction and naturalistic reconstruction of ethics."[105] These claims with their neuroscientific proof, lay truth to the importance of proper childhood

---

[101] Ibid.
[102] Ibid.
[103] Ibid.
[104] Ibid.
[105] Ibid., 71.

development. In this thesis, I will review some of Spinoza's claims, in light of Damasio's neuroscientific understanding.

Central for Spinoza was what he termed the *conatus,* a sort of "mechanism of survival and enhancement of organic self-organization."[106] Ravven describes the conatus in the following excerpt, "external objects, situations, and especially people had an affective valence, i.e., value, extended to them in terms of their contribution to or detraction from one's own survival needs embodied in the biological mechanisms of regulation maintaining organic homeodynamic stability and integrity."[107] In *Looking for Spinoza*, Damasio reminds his readers of Spinoza's words from *Ethics*, "Each thing, as far as it can by its own power, strives to persevere in its being."[108] Furthermore, he adds, "The striving by which each thing strives to persevere in its being is nothing but the actual essence of the thing."[109] Damasio parallels this to "the continuous attempt at achieving a state of positively regulated life," in the defining reality of our existence or what Spinoza called conatus,[110] and essentially what Damasio himself refers to as the homeostatic imperative.

To further clarify Spinoza's meaning, Damasio points out that the Latin term conatus is similar to the words: striving, endeavor and tendency.[111] From a neuroscience perspective, Damasio explains conatus in biological terms as follows: "It is the aggregate

---

[106] Ibid., 71.
[107] Ibid., 71.
[108] Damasio, *Looking for Spinoza: Joy, Sorrow, and the Feeling Brain*, 36.
[109] Ibid., 36.
[110] Ibid., 36.
[111] Ibid.

of dispositions laid down in brain circuitry that, once engaged by internal or environmental conditions, seeks both survival and well-being."[112] It is worth noting that in his writings on the matter, according to Damasio "Spinoza uses neither the word emotion nor the word feeling but rather affect—in Latin, affectus—a word that is appropriate for both concepts."[113] Damasio thinks Spinoza would welcome the difference in the meaning of emotion or feeling as the distinction is founded in the identification of different events in the process of "being affected."[114]

Ravven, states that "Spinoza identified the source of our human ethical capacity in the biology of our emotions."[115] For Spinoza, "emotion is the registering of body experience (in body and mind) as it reflects the body's furthering or diminishing (pleasure or pain) by such experiences or encounters."[116] According to Ravven, Spinoza also proposed an affective mechanism called the *Imitation of the Affects*, which describes "that our biological psychological (today read genetic) make-up includes hard-wired social emotions creating group feelings and promoting group cooperation."[117] Spinoza believes "bodily or affective imitation and contagion are primitive sources of sociality and thus the default position."[118] In fact, Ravven points out that the *Imitation of the*

---

[112] Ibid., 36.
[113] Ibid., 301.
[114] Ibid., 301.
[115] Morrison Ravven, "Spinozistic Approaches to Evolutionary Naturalism: Spinoza's Anticipation of Contemporary Affective Neuroscience.", 71.
[116] Ibid., 71.
[117] Ibid., 71.
[118] Ibid., 71.

*Affects* also explains our ability to empathize, which draws from "incorporating into our self-boundaries an initially primitive affective identification with others."[119]

Moreover, Spinoza also added that "Value arises from the embodied pursuit of survival and well-being through homeostatic or homeodynamic somatic mechanisms governed by pleasure and pain—the conatus."[120] I have already described Damasio's considerations of pain and pleasure, but in regards to his thoughts on value, in *The Strange Order of Things*, Damasio in turn, suggests a world of valence, which reflects the goodness or badness of the state of fluctuating life regulation.[121] Ravven points out that in *The Feeling of What Happens*, Damasio confirms Spinoza's theory of the conatus, in his conjecture that "we have basic biological homeodynamic survival and enhancement mechanisms and that they are at the root of our capacity for valuing external objects and states of affairs and especially other people insofar as the latter contribute to or interfere with survival and its enhancement."[122]

As Ravven interprets Spinoza's view of ethics, she remarks that for Spinoza, "Ethics, at core, is not about reasoning from principles or finding the right principles or virtues and determining a hierarchy or coherent set of values."[123] This is a significant departure from the philosophies of Spinoza's contemporaries. For Spinoza "ethics consists in revising or educating the innate body-mind *conatus* promoting survival and

---

[119] Ibid., 72.
[120] Ibid., 71.
[121] Damasio, *The Strange Order of Things Life, Feelings, and the Making of Cultures*.
[122] Morrison Ravven, "Spinozistic Approaches to Evolutionary Naturalism: Spinoza's Anticipation of Contemporary Affective Neuroscience.", 71.
[123] Ibid., 72.

self-determination (through the pleasure-pain axis) to integrate into itself, *i.e.*, into one's affective experience of benefit and harm."[124] Accordingly therefore, ethics is derived from our consciousness of the conatus. As Damasio has assessed that consciousness and emotions are inseparable, so too, therefore ethics and emotions are for Spinoza, equally inseparable. According to Ravven, Spinoza believed that "conscious thought arises as self-reflection on body processes and body-world interactions."[125]

Notwithstanding, however, Spinoza also thought that our mental and emotional processes are largely unconscious, "especially the etiology of our emotions."[126] Likewise, Damasio suggests that we are not conscious of which memories we store, or do not store, nor of how we store them, classify and organize them, nor "how we interrelate memories of varied sensory types, different topics, and different emotional significance."[127] In terms of what remains nonconscious, Damasio includes:

1. all the fully formed images to which we do not attend;
2. all the neural patterns that never become images;
3. all the dispositions that were acquired through experience, lie dormant, and may never become an explicit neural pattern;
4. all the quiet remodeling of such dispositions and all their quiet renetworking—that may never become explicitly known; and
5. all the hidden wisdom and know-how that nature embodied in innate, homeostatic dispositions[128]

---

[124] Ibid., 72.
[125] Ibid., 71.
[126] Ibid., 71.
[127] Damasio, *The Feeling of What Happens: Body and Emotion in the Making of Consciousness*, 226.
[128] Ibid., 228.

Additionally, in the interest of self-determination and perpetuation, Spinoza described that the conatus, derived from affective thought, includes all mental processes including moral thinking.[129] Spinoza furthermore, proposed that thought originates in images based in the body and in body experiences.[130] According to Damasio, mental images or mental patterns are built from each of the sensory modalities including visual, auditory, olfactory, gustatory and somatosensory.[131] Furthermore, Damasio states "the process we come to know as mind when mental images become ours as a result of consciousness is a continuous flow of images many of which turn out to be logically interrelated. The flow moves forward in time…*Thought* is an acceptable word to denote such a flow of images."[132]

Spinoza also saw the role of language as essential to the understanding of emotions and experiences. Spinoza claimed that "language is imaginative and uses images based in and on the body."[133] Damasio points out that the mind has a "powerful, image-based memory function capable of learning, and interrelating unique facts and events; an expansion of the imagination, reasoning, and symbolic thought capabilities such that nonverbal narratives could be generated; and the ability to translate nonverbal

---

[129] Morrison Ravven, "Spinozistic Approaches to Evolutionary Naturalism: Spinoza's Anticipation of Contemporary Affective Neuroscience."
[130] Ibid.
[131] Damasio, *The Feeling of What Happens: Body and Emotion in the Making of Consciousness*.
[132] Ibid., 318.
[133] Morrison Ravven, "Spinozistic Approaches to Evolutionary Naturalism: Spinoza's Anticipation of Contemporary Affective Neuroscience.", 72.

images and symbols into coded languages."[134] Damasio shows empirical evidence that "all the words we use, in any language, spoken, written, or appreciated by touch, as in Braille, are made of mental images."[135] Infants have consciousness and emotions before they develop language. The brain evolved to manage our physiology from the beginning, and thus even without language, infants are making sense of their surroundings through their imaginations and through nonverbal narratives stored in memory. Infants, however, are more vulnerable than adults to emotional abuse because they have limited experiences from which to make comparisons to and are limited by their lack of language skills that can create meaning from their experiences. Therefore, infants, and young children are considerably more susceptible to the negative effects of trauma than are adults. Childhood abuse does not allow for the proper development of emotions and thus frequently leads to mental illness, which has the possibility of improving if the reprocessing of emotions can occur. The acknowledgement of emotional trauma as a source of mental illness reduces the stigma of mental illness by clarifying its origins.

Furthermore, in *The Strange Order of Things* Damasio, points out that "All mind, is made of images, from the representation of objects and the events to their corresponding concepts and verbal translations. Images are the universal token of the mind."[136] Representation for Spinoza, is always of the relation of self or body to object (external or internal), in his "Definitions of Emotions" Spinoza states:

---

[134] Damasio, *The Strange Order of Things Life, Feelings, and the Making of Cultures*, 187.
[135] Ibid., 89.
[136] Ibid., 90.

> (a) i.e., of changes in self or body in response to impinging objects; it is therefore (b) more fundamentally of states of self than of objects and developmentally begins with self yet requires an object; thereby (c) creating an associative link (which is cognitive and affective) in imagination and memory between self and object; and (d) the associative link can endure and its repetition is triggered subsequently even in the absence of the object.[137]

In consideration of mental health, Spinoza describes what is essential for proper child development. It is in our younger years that human brains grow and develop so dramatically and that humans are at their most malleable and vulnerable. In light of early child development, the situations and circumstances children find themselves in are normally enriching, where children are continually learning from either success or failure. However, in cases of childhood mistreatment and trauma, disruption of normal emotional growth interferes with the development of what Spinoza calls conatus. Abuse is in opposition to achieving a positively regulated life or homeostatic drive. Furthermore, it should be noted that even Spinoza recognized that the associative link created in memory of an event can endure even without the object normally causing the abuse, such as in the example of post-traumatic stress syndrome.

Ravven explains that in his *Ethics*, Spinoza claimed that "the conatus is the sole basis of virtue" suggesting "survival depended upon our interdependence as well as our competitive strivings."[138] Such survival is unfortunately challenged in childhood mistreatment. What happens in the brain circuitry of children who have been repeatedly

---

[137] Morrison Ravven, "Spinozistic Approaches to Evolutionary Naturalism: Spinoza's Anticipation of Contemporary Affective Neuroscience.", 71.
[138] Ibid., 71.

emotionally abused? Under normal circumstances, family and society would encourage internal or environmental conditions to support the emotional and intellectual growth of children, however, this is unfortunately not always the case. Later in this thesis, I will review research that demonstrates that childhood adversity is associated with left basal ganglia dysfunction in adulthood which impacts mental health. Prior to that I will review the meaning of morality and ethics in order to clarify the role of emotions and feelings for both and explain how they are ultimately inextricably linked.

# SECTION III – ETHICS, EMOTIONS, AND MENTAL HEALTH

> *Joy is an emotion by which the body's power of action is increased or decreased or assisted. Sorrow, on the other hand, is an emotion by which the body's power of action is lessened or restrained, and therefore joy is…good; sorrow on the other hand is…evil.*
>
> *Baruch Spinoza (1632-1677)*[139]

The clarification of the distinction of what morality and ethics mean is imperative for an understanding of the significance that the role of emotions and feelings play in the development of each. Fundamentally, morality and ethics cannot exist without feeling emotions, as it from these that they derive meaning. To simplify the concepts of morality and ethics, it should be noted that they generally have to do with distinguishing the difference between right and wrong or good and bad.[140] According to the Encyclopedia Britannica, "many people think of morality as something that's personal and normative, whereas ethics is the standards of "good and bad" distinguished by a certain community or values."[141] Ultimately, however, their meanings influence each other.

Remembering that emotions and feelings do not exist in a vacuum, and that they are the basic, yet crucial elements for survival and communication between interdependent social beings, it becomes clear that morality and ethics, upon which they

---

[139] Leon Cytryn and Donald McKnew, *Growing up Sad: Childhood Depression and Its Treatment* (New York: W.W. Norton & Co., 1998). Epilogue
[140] "Encyclopedia Britannica." Accessed July 2018 https://www.britannica.com/topic/morality
[141] Ibid.

are based, are likewise dependent upon the nature of living in a society. What people interpret as personal and normative is in relation to the environment around them. Additionally, the ethics we define as a society are influenced by what we feel to be moral and immoral. There is ample evidence in neuroscience that demonstrates that stimuli produce emotive responses from which evolution occurs in order to perpetuate survival or homeostasis. Collectively, learning from our experiences and sharing them with those around us creates meaning enabling our survival.

## Morality and Ethics: The Role of Emotions and Feelings

I will first consider the meaning of morality. Fundamentally, morality is about human well-being.[142] Though the study of morality was once the sole domain of philosophers, it has become an interdisciplinary field spanning the cognitive, social, and biological sciences. While morality involves the theoretical principles concerning the distinction between right and wrong or good and bad behavior, neuroscience has enlightened the understanding of the contributions of emotions and feelings in its development. In *Philosophy in the Flesh*, Lakoff and Johnson explain that "our moral ideals, such as justice, fairness, compassion, virtue, tolerance, freedom, and rights, stem from our fundamental human concern with what is best for us and how we ought to live."[143] Feelings, as Damasio has shown, are the tools, the motivators, monitors and negotiators

[142] George Lakoff and Mark Johnson, *Philosophy in the Flesh the Embodied Mind and Its Challenge to Western Thought* (New York: Basic Books, 1999).
[143] Ibid., 290.

we use to distinguish different emotions from which to create feelings that give us the meaning of right and wrong or good and bad, in terms of morality.

In this paper, I present ethics as biologically based, yet this does not mean that ethics is a preset formula in our genes, it is an interactive, reactive aspect of our beingness in the world. As I have already discussed, emotions and feelings are inseparable for defining morality. If ethics are the agreed upon standards for what we consider to be moral or immoral, they are also dependent upon our emotions and feelings. Although, religions have established ethics as derived from supernatural sources, I argue, that humans have made an interpretation about their environment and its existence from their emotions, and from this that they create an explanation which defines their religion. This does not mean God does not exist, but rather that ethics is being explained in terms of the existence of a god or gods. If we, as humans, acknowledge that ethics are based on morality, we can accept that ethics develop interdependently with emotions.

Lakoff and Johnson clarify that virtually all of our abstract moral concepts are structured metaphorically.[144] Therefore, since "our moral understanding is metaphorical, drawing structure and inference patterns from a wide range of experiential domains that involves values, goods, ends, and purposes,"[145] there are no pure moral concepts that are understood solely in themselves or in relation only to other pure ethical concepts.[146]

---

[144] Ibid.
[145] Ibid., 334.
[146] Ibid.

Moreover, current research indicates the major findings of empirical moral psychology show that emotion appears to play an indispensable role in moral judgment.[147]

In, *The Strange Order of Things,* Antonio Damasio, shows that phenomenology counts. Minds result from emotions experienced with the whole body. Damasio explains:

> It is essential to recall the critical distinction…between emotive processes, which are action programs related to affect, and feelings, the mental experiences of organism states, including the states that result from emotions. Why is this important? Because moral values arise out of reward and punishment processes operated by chemical, visceral, and neural processes in creatures equipped with minds. The processes of reward and punishment result in none other than feelings of pleasure and pain. The values that our cultures have been celebrating in the form of arts, religious beliefs, justice, and fair governance have been forged on the basis of feelings. Once we would remove the current chemical substrate for suffering and its opposite, pleasure and flourishing, we would remove the natural grounding for the moral systems we currently have.[148]

Antonio Damasio makes it clear that neuroscience has much to contribute to the understanding of morality and ethics. Thriving depends on proper emotional development that is influenced by exposure to moral and ethical understanding of our experiences. All living creatures *should* share the imperative of regulating their life processes. They all have the chemical substrates that allow them to feel pain and pleasure, and normally experiences would be such that learning related to those feelings would be fitting to their

---

[147] Cristopher Suhler and Patricia Churchland, eds., *The Neurobiological Basis of Morality*, First ed., The Oxford Handbook of Neuroethics (New York Oxford University Press Inc., 2011).
[148] Damasio, *The Strange Order of Things Life, Feelings, and the Making of Cultures*, 203.

meaning. While Damasio does not directly consider childhood abuse, it is interesting to consider the circumstances in which the rewards and punishments are manipulated so that they do not reflect the values that have become instinctively expected by way of evolution.

In such a situation, emotions are given false valence that do not allow for homeostatic regulation. I argue, this weakened state of homeostasis can promote the development of mental illness. In such cases, the mental expressions and experiences, or feelings, of abused individuals may not lead towards a desire to persist or flourish, which would normally be the case in the drive for homeostasis. The fact that homeostatic regulation and life are inseparable is crucial to understanding that emotions are fundamentally meaningful and understood because of the context of social morality which is in part intrinsically derived from evolutionary development.

## Emotions in Animals

By studying animal models, scientists can simplify the study of emotions. As studies have shown that early bacteria have the capacity to react to stimuli in a similar way that animals with neural systems react to emotions, we can trace evolutionary development in humans from other animals. Animals and humans share many similar neuropathways and neurochemicals. Neuroscience can be applied to the study of animals as well as humans in order to study emotions. Moreover, animal studies can be the precursors to future studies involving humans.

Interestingly, there have been many studies comparing prairie voles and meadow voles that have revealed a unique difference in their chemical makeup leading to significantly different bonding habits. At Atlanta's Yerkes National Primate Research Center, Larry Young has studied the breeding habits of voles for over twenty years, and has discovered a great behavioral difference in two types of voles; the prairie vole and the meadow vole.[149] The prairie vole, unlike 97 percent of mammals—including the meadow vole, are monogamous, forming bonds that last long after mating.[150] Moreover, they display social traits that we tend to think of as deeply human.[151] Young asks "Why do we interact with others the way we do?"[152] In his opinion, the answer almost always comes down to neurochemistry.[153] Damasio and Spinoza both agree that non-human animals also, have emotions. These emotions are inextricably linked to a consciousness that is also shared and experienced chemically. I am not suggesting animals share the same complexity and intelligence of humans, but am pointing out that we have a shared evolutionary development that is emotions.

By comparing the prairie voles and meadow voles, Young has established that "The prairie voles crave social contact, and the meadow voles don't."[154] Using biomolecular tools, from genetic sequencing to transcriptomics, Young has identified that unlike meadow voles, prairie voles have receptors in areas of the brain associated with

---

[149] Abigail Tucker, "What Can Rodent's Tell Us About Why Humans Love?" *Smithsonian Magazine*, February 2014.
[150] Ibid.
[151] Ibid.
[152] Ibid.
[153] Ibid.
[154] Ibid.

reward and punishment for the neuropeptides oxytocin and vasopressin—hormones associated with social cues, childbirth and maternal bonding.[155] In order to test their hypothesis, that these were responsible for the pair bonding, Young's team, put a prairie vole gene that codes for a vasopressin receptor into a virus, and then injected the virus into the rewards center of the meadow vole brain in order to see if the DNA would alter their behavior—and it did![156] As the animals grew up, they began exhibiting pair-bonding behaviors.[157]

From these experiment, Young's team wondered "Can early life experiences make a difference? And could the difference shed light on human behavior and social disorders?"[158] Working with the voles, Katie Barret, from Young's team, found that when baby voles were isolated from the licking and grooming of parents, an interaction known to stimulate oxytocin production, they had trouble bonding with future mates."[159] I would argue, this would be similar to prompting a condition of childhood abuse in an abandonment situation. Barret concluded "Early-life oxytocin release appears to build a stronger brain."[160] While Thomas Insel, also a pioneer in vole studies and head of the National Institutes of Mental Health, warns, "You have to beware of premature extrapolation," the research does clearly demonstrate the significance of chemical signals in communication amongst animals.[161]

---

[155] Ibid.
[156] Ibid.
[157] Ibid.
[158] Ibid.
[159] Ibid.
[160] Ibid.
[161] Ibid.

Furthermore, Young's team has also studied the emotion of grief in voles.[162] Young and his colleagues have studied what happens when voles and their life partners become separated.[163] "In rigorous stress tests, including ones that dropped rodents in a beaker of water, those that had just lost a partner struggled far less than the others. Instead, they passively floated, not seeming to care if they lived or died. In some ways, their symptoms resembled depression."[164] Young explains "It's a maladaptive consequence of an evolutionarily helpful thing. It's love sickness."[165] After dissecting the bereaved animals' brains, the researchers found elevated levels of corticotropin-releasing factor and when they subsequently blocked those receptors, the voles behaved normally, and "struggled fiercely for life."[166] These experiments are among those that led to the creation of the Center for Translational Social Neuroscience at Emory University, which focuses on how basic animal research can inform new treatments for human social disorders.[167]

By studying the neurobiology of bonding and monogamy in voles, discoveries have shown that neurochemicals are responsible for certain behaviors in similar ways to the chemical signals or emotions humans share, which exemplify the action programs related to affect. Without reducing the intellectual superiority and sophistication of humans, in consideration that Damasio has established that moral values arise out of

---

[162] Ibid.
[163] Ibid.
[164] Ibid.
[165] Ibid.
[166] Ibid.
[167] Ibid.

reward and punishment processes operated by chemical, visceral and neural processes in creatures equipped with minds, one wonders if the feelings of pleasure or pain which result from pair bonding could imply that voles too could essentially have their own form of morality. In fact, the consequences of their behavior are essential for their well-being and survival.

Research in social neuroscience is making discoveries that will improve treatment for psychiatric disorders. Research in animal models, including voles, as well as human subjects, is of relevance because humans and animals share an evolutionary history based in emotions. Investigating animal models can illuminate the relationship of emotions to behavior that can be used towards creating clinical applications to help improve treatment for those affected by mental illness. Studying social neurobiology, in both animals and humans, including social bonding, cooperation, compassion, social cognition, gene and brain behavior, and neural circuitry, all fundamentally based in emotions, can enlighten the scientific understanding of disorders of social function found in patients with psychiatric disorders such as schizophrenia.

It is established that neuroscience elucidates the significance of healthy emotional development in animals, human and non-human. Studying emotions in animals may stimulate the debate on the origins of psychiatric disorders. Though there still seems to be considerable misunderstanding on the direct causes of mental illness, I argue that the current research on childhood adversity reflects a new understanding of the direct relationship between childhood trauma and mental illness. In order to clarify the current understanding of mental illness, it is worth examining some of the vast research that has

recently established the connection between childhood adversity and mental illness. In the following section I review this current research in order to broaden our understanding of the sources of mental illness in humans, in hopes that this new understanding will reduce the stigma associated with mental illness.

## Childhood Adversity and Emotional Development

During early childhood development, there is an innate understanding of appropriate good and bad emotions, such as pain and pleasure derived from our evolution. These understandings are valuable not only for the individual, but are also valuable in consideration of the interdependence of individuals for the survival of the group as well. What happens in brain development if the expectation of an emotion is not congruent with the experience in a certain interaction? There is an abundant amount of research in the area of child maltreatment, which correlates childhood abuse with future mental illness. The relevance of emotions to mental illness will be evident in the following examples of research in psychosis, schizophrenia, psychopathology and depression.

This section presents the results that have emerged from broad studies of meta-analyses of patients with schizophrenia in comparison to research that casts doubt on earlier findings of genetic significance for the detection of schizophrenia. In addition, I will share conclusions drawn through research that suggest an irrefutable claim that childhood trauma causes mental illness. Furthermore, I will present a study of reward processing that used neuroimaging to show that their results lend strong support to the idea that expectations are dependent upon previous experience, such that traumatized

individuals show less motivation. Generally, analyses of all the research shows a meaningful correlation between severity of abuse and likelihood of trauma as well.

For example, according to 2012 research from the University of Liverpool, in *Childhood Adversities Increase the Risk of Psychosis: A Meta-anaylsis of Patient-Control, Prospective-and Cross-sectional Cohort Studies*, published in *Schizophrenia Bulletin*, children who have experienced severe trauma are three times as likely to develop schizophrenia in later life.[168] This finding, was derived from a review of over 27,000 research papers, collected from a 30 year time span, looking at the association between childhood trauma and the development of psychosis.[169] In addition, the researchers of this study also found a relationship between the severity of the trauma and the likelihood of developing illness later in life.[170] Psychologist Richard Bentall, thinks that these findings suggest that "a patient's life experiences need to be considered, along with neurological and genetic factors."[171] Bentall suggests that a patient's emotional experiences, are responsible for at least a part of the development of mental illness.

While there is a traditional view that schizophrenia is due to exposure to stress that "unlocks some genetic time bomb that is waiting in people's minds," it is likely that the relationship is more causal.[172] In a comprehensive literature review, John Read, et al

---

[168] See, Janice Wood, "Childhood Trauma Linked to Schizophrenia." and Varese et al., "Childhood Adversities Increase the Risk of Psychosis: A Meta-Analysis of Ptient-Control, Prospective-and Cross-Sectional Cohort Studies," *Schizophrenia Bulletin* 38, no. 4 (2012).
[169] Ibid.
[170] Ibid.
[171] Ibid.
[172] Sara Staggs, "Can Trauma Cause Schizophrenia?"Accessed July 2018 http://blogs.psychcentral.com/after-trauma/2014/10/can-trauma-cause-schizophrenia/.

argue that child abuse does in fact cause schizophrenia.[173] Although, one would need a huge study to prove causation, such as in the examples of smoking and lung cancer, there are numerous studies that have established that severe trauma is known to cause psychotic symptoms, a major component of schizophrenia.[174]

In *Breaking News: The Cause of Schizophrenia Finally Discovered?* Noel Hunter, calls into question the value of the recent proclamations touting the latest breakthroughs to occur in psychiatric research involving genetic studies, particularly in relation to schizophrenia.[175] His perspective draws from the accumulating evidence indicating "an almost irrefutable causal relationship between childhood adversity and most experiences labelled psychotic."[176] For example, Hunter points to the discovery of a protein, named C4, that is associated with a .25 percent increase in the risk of meeting criteria for a diagnosis of schizophrenia in the general population.[177] Hunter tells us that this is a very tiny statistical likelihood that variations of genes associated with the immune system were more prevalent in a group designated to have schizophrenia.[178] Furthermore, he discredits the Feinberg hypothesis of excessive synaptic pruning which emerges from some illness, as a still unproven hypothesis that at most has only found a "biological correlate associated with a small number of individuals fitting into a particular category

---

[173] Ibid.
[174] Ibid.
[175] Noel Hunter, "Breaking News: The Cause of Schizophrenia Finally Discovered?" Accessed July 2018 http://psychintegrity.org/breaking-news-the-cause-of-schizophrenia-finally-discovered/.
[176] Ibid.
[177] Ibid.
[178] Ibid.

called schizophrenia."[179] Moreover, he describes that genes are not determinants of most behavior and experience. Yet "genes are affected by the environment and may get 'turned on' by events within the environment, such as pollution, viruses, psychological trauma, and other acquired experiences" or epigenetics.[180]

Ultimately, Hunter explains that while it is clear that there are certain biological correlates associated with a diagnosis of schizophrenia, "this does not tell us much of anything beyond the fact that the brain and body are demonstrating a different physiology than those who are not in such extreme distress."[181] Hunter provides many studies that show a positive relationship between childhood adversity and psychotic disorders. For example, he discusses a study by Read et al noted above, who concluded that "child abuse is a causal factor in schizophrenia."[182] In 2006, Read et al, demonstrated the neurodevelopmental pathway through which childhood adversity may cause psychosis.[183] Additionally, Hunter refers to the study by Janssen et al, [184] who established a strong dose-response relationship between childhood abuse and psychosis, after following 4045 individuals from the general population over two years.[185] Moreover, in a study by Bentall et al, Hunter recalls that they also found a similar dose-response relationship,

---

[179] Ibid.
[180] Ibid.
[181] Ibid.
[182] Ibid.
[183] Ibid.
[184] Ibid.
[185] Janssen I. et al., "Childhood Abuse as a Risk Factor for Psychotic Experiences," *ACTA Psychiatrica Scandinavica* 109 (2004).

wherein "those who had a high-severity of child abuse were 48.4 times more likely to develop psychosis as an adult."[186]

It has also been established that childhood adversity increases the risk of psychopathology.[187] In order to understand the neurobiological mechanisms underlying this vulnerability, Dillon et al., have studied childhood adversity associated with left basal ganglia dysfunction during reward anticipation in adulthood.[188] Based on the fact that animal models have determined that early adversity is associated with dysfunction in basal ganglia regions involved in reward processing, Dillon et al. used magnetic resonance imaging to examine basal ganglia responses to both cues signaling possible monetary rewards and losses, and delivery of monetary gains and penalties.[189] The results of this study found that individuals exposed to childhood adversity reported elevated symptoms of anhedonia and depression, and they additionally rated reward cues less positively, and displayed a weaker response to reward cues in the left globus pallidus.[190] Despite neuroimaging technology, a strong causal interpretation of the data is premature. The study cannot separate the effects of maltreatment from an inherited dysfunction in neural activity, parental depression or other previous psychiatric issues. However, the results of this experiment indicate that childhood adversity in humans is associated with "blunted subjective responses to reward-predicting cues as well as dysfunction in the left

---

[186] Hunter, "Breaking News: The Cause of Schizophrenia Finally Discovered?".
[187] Daniel G. Dillon et al., "Childhood Adversity Is Associated with Left Ganglia Dysfunction During Reward Anticipation in Adulthood," *Biological Psychiatry* 66, no. 3 (2009).
[188] Ibid.
[189] Ibid.
[190] Ibid.

basal ganglia regions implicated in reward-related learning and motivation."[191] In conclusion, the researchers propose that interventions that target motivation and goal-directed action might be useful for reducing the negative consequences of childhood adversity.[192]

The association between abuse, emotional and physical, in childhood and adverse adult outcomes is well established. Childhood abuse is common. Nonclinical samples of adults in the United States and internationally show self-reported childhood physical abuse rates of 10% to 31% in men and 6% to 40% in women.[193] Moreover, it is worth noting that those who have suffered neglect or maltreatment in childhood, are more likely to become victims of abuse as adults.[194] Furthermore, unfortunately, there is a substantial body of literature linking childhood abuse with poor educational outcomes.[195] It is important to recognize that childhood abuse predisposes adults to a number of chronic mental health as well as physical problems for many years after the abuse.[196] Doing so will be the beginning of addressing the significance of childhood adversity as the source of so many health care needs.

In their book, *Growing Up Sad: Childhood Depression and Its Treatment*, Leon Cytryn and Donald McKnew acknowledge the useful insights researchers have gained

---

[191] Ibid.
[192] Ibid.
[193] Kristen W. Springer, Jennifer Sheridan, and Molly Carnes, "The Long-Term Health Outcomes of Childhood Abuse: An Overview and a Call to Action," *Journal of General Internal Medicine* 18, no. 10 (2003).
[194] Ibid.
[195] Ibid.
[196] Ibid.

through the use of neuroimaging, but warn that the new technological advances have the possibility of misleading health professionals to rely solely on neuroscientific advances for treatment. Similarly to Dillon et al, in being forward thinking, Cytryn and McKnew recommend that the mental health clinics of the future would better serve their patients if they also "offer social skills training, crisis intervention, grief and divorce counseling, parent and teacher effectiveness training, and other modalities aimed at strengthening the emotional resilience of the child and his family."[197] Furthermore, they propose that "such a comprehensive biopsychological approach will ensure the necessary *remedicalization* of psychiatry, while preventing its *dehumanization*."[198]

The role of affect is at the heart of life. Damasio has shown us that all creatures share a functional imperative known as homeostasis which is used to regulate their life processes, or feelings, such that life can persist, flourish and project itself into the future.[199] Emotive responses to sensory stimuli and to regulatory needs lead to mental expressions of bodily states or feelings. Feelings monitor and regulate body states in order to construct narratives about what has happened in the past as well as to envision what might happen in the future. Humans and non-humans are subject to emotions and therefore vulnerable to abuse that interferes with homeostatic regulation. As feelings reflect the state of life at a certain moment, they are subject to change. While certain physiologic conditions lead to certain homeostatic feelings, humans have the ability to

---

[197] Cytryn and McKnew, *Growing up Sad: Childhood Depression and Its Treatment*, 186.
[198] Ibid., 186.
[199] Damasio and Damasio, "Antonio & Hanna Damasio, the Strange Order of Things: Homeostasis, Feeling, and the Making of Cultures".

negotiate the meaning of those feelings, hopefully yielding the best possible steady state of being including growth.

# CONCLUSION

The problem of mental illness is a complex one. While reviewing all of the sources of mental illness is beyond the scope of this paper, it is reasonable to conclude that childhood abuse is in part the cause of a great deal of mental illness. This thesis has provided conclusive evidence of the detrimental effects of childhood trauma. It has highlighted the healthy processing of emotions as fundamental to the development of well-being and has drawn more attention to the repercussions of being exposed to childhood abuse that prevents the normal development of emotions.

This thesis may contribute towards a better understanding of the relationship between emotions and mental illness, in consideration of what present neuroscience reveals about the inner workings of the brain and body as well as in light of the philosophical understanding of our minds provided by the philosopher Spinzoa. From a naturalistic standpoint, this thesis has attempted to show that the mind and body are inextricably linked and that the ability to experience emotions is the basis for that connection. By bringing to light recent neuroscientific research, I have shown that the results of Antonio Damasio's work represent the main contributions from which we are able to draw a number of conclusions regarding the significance of emotions related to ethical and moral development.

This thesis has defined, shown the development of, and made contributions to the field of neuroethics, by highlighting the research provide by neuroscience, as well as the theoretical and reflective considerations of the meanings of this research. Neuroscience and philosophy have underscored the significance of the proper development of moral

understanding and that morality and ethics are based in emotions. Moreover, this thesis has provided suggestions for improvements in clinical neuroethics by suggesting avenues for improved treatment for patients with mental illness that encompass the whole person as oppose to merely treating the psychiatry of the mentally ill. From this, it can be argued that this review is an example of public and cultural neuroethics. This approach underlies the importance of philosophical inquiry in the examination of neuroscience, in consideration of the limitations of neuroimaging. While there are obvious limitations to the study of the mind, including the need to interpret neuroscience images, this thesis shows that the approach of computational theory provides advantages towards interpreting vast amounts of data. Furthermore, in this thesis, I have identified the call for guidelines to better take advantage of the new technology of neuroimaging.

Specifically, this thesis has focused attention on the work of Antonio Damasio, who has demonstrated the significance of emotions and feelings in his explanation of homeostasis, or the drive to survive. Through his explanation of affect, in consideration of Spinoza, I have shown that Damasio has provided convincing evidence of the need for communication between beings in the existence of a society. Furthermore, I have discussed the inextricable link between consciousness and emotions, and the value of consciousness of emotions in childhood development. Additionally, I have explained the value that language brings to the interpretation of emotions in feelings.

This thesis has also provided empirical validation for what Spinoza theorized and called the *conatus*, or the drive for survival. I have explained Damasio's neuroscience research that parallels the conatus to homeostasis, putting forth the work of Ravven's

analysis of Spinoza. In addition, this thesis also, considered Ravven's analysis of Spinoza's theory of the *Imitation of Affects*, in the relationship between humans, as necessary since humans and emotions are interdependent.

In order to further understand emotions, this thesis highlighted the role of emotions and feelings in morality and ethics. By defining each, this thesis enabled a better explanation of the relationship between reward and punishment in morality, based on emotions and feelings. From this, we are able to draw the conclusion that morality is biologically based. Moreover, the results of this research, show that animal studies may be relevant to the study of emotions in human morality, such as those described in this thesis involving the differences in bonding practices between prairie voles and meadow voles. This thesis shares key insights into neurobiology of all animals, by examining the roles of two neuropeptides, oxytocin and vasopressin, in the activation of different behaviors in the different voles.

Finally, this thesis considers the effects of childhood adversity in the development of mental illness and concludes that the disruption of proper emotional development due to childhood trauma does lead to mental illness. This thesis provides convincing evidence of the results of childhood trauma through research in psychosis, schizophrenia, and psychopathology. In this thesis, I propose that acknowledging childhood maltreatment as the frequent source of mental illness, has the potential for reducing the stigma of mental illness, by identifying that the source of much mental illness stems from an avoidable external circumstance as oppose to a weakness or inherent flaw in an individual. The questions raised by this study warrant further investigation. Tools are now available to

further investigate the neuroscience of emotions in mental illness and the findings presented here provide a starting point for further examination of the effect of emotions in mental illness. My recommendation is to re-examine our foundations in understanding how mental illness develops and concentrate on what can be done both to prevent childhood abuse from occurring as well as what can be done to best treat mentally ill patients. Sharing with patients a better understanding of their own emotional development can help them reconsider the impact of their experiences in hopes of finding peace and a desire to live a homeostatic existence.

# Bibliography


Boleyn-Fitzgerald, Miriam. *Pictures of the Mind: What the New Neuroscience Tells Us About Who We Are.* Upper Saddle River, New Jersey: FT Press, 2010.

Brady, Linda S. "NIMH Division of Neuroscience and Basic Behavioral Science." The National Institute of Mental Health, Accessed 2018 https://www.nimh.nih.gov/about/organization/dnbbs/index.shtml.

Center, The National Institute of Mental Health Information Resource. Accessed 2018 http://www.nimh.nih.gov/health/statistics/mental-illness.shtml.

Cytryn, Leon, and Donald McKnew. *Growing up Sad: Childhood Depression and Its Treatment.* New York: W.W. Norton & Co., 1998.

Damasio, Antonio. *The Feeling of What Happens: Body and Emotion in the Making of Consciousness.* Orlando, Florida: Harcourt, Inc., 1999.

———. *Looking for Spinoza: Joy, Sorrow, and the Feeling Brain.* New York: Houghton Mifflin Harcourt, 2003.

———. *The Strange Order of Things Life, Feelings, and the Making of Cultures.* First ed. New York: Pantheon Books, 2018.

Damasio, Antonio, and Hanna Damasio. "Antonio & Hanna Damasio, the Strange Order of Things: Homeostasis, Feeling, and the Making of Cultures." Copernicus Center for Interdisciplinary Studies, 2017 https://www.youtube.com/watch?v=CAmkDrVvJ68&t=503s.

Dillon, Daniel G., Avram J. Holmes, Jeffrey L. Birk, Nancy Brooks, Karlen Lyons-Ruth, and Diego A. Pizzagalli. "Childhood Adversity Is Associated with Left Ganglia Dysfunction During Reward Anticipation in Adulthood." *Biological Psychiatry* 66, no. 3 (2009): 206-13.

"Encyclopedia Britannica." Accessed 2018 https://www.britannica.com/topic/morality

Evers, Kathinka. "Neuroethics: A Philosophical Challenge ". *American Journal of Bioethics* 5 (2005): 31-33.

Fins, J.J. . "Neuroethics and Neuroimaging: Moving toward Transparency." *American Journal of Bioethics* 8, no. 9 (2008): 46-52.

Fischbach, Ruth, and Janet Mindes. "Why Neuroethicist Are Needed." In *The Oxford Handbook of Neuroethics*, edited by Judy Illes and Barbara J. Sahakian. New York: Oxford University Press, 2011.

Gazzaniga, Michael S. *The Ethical Brain.* New York: The Dana Press, 2005.

Giordano, James. "Unpacking Neuroscience and Neurotechnology— Instructions Not Included: Neuroethics Required." *Neuroethics* (2013).

Glannon, Walter. *In Defining Right and Wrong Brain Science.* Edited by Walter Glannon. New York/Washington, D.C.: Dana Press, 2007.

Goering, Sara, and Rafael Yuste. "On the Necessity of Ethical Guidelines for Novel Neurotechnologies." *Cell* 167 (2016): 882-85.

Hunter, Noel. "Breaking News: The Cause of Schizophrenia Finally Discovered?"Accessed July 2018 http://psychintegrity.org/breaking-news-the-cause-of-schizophrenia-finally-discovered/"

I., Janssen, Krabbendam L., Bak M, Hanssen M., Vollebergh W., de Graaf R., and van Os J. "Childhood Abuse as a Risk Factor for Psychotic Experiences." *ACTA Psychiatrica Scandinavica* 109 (2004): 38-45.

Illes, Judy. "Neuroethics in a New Era of Neuroimaging." *American Journal of Neuroradiology* (2003): 1739-41.

Jardetzky, Oleg. "fMRI in Brain Research in Its Historical Context." *American Journal of Bioethics* 8, no. 9 (2008): 43-45.

Kandel, Eric R., James H. Schwartz, and Thomas M. Jessell. "From Nerve Cells to Cognition: The Internal Cellular Representation Required for Perception and Action." In *In Principles of Neuroscience*. New York: MacGraw Hill, 2000.

Kennedy, Donald. "Neuroimaging: Revolutionary Research Tool or a Post-Modern Phrenology?" *American Journal of Bioethics* 5, no. 19 (2005).

Lakoff, George, and Mark Johnson. *Philosophy in the Flesh the Embodied Mind and Its Challenge to Western Thought.* New York: Basic Books, 1999.

Logothetis, Nikos K. "What We Can and Cannot Do with fMRI." *Nature Reviews Neurology* 453, no. 7197 (2008): 869-78.

Morrison Ravven, Heidi. "Spinozistic Approaches to Evolutionary Naturalism: Spinoza's Anticipation of Contemporary Affective Neuroscience." *Politics and the Life Sciences* 22, no. 1 (2003).

Passingham, Richard. *Cognitive Neuroscience: A Very Short Introduction.* Very Short Intoductions. United Kingdom: Oxford University Press, 2016.

Poldrack, Russell A. *Neuroimaging: Separating the Promise from the Pipe Dreams.* Podcast audio. The Dana Foundation Podcast 2009. http//www.dana.org/printerfriendly.aspx?id=22220.

Racine, Eric. *Pragmatic Neuroethics: Improving Treatment and Understanding of the Mind-Brain.* Cambridge, Massachusetts: The MIT Press, 2010.

Rommelfanger, K. Karen. *Neuroethics: How Neuroscience Challenges Our Values: A Conversation with Dr. Karen Rommelfanger.* Podcast audio. Spotlight on Ethics 2012. neuroethicswomenleaders.worldpress.com/2012/06/.

Russell, Bertrand. "Analogy." Chap. 62 In *Philosophy of Mind: Classical and Contemporary Readings*, edited by David J. Chalmers, 667-69. New York: Oxford University Press, 2002.

Rutledge, Robb. "Max Planck Ucl Centre for Computational Psychiatry and Ageing Research." https://www.mps-ucl-centre.mpg.de/en/people/robb-rutledge.

———. "Robb Rutledge Cognitive and Computational Neuroscientist." https://www.robbrutledge.com/.

Shrivastava, Mohita, and Madhuri Behari. "Neuroethics: A Moral Approach Towards Neuroscience Research." *Neuroethics* 2, no. 1 (2015).

Smith, K. "Brain Imaging: Fmri 2.0." *Nature* 484, no. 7392 (April 4 2012): 24-6.

Springer, Kristen W., Jennifer Sheridan, and Molly Carnes. "The Long-Term Health Outcomes of Childhood Abuse: An Overview and a Call to Action." *Journal of General Internal Medicine* 18, no. 10 (2003): 864-70.

Staggs, Sara. "Can Trauma Cause Schizophrenia?" Accessed July 2018 http://blogs.psychcentral.com/after-trauma/2014/10/can-trauma-cause-schizophrenia/.

Suhler, Cristopher, and Patricia Churchland, eds. *The Neurobiological Basis of Morality*. Edited by Judy Illes and Barbara J. Sahakian. First ed, The Oxford Handbook of Neuroethics. New York Oxford University Press Inc., 2011.

Tsomo, Karam Lekshe. "Compassion, Ethics, and Neuroscience: Neuroethics through Buddhist Eyes." *Science and Engineering Ethics* 18 (2012): 529-37.

Tucker, Abigail. "What Can Rodent's Tell Us About Why Humans Love?" *Smithsonian Magazine*, February 2014.

Wang, Yida, Jonathan D. Cohen, Kai Li, and Nicholas B. Turk-Brown. "Full Correlation Matrix Analysis of fMRI Data." Princeton University.

Wolpe, Paul Root. *Neuroethics.* The Encyclopedia of Bioethics. Edited by S.G. Post. New York: MacMillan Reference, 2004.

Wood, Janice. "Childhood Trauma Linked to Schizophrenia."

# VITA

Isabel Mendelsohn

Silver Spring, MD  04/27/72

Dr. Benoit de Crombrugghe

| | | | |
|---|---|---|---|
| Episcopal High School | Houston, TX | High School Diploma | 1990 |
| Skidmore College | Saratoga Springs, NY | Bachelor of Arts, Psychology | 1994 |
| Drew University | Madison, NJ | Masters in Medical Humanities | 2018 |