Brain Based: Understanding Treatment, Evidence and Recovery in Neuroscience and Psychology

by

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Introduction

Given my upbringing in a home with a professor of science communication and a family therapist specializing in talk therapy, the topic of this thesis does not come as much of a surprise. When my mother would talk about her work, she often discussed the difficulty of relying only on talk therapy as insurance companies pushed her and her agency towards increasingly standardized measures of reporting treatments and patient progress. Insurance companies insisted on specific diagnoses, and specific treatment protocols based on these diagnoses. At the same time, she often spoke about her fascination and optimism for neuroscience. After professional learning workshops, mom loved to chat about how exciting it was that the talk (and play) therapies she used had an actual effect on the brain. For her, the knowledge that talk therapy produced a tangible effect on the brain was a powerful persuasive tool when she worked with her clients. Even as a talk therapist who believed in the value and effect of talk therapy, tangible demonstrations of the effects of talk therapy on the brain were affirming for my mom.

As I got older and began thinking about subjects to study in college, our dinnertime conversations about mental health care led me to consider neuroscience. As it turned out, the 2012-2013 academic year was an ideal time to be an aspiring neuroscientist: on April 2, 2013, Barack Obama announced the BRAIN initiative, a massive, well funded research initiative designed to revolutionize our understanding of the brain. This new scientific knowledge, Obama said, would be "transformative" (Obama, 2013). This word, transformative, felt relevant and descriptive of the content in my neuroscience coursework. In classes, neuroscience provided explanations for
every part of daily life, providing a new neurological perspective into a wide range of experiences. The Wesleyan Neuroscience Department website "welcome" page reads, "Neuroscience probes one of the last biological frontiers in understanding ourselves". (Wesleyan Neuroscience). Transformative also provides a salient description of the state of mental health care. In the decades before I came to college, the treatment technologies used in mental health care were rapidly changing. The use of talk therapy declined as the number of people seeking treatment for mental health problems increased. For the duration of this thesis, I will focus on depression to illustrate how psychological disorders were diagnosed, assessed and treated.

Between 1998 and 2007, the percentage of individuals with depression receiving psychotherapy declined from 53.6% to 43.1% (Marcus & Olfson, 2010). During this same period, the percentage of Americans receiving treatment for depression from 2.37% to 2.88%, both a massive increase from the 1987 level of .73%. Thus, talk therapy has fallen to the wayside as the need for mental health care for depression has increased.

This thesis attempts to better situate that trend in the context of the increased precedence of neuroscience, and neuroscientific conceptions of personhood. To this end, this thesis will first cover the history of mental health care in the United States after World War II, then consider a case study between two treatments for depression, a brain based treatment and a talk therapy, and finally will analyze contemporary cultural surrounding the brain and neuroscience.

To begin, the first chapter reviews the enormous changes in clinical psychology in the United States after World War II. The rise in need for effective
mental health care caused by the return of soldiers after World War II prompted a shift in the clinical training and approaches of clinical psychologists. It became clear that existing models of psychotherapy, such as Freudian psychoanalysis, were too inefficient to meet the post-WWII increased demand. Consequently, a number of new and heterogeneous treatments for mental health problems were developed. These novel treatments, ranging from novel talk therapies to new psycho-pharmaceuticals, required new, standardized tools for diagnosis and measurement to fit into the rapidly medicalizing field. In addition, research techniques changed; notably randomized control trials became the gold standard by which treatments were tested. These standardizations were structured in a way that better accommodated certain types of treatments, specifically psycho-pharmaceuticals. Thus, the first chapter provides context to better trace the emerging standards of evidence and assurance required of mental health treatments. As clinical psychology transitioned to adopt an increasingly medicalized model of diagnosis and definition, neuroscience arose as a promising tool for discovering and describing the causes of mental illness, designing treatment technologies and measuring post-treatment outcomes.

The second chapter examines the two selected treatment technologies for depression, repetitive transcranial magnetic stimulation (rTMS) and interpersonal psychotherapy (IPT), as case studies for demonstrating how brain-based treatments and talk therapies demonstrated their efficacy using the post-WWII evidence production system. At first glance, the two treatments appear radically different, their underlying assumptions about the causes of depression so disparate as to be incomparable. However, further examination shows that the two treatments are not as
different as they initially appear. rTMS is based on a body of literature suggesting that depression is the result of irregular activity in the left dorsolateral prefrontal cortex of the brain. In contrast, IPT is based on a complex theory of depression citing biology and personal circumstance as causal agents for depression. The implications of these different models of depression are reflected in the methods of intervention of the two techniques. rTMS uses magnetic stimulation to affect brain activity, while a clinician regularly meets with a client for sessions of IPT. Despite the fact that rTMS is a neuromodulation technique and IPT is a talk therapy, the structures of the treatment technologies are largely the same. Both treatment technologies are based around a standardized structure of regularly scheduled clinical interactions with predefined dates of termination. Because of these structural similarities and the standardized methods for evaluating the outcomes of the treatments, the studies supporting their efficacy are well suited for comparison. Comparing the evidence supporting rTMS and IPT reveals strikingly few differences considering the different bases of depression used by the two treatments. Despite the fact that rTMS is based on a conception of depression identifying a specific area of abnormal neural activity as the cause of depression, most of the research supporting rTMS does not use the brain as a source of evidence. Instead, the developmental profile of rTMS is very similar to that of IPT. Both treatments use clinical rating scales as their primary evidence type for testing the effectiveness of the treatments. The similarities in the structure of IPT and rTMS and the lack of neurological data used as evidence for rTMS complicates the widely held cultural idea that brain based treatments constitute a radically different approach to mental health care.
Because the supporting evidence for rTMS and IPT does not clearly explain the cultural conception of neuroscience as "transformative", the third chapter considers the causes of this conception. Consequently, the third chapter examines the social forces that shape the communication of information about biotechnologies and neuroscience. A combination of factors has promoted highly optimistic representations of biotechnologies and neuroscience in the media. Scientists are incentivized to emphasize the potential benefits and the applicable features of their research. This image of biotechnologies and neuroscience is transmitted by the media to the public, who subsequently form lofty expectations of research. A robust culture of "neurochemical selfhood", in which the brain serves as the definitive unit of the self, has emerged as a consequence of these widely circulated ideas of the brain. Put differently, contemporary media coverage of the brain supports the notion that "you are your brain". Thus, this chapter argues that the popular image of neuroscience as transformative does not arise from radical new evidence or explanatory techniques used by scientists, but rather from the broader culture resulting from the communication and circulation of neuroscience research.

Because of the complexity and breadth of the topic, this thesis is not, and is not meant to be, a comprehensive analysis of the decline of talk therapy or the ascendance of neuroscientific explanations for mental health. The role of health insurance companies in determining what qualifies as evidence-based treatments is notably absent from this work. However, by describing the history of mental health care treatments and the tools used to prove their efficacy, this thesis offers a window
into some of the ways that neuroscience has come to be known as a "transformative" discipline that offers superior insights into both mental health and our selves.
Chapter 1: New treatments, new evidence

Introduction

This thesis compares two different treatments for depression, rTMS and IPT. This later comparison is possible because of an evidence production system created after World War II that was part of a greater movement in clinical psychology to standardize the practice. As a result of this, treatments with very different means of action, such as talk therapies and antidepressants, could be compared using standard, shared measurements. This chapter explores how, and why the different evidence production tools used in the later comparison were created, and why their creation justifies the comparison of rTMS and IPT.

In order to fully examine findings in clinical trials, it is crucial to understand how the current evidence production system for mental health care treatments came to be. At the most basic level, a scientific study of the effectiveness of a particular treatment for a particular disorder requires three things: a population of clinical subjects who have the same disorder, a tool to measure the effect of a treatment, and a means of ensuring that any changes in the severity of the disorder are the result of the tested treatment. These tools would be created in clinical psychology as the need for mental health care increased after World War II. The return of veterans after World War II created a new need for effective mental health care in the United States. A number of new types of treatments, including psycho-pharmaceuticals and talk therapies, or psycho-technologies, were created in this post-war period. Assessment of these new treatments required a system of standardized testing and comparison. Thus, after describing the variety of treatments that were created after World War II,
this chapter highlights how the *Diagnostic and Statistical Manual of Mental Disorders* (DSM), depression rating scales, and randomized control trials were designed as tools to serve the scientific needs of clinical psychology. As a whole, this chapter thus describes how clinical psychology research and practice was transformed from its pre-war state to the medicalized form that would be visible in the 1980 publication of the DSM-III.

When veterans came back from World War II, the previously popular treatment model, psychoanalysis, fell out of widespread use, in large part because it lacked research supporting its effectiveness (Shorter, 1997) (Hilgard, 1987). Largely untestable, it fit poorly into an evolving field that strived to be more scientific. A multitude of new, treatments, including talk therapies and psycho-pharmaceuticals, were created as psychoanalysis declined in use. The diverse group of talk therapies developed in this period included both individual and group therapies. Individual talk therapies varied between focusing on the intrapersonal thought processes that were believed to create psychological disorders and the interpersonal social relationships thought to shape the individual's state of mind; in contrast family therapy, an example of a group therapy, viewed the family as the unit for understanding mental health problems. Just as these and other novel talk therapies developed, new psycho-pharmaceuticals were also being introduced. Anti-depressants and anti-psychotics were first synthesized and used in the years following World War II and helped patients previously thought to be untreatable recover from crippling psychological disorders (Shorter, 1997). These different types of treatments were based on different assumptions about the causes of psychological disorders. Yet, despite their different
focuses, these varying treatments needed to be assessed and compared. To remedy this, clinical psychology would move away from focusing on the causes of psychological disorders, and would instead focus on categorizing the symptoms that characterized psychological disorders. By focusing on symptoms instead of causes, the evidence production system of clinical psychology became equipped to accurately and precisely measure and compare treatment models with vastly different assumptions about the causes of psychological disorders.

As new treatments arose for psychological disorders, there was an increasing pressure for scientific demonstration of their effectiveness. To properly organize a study with a consistent pool of subjects, clinicians first had to produce a commonly agreed upon definition of the subject's problem and its severity. Put differently, to test whether or not a treatment was effective for a particular disorder, psychologists needed to have a consistent, organized framework to describe psychological disorders. In the late 1940s, a variety of naming systems for psychological disorders existed without a standard way to apply them (Shorter, 1997). In response to this problem, and as a move towards a medical model, clinicians developed the *Diagnostic and Statistical Manual of Mental Disorders*, often referred to as the DSM (Shorter, 1997). Through the use of the DSM, clinical psychologists as well as psychiatrists hoped to standardize the diagnosis of different disorders between clinics across the country. As these new treatments became more widely used and the diagnosis of psychological disorders came to be standardized, measures of the severity of these disorders were created as well. For depression, these measurement scales included clinician evaluations, such as the Hamilton Depression Rating Scale.
and patient self-evaluations such as the Beck Depression Inventory. In addition to these measures of severity, new experimental designs were used to ensure the accuracy of scientific studies about new treatments. Randomized control trials began to be used as the standard experimental design for evaluating treatments. Among the effects of all these changes in clinical psychology was a transition towards a model of practice that focused on observable symptoms rather than the underlying causes of psychological disorders. This transition facilitated the testing and comparison of the variety of treatments that developed after World War II.

New emerging practices

The decline of psychoanalysis

The years after World War II would be a productive, dynamic time for both clinical psychology and psychopharmacology in the United States as psychoanalysis became less commonly used in clinical practice. World War II created an increased need for mental health care providers in the US. In 1941, there were only 35 psychiatrists in the army; by 1945 there would be 2,500 psychiatrists in the armed forces (Hilgard, 1987). After the war, veteran’s hospitals struggled to accommodate the large number of returning soldiers with physical and psychological ailments. In addition to this, the audience of clinical psychology was expanding to new social groups such as the family. This immense influx of patients brought a period of enormous growth in clinical psychology. The increased need for mental health care created a demand for treatments with demonstrable effects. New and different treatments arose as previously popular methods of care struggled to prove their efficacy in the new scientific field.
At the time of World War II, psychoanalysis was the dominant psychological model in the United States (Shorter, 1997). Bertram Brown, former director of the National Institute of Mental Health said, "it was nearly impossible for a nonpsychoanalyst to become chairman of a department or professor of psychiatry" in 1945, while in 1953 Karl Menninger, a prominent psychiatrist said, "gradually the dynamic concepts [note: dynamic was a code word for psychoanalytic] have gained complete supremacy" (Shorter, 1997). However, despite its prevalence after the war, psychoanalysis began to come under fire. In 1954, William Mayer-Gross, a psychiatrist, wrote, "Freud's superficially rational appeal, made under the cloak of science, is probably the most effective form of faith healing today" (Shorter, 1997). Elsewhere, more and more practitioners abandoned psychoanalysis as psychoanalysts struggled to justify their practices to skeptics (Hilgard, 1987).

In the face of such criticism, major proponents of psychoanalysis tried to provide critics with the scientific proof of efficacy they demanded, yet attempts to use statistical studies to justify psychoanalysis proved largely unsuccessful. A major attempt by the American Psychoanalytic Association (APA) to generate evidence of the effectiveness of psychoanalysis ended in embarrassing failure (Shorter, 1997). Beginning in 1953, the APA attempted to research the success of patients participating in psychoanalysis. Despite support from the president of the APA, the statistical categories used for evaluation proved too imprecise and unwieldy to measure the success of analysis, and the results of the study were kept largely confidential. Citing "the potentially misleading nature of the statistics", the chair of the American Psychoanalytic Association committee responsible for the research
study recommended the results *not* be widely circulated (Shorter, 1997). Thus, psychoanalysis struggled to maintain scientific validity as it competed with new and different talk therapies and medications. A 1982 court case exemplified the extent to which psychoanalysis had been dismissed as an effective medical therapy (Shorter, 1997). Rafael Osheroff, a 42-year-old physician sued a psychoanalytically oriented hospital for malpractice for not providing him with the most modern available treatment for his depression. Prior to the suit, he had been admitted to the hospital, received seven months of psychoanalysis, and was denied medication despite his requests for it. After securing a transfer to a different hospital and receiving psycho-pharmaceutical treatment Osheroff recovered within three months (Shorter, 1997). Though the case would be resolved out of court, it signified the decline of psychoanalysis, and the triumph of a bio-psychological view of mental health.

Paralleling the challenges to psychoanalysis, a host of new psychotherapies using very different techniques of intervention arose in the years after World War II. These psychotherapies varied in the duration and intensity of their intervention, their units of focus, and the individual methods they used to alleviate the symptoms of patients. Coupled with these new types of psychotherapy were advancements in the synthesis of psycho-pharmaceuticals. Early in their development, these new drugs appeared miracle-like: patients recovered from psychoses previously thought hopeless (Healy, 2002). The excitement generated by such recoveries fueled more and more research on psycho-pharmaceuticals.

Considered as a group, this array of talk therapies and psycho-pharmaceuticals were wildly diverse. Different treatments provided different
explanations of the causes of psychological disorders, including both psychological and biological causal factors. Yet, despite the diversity in treatment structure and assumptions about the causes of psychological disorders, the efficacies of these treatments needed to be assessed and compared.

**Psychoanalytic Psychotherapy**

To avoid confusion, the following section concerns *psychoanalytic psychotherapy* not *psychoanalysis*, the treatment covered above. While the previous section covered the decline in precedence of psychoanalysis, this section will first describe the substance of psychoanalysis, then how the substance of psychoanalysis was translated into psychoanalytic psychotherapy. Though similar in their conceptual roots, the two were meaningfully different.

Psychoanalytic psychotherapy was an attempt to fit traditional psychoanalytic techniques into a form that was useful in the post-war upsurge of need. Traditional psychoanalysis required an enormous investment of time and energy by both the client and the analyst, typically entailing multiple hour-long meetings a week for a year or more (Hilgard, 1987). Psychoanalysts helped patients understand their past in order to live with it in the present, and worked to help patients cope with traumatic memories (Hilgard, 1987). However, in the United States, few people practiced full-scale psychoanalysis (Hilgard, 1987). Instead, those who believed in the value of psychoanalysis typically practiced it in the form of psychoanalytic psychotherapy (Hilgard, 1987).

Psychoanalytic therapy used many of the same assumptions of psychoanalysis, but fit them into a more modern context. Instead of meeting multiple
times a week for an hour, as was done in traditional psychotherapy, therapists and clients would typically meet for an hour just once a week for as long as it took for the client to recover (Hilgard, 1987). Yet the methods of psychoanalytic therapy were clearly rooted in a Freudian tradition, and used the past of the patient as the basis for their current psychological state. Instead of solving problems, psychoanalytic therapy helped patients cope with them. Because the problem was based in the past, no amount of intervention could remove the basic cause of the problem; instead, the problem remained with the patient regardless of their actions in the present. This premise led some in the clinical community to reject psychoanalytic therapy as pessimistic. Although problems could be identified, they could never be solved. As psychoanalysis faded from relevancy in mental health care, so too did this notion of a patient's limited capacity to recover. Instead clinicians designed new therapies that encouraged patients to solve the current problems in their life were (Hilgard, 1987).

**Client Centered Therapy**

As he worked at the Institute for Child Guidance in Rochester, New York, Carl Rogers grew disillusioned with the practice of psychoanalysis. In 1951, his dissatisfaction eventually led him to publish *Client Centered Therapy*, which exemplified the conceptual and practical transitions that were occurring throughout clinical psychotherapy after the war. At the heart of Rogers' model was a fundamental optimism about an individual's potential to recover: he focused on present problems and concrete changes that could be made in the individual (Hilgard, 1987). This client-centered focus, as it came to be called, paved the way for future practices in psychotherapy. Rejecting the idea that the causes of mental health problems were
located in the unchangeable past, the client-centered model brings the causes and
treatments of mental disorders into the malleable present. Put differently, Rogers' reflected and contributed to an optimistic prognosis for recovery for an individual with mental health problems (Hilgard, 1987), and this positive outlook on patient recovery emerged in a variety of other treatments that aimed to solve concrete present problems in the patient's life.

Family Therapy

Family therapy was among the myriad of therapies emerging in the postwar decade. Instead of locating problems and symptoms within the scope of the individual, family therapists turned their attention toward the interactions between members of a family. Although family therapists were largely united by a common focus on the family as the unit of analysis, their actual therapeutic techniques varied greatly. This variation showed the extent to which new evidence production techniques had to account for a diverse array of techniques, even within one family of treatments. Some family therapists advocated for weekly, hour-long meetings with families that would continue for anywhere from six months to two years; others used intensive methods of therapy for families in which family members underwent two days of intensive meetings with social workers, psychologists and psychiatrists in individual and group settings (Weinstein, 2013). Some clinicians held that crisis was key in order for treatment to proceed, and used homework assignments to drive families towards extreme behavior. By doing this, these therapists sought to bring the underlying problems within the family into sharp relief (Weinstein, 2013). Historian, Deborah Weinstein describes one instance saying, "The therapists gave the husband
an assigned task: to come home later than his wife expected one evening, without warning. He did so on the Friday of a weekend when his wife had planned a trip. The ensuing quarrel reached a point at which the typically gentle wife attacked her husband with scissors" (Weinstein, 2013). Yet other therapists would choose other techniques that did not involve such radical conflicts, for instance, some recommended tasks such as communicating only in writing for a week, or learning about family history by meeting with in-laws (Weinstein, 2013). These differences underscore the diversity that existed even within one sub-discipline of psychotherapy with a clear uniting model.

**Interpersonal Psychotherapy**

Interpersonal Psychotherapy (IPT) exemplifies the movement towards scientific models of practice in talk therapy. Created by Gerald Klerman and Myrna Weissman in the early 1970s, IPT was initially used studies as a comparison treatment with early anti-depressants (John C Markowitz & Weissman, 2013). Because of this, IPT was structured much like a course of anti-depressants (John C Markowitz & Weissman, 2013). Devised as a short duration, high intensity psychotherapy, IPT was designed as a series of sessions that worked towards a definite endpoint. For a limited amount of time, patients would work with a clinician to outline the life circumstances that led them to become depressed. After identifying the life circumstances causing their depression, the patient's problems could be resolved and the intensive treatment could end (Gerald L. Klerman, 1984). In this way a "course" of IPT could be prescribed much like a "course" of anti-depressants.
IPT was present-oriented, and attempted to locate the proximal cause of depression for its patients.

**Cognitive Therapy**

Cognitive therapy (CT) was introduced after World War II as a novel therapy that focused on present problems in the patient's life, rather than the problems caused by the patient's past. Originally designed by Aaron Beck, CT differed from family systems therapy and interpersonal therapy by rejecting the idea that problematic relationships alone caused psychological problems (Herbert & Forman, 2011). Instead, CT focuses on the intrapersonal elements of a client's cognition, and attributed psychological problems to these thought processes. At the core of the theory of cognitive therapy is the premise that a patient's internal cognition affects their view of the outside world: a patient's reactions to their experiences provide an important insight into the patient's core beliefs (J. S. Beck, 2011). Put differently, a patient with negative beliefs about themselves interprets neutral experiences negatively while a patient without those negative beliefs does not. Furthermore, these negative beliefs often resulted in negative projections of the future and an expectation that improvement in the future was impossible. Beck believed that the goal of cognitive therapy was to build an empirical model of the patient's beliefs so that these beliefs could be tested and shown to be true or false. By doing this, the patient learns to identify the negative beliefs causing their psychological problems and prove them false (J. S. Beck, 2011). CT illustrates the extent to which had scientific ethos permeated new psychotherapies: evidence trumped perceptions of experience, and patients were encouraged to become aware of the biases that filtered their world-
views, and to be scientific in their evaluation of these beliefs. Although the intrapersonal focus of CT was reminiscent of psychoanalysis, its aim to correct negative cognitive dispositions makes it crucially different. Problems are based in the present, and through careful observation of cognitive processes, recovery is possible and accessible.

**The Creation of Psycho-pharmaceuticals**

The emergence of new techniques for psychotherapy was paralleled by the creation of psycho-pharmaceuticals. These newly synthesized drugs were in many ways the antithesis of previous techniques for mental health care. They were fast acting while talk therapies were slow, impersonal where talk therapies were intimate, and crucially, biological rather than psychological—psycho-pharmaceuticals were an abrupt shift away from many of the fundamental traits of psychotherapies. A string of unprecedented successes spurred the acceptance of these new drugs, as psycho-pharmaceuticals succeeded with patients for whom psychotherapy had been ineffective.

The number of anti-depressants and anti-psychotics for psychological disorders grew enormously in the second half of the 20th century, starting with the synthesis of reserpine and chlorpromazine in 1952.

Derived from a traditional Indian medicinal root and first isolated in 1952, reserpine was shown to be a potent psycho-pharmaceutical (Baumeister, Hawkins, & Uzelac, 2003). In a 1955 study, cited as the first modern clinical trial in psychiatry, reserpine was compared with a placebo for a group of individuals with depression; the results showed reserpine to be effective as an anti-depressant. Other laboratories
also replicated the success of reserpine as an antidepressant, leading some physicians to proclaim that reserpine was "psychotherapy in pill form" (Wilkins, 1954) (Healy, 2004).

Chlorpromazine, discovered in France, was introduced as an antipsychotic. The success of chlorpromazine at treating psychosis was remarkable. Doctors reported that two thirds of psychotic patients receiving the medication either completely recovered or showed clear improvement. Average hospital stay duration decreased by half after chlorpromazine began to be used in mental hospitals (Healy, 2002). Although the underlying mechanisms of its action were not known, chlorpromazine was able to treat patients with deep, long-term psychoses. Psychiatrist and historian David Healy writes, "this result was as magical as the results achieved when penicillin was first used to treat patients with suppurating infections" (Healy, 2002). Chlorpromazine became popular soon after it arrived in the US. The most influential study on chlorpromazine showed that it was "capable of strongly influencing the course of some psychiatric illness" and did not have the negative side effects associated with other treatments (Shorter, 1997). The success of chlorpromazine made it a massive commercial success, and sparked the "era of psychopharmacology" as many more anti-psychotic, anti-manic and anti-depressant drugs were synthesized and brought to the market (Healy, 2002; Shorter, 1997).

New Tools for Research

As these new, diverse treatments were created, clinical psychology became a more scientific discipline requiring objective, often quantitative techniques for
assessment. Scientific study required a level of standardization that was reflected in
new tools developed by clinical psychologists, and the experimental designs they began to use. As clinical psychology established itself as a scientific discipline, mental health professionals created the DSM, assessment scales, and used the paradigm of randomized control trials to better classify disorders, assess the severity of these disorders and prove the effects of the new treatments being tested.

**DSM**

The development of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM) reflected both the increasing medicalization and scientific inclination of mental health care. This section will consider the transition from DSM-I to DSM-III. The publication of DSM-III was a critical pivot point in the history of clinical psychology, as leading psychologists heralded it as "a victory for science" and "a great triumph for 'science over ideology'" (Mayes & Horwitz, 2005). DSM-III was regarded this way because diagnoses came to be defined by their symptoms rather than their causes. Because of this, the progression of the DSM facilitated comparison treatments regardless of their underlying theories of pathology.

The first DSM, published in 1952, was devised as a way to standardize diverse nomenclatures and classifications across psychology (Shorter, 1997). Political scientist Rick Mayes and health sociologist Allan Horowitz write that the focus of the early DSMs was to describe "the total personality and life experiences of the person that provided the context for the interpretation of symptoms" (Mayes & Horwitz, 2005). In the words of the influential psychiatrist Karl Menninger, the early DSMs were meant to understand “What is *behind* the symptom?” (Mayes & Horwitz, 2005).
Because of this, early editions of the DSM allowed practitioners wide flexibility in diagnosis. Descriptions of the methods used to make diagnoses were absent from DSM-II (Hirshbein, 2009) As a result of this, an individual patient could be evaluated by different practitioners, all of whom could arrive at different diagnoses (Hirshbein, 2009).

The DSM-III marked a move away from describing the causes of disorders, and instead focused on descriptions of the disorders; this notable change resulted in a number of different benefits for research in practice. As a result of shifting away from assessing etiology, the DSM became less beholden to specific explanatory models of psychopathology. This shift allowed different techniques to be used to treat the same disorder (Mayes & Horwitz, 2005). For instance, Cognitive Therapy and Family Therapy provide distinct accounts of the causes of psychological disorders. While CT-oriented-clinicians would attribute psychological disorders to negative thought processes, family therapy clinicians would attribute those same disorders to problems in the social dynamic of the family. Since the new DSM only defined symptoms of psychological disorders and not their causes, both treatments could be judged on their ability to alleviate those symptoms. Thus, DSM-III allowed for research comparisons between talk therapies, psycho-pharmaceuticals, and other types of treatments.

**Rating Scales**

Just as the DSM-III showed the extent to which the process of diagnosis was becoming standardized, the variety of rating scales developed to assess the severity of these disorders reveal a similar trend. Because this thesis considers two different treatments for depression, depression-rating scales provide the focus of this section.
These scales were notable for three reasons: their very existence demonstrated the extent to which psychology was becoming more standardized; they seemed to provide a more objective means of assessing patients; and finally, they illustrate specifically what changes in patient condition constituted recovery from depression. Because these rating scales were the main tools of evaluation for many studies of depression, analyzing their content provides insight into what effects were understood to be reductions in the severity of depression. Depression assessments can be split into two types, clinician assessments, such as the Hamilton Depression Rating Scale, and self-assessments such as the Beck Depression inventory. Clinical assessments were performed by clinicians, and were based on their judgment of the patient's condition, while patients filled out self-assessments about their own condition.

First published in 1960, the Hamilton Depression Rating Scale (HDRS for short) came to be considered the gold standard for measuring depression severity (Williams, 2001; Worboys, 2013). Produced using data from 49 depressed male patients, the HDRS is a clinical assessment done by clinical interviewers. Clinicians evaluate patients on 17 criteria including somatic symptoms such as weight loss and gastrointestinal problems, and affective symptoms such as feelings of guilt and "depressed mood" (M. Hamilton, 1960). For reliability, two clinicians evaluate one patient, and their ratings are summed for an overall patient rating (M. Hamilton, 1960).

Aaron Beck created the Beck Depression Inventory (BDI) in 1961. The BDI provides a notable contrast to the HDRS. One of the main critiques of the HDRS was its susceptibility to bias. Because clinical observers administer it, the results of the
HDRS are subject to their judgment of the patient interview. In contrast, the BDI relies on the patient's self-evaluation of their emotional and mental state. Patients complete the BDI by filling out a 21-question survey that asks them to rate their symptoms including many similar items as the HDRS such as mood, weight loss and guilt (A. T. Beck, Ward, Mendelson, Mock, & Erbaugh, 1961).

As these and other scales became prominent, treatments that affected the symptoms rated by the scales were rated as the most effective. These treatments thus became popular, and continued using the scales that showed demonstrable effects. Some have argued that the popularization of the HDRS was facilitated by the concurrent development and testing of tricyclic anti-depressants, as the HDRS was ideally suited to demonstrate the effects of these drugs (Worboys, 2013). Thus, the scales that would become standard for depression did not necessarily become widely used because of their fidelity to a standard diagnosis. Instead, these scales became used because the particular patient characteristics measured by the scales were the characteristics that were affected by popular treatments at the time.

**Randomized Control Trials**

Randomized control trials were used to confirm that the changes seen in rating scales such as the HDRS could be directly attributed to the action of the treatment. The use of these scales helped to establish the scientific reliability of treatments, and showed that treatment caused the effects seen in patients. However, talk therapies and other treatments such as anti-depressants were not equally suited for use in randomized control trials. The difficulty of creating blinded experiments, in which the
patient and the clinician were unaware of the treatment, and placebo conditions, made using talk therapies in randomized control trials difficult.

In pharmaceutical research, double blinded conditions were relatively simple to achieve through the use of a placebo pill, a pill without the active ingredient of the medication being tested for efficacy. However, while these practices were applicable and suitable for pharmaceutical trials, were not always practical for psychotherapeutic trials. In order to test the efficacy of a particular model of therapy, the treating therapist must, by definition, be aware of the technique they are using. Thus, a clinical therapist could not possibly be unaware of the treatment technique they were using to treat a patient, and indeed the clinician's awareness of the trial condition was often visible to the patient as well (Wampold & Bhati, 2004).

In addition to this, "placebo conditions" for talk therapies, treatments that mimicked talk therapies without their therapeutic benefits, are difficult, if not impossible to create. Unlike the placebo pills used in pharmaceutical trials, which provided no medical benefit, the techniques used to mimic psychotherapies were often beneficial for the patient. For example, one of the principle treatments used as a comparison for interpersonal psychotherapy and cognitive behavioral therapy was supportive psychotherapy (Wampold & Bhati, 2004). Although supportive psychotherapy is defined as a "non-interpersonal, and non-cognitive behavioral therapy", and is potentially hampered by its non-use of interpersonal and cognitive elements, it is not a non-treatment. As John Markowitz, a prominent researcher of psychotherapies, observed "it was by no means a non-treatment, particularly as delivered by empathetic, skillful, experienced and dedicated psychologists" (J. C.
Markowitz et al., 1995). Thus, holding psychotherapies to the same standards of randomized control trials as psycho-pharmaceuticals ignored the crucial differences between the two types of treatments.

**Conclusion**

The massive increase in need for mental health care in the aftermath of World War II spurred massive changes in the techniques practitioners used to diagnose, assess and treat patients. As psychoanalysis declined in use, a number of different individual therapies were created, in addition to family therapies and psycho-pharmaceuticals. The emergence of this variety of treatments coincided with the emergence of a new, more scientific discipline of clinical psychology. The new scientific focus of clinical psychology was reflected in the progression of the DSM III, the creation of rating scales to assess the severity of disorders, and the use of randomized control trials to test the effectiveness of treatments.

Both rTMS and IPT would develop in this context of scientific clinical psychology. To prove their efficacies, both treatments would use the common shared scientific vocabulary of DSM diagnoses, standardized assessments and randomized control trials to prove the therapeutic benefits of their treatment. Despite the deep differences in the bases of the two treatments, the evidence production system created after World War II facilitated the comparison of rTMS and IPT.
Chapter 2: rTMS and IPT, a case study

Introduction

This chapter will use repetitive transcranial magnetic stimulation (rTMS) and interpersonal psychotherapy (IPT) as a case study to examine what, if anything makes brain-based neuroscience treatments "transformative". These two treatments are useful to pair for comparison because they are representative examples of two categories useful for comparison: talk therapies and "brain based" therapies. As described earlier, IPT was created during a time when clinical psychology was standardizing. Because of this, IPT was designed with clinical trials in mind, and was first used as a comparison in early anti-depressant research (John C Markowitz & Weissman, 2013). Therefore, although it is a talk therapy, IPT is well suited for testing within the post-WWII evidence production system. Meanwhile, rTMS provides a compelling example of a brain-based treatment. Developed in "The Decade of the Brain", it is based on the targeted modulation of activity in brain areas thought to be responsible for depression. This direct modulation of brain activity, and the absence of any other form of intervention, makes rTMS a good example of a treatment that is purely "brain-based". Because of these characteristics, rTMS and IPT are useful partners for comparison to better analyze what differentiates brain-based treatments from talk therapies.

This chapter examines the procedure and evidence provided for rTMS and IPT. Through description and comparison of the two treatments, it becomes clear that although rTMS and IPT initially seem to be quite different treatments and are
presented as such, close examination of the treatment protocols and the evidence of their efficacy reveals few meaningful differences. Thus, although neuroscience treatments and psychotherapeutic treatments are typically described as widely disparate approaches towards similar problems, in the case of rTMS and IPT, the types of approaches used by scientists and the justifications they provided for the two treatments have crucial commonalities.

On the surface, rTMS and IPT are quite different treatments, based on different assumptions about the nature of depression. As a brain based treatment that is premised on the modulation of brain function, rTMS modifies the neurochemical progenitors of depression. Life circumstances are not considered as part of the treatment protocol. By contrast, interpersonal psychotherapy focuses on the interpersonal components of depression (Gerald L. Klerman, 1984). It is based on the careful consideration of life circumstance, and the therapist seeks to help the patient cope with their life circumstances as a means for treating depression. Thus to compare rTMS and IPT is to examine two conceptually incongruent treatments that function using similar structures. rTMS is a material treatment, set for the physical alteration of brain function, while IPT is based in the immaterial space of social relationships. At the same time, IPT is tangible, and focuses on the relatable, shared experiences of social spaces. In contrast, rTMS is based on a conception of the brain that is powerful, but fundamentally removed from everyday interactions. Yet, while these two therapies are critically different, they are also meaningfully similar. Because of this, they are good candidates for comparison.
Developed throughout the 1990s, rTMS is a treatment for depression that uses magnetic interaction as its means of intervention (Rossi, Hallett, Rossini, & Pascual-Leone, 2012). In research studies of its efficacy, patients come in for a set number of treatments over a set period of time to receive rTMS as a therapy. In this respect, rTMS is similar to IPT; both are designed to be time limited, with a set number of sessions and a clear plan of action for patient treatment (Gerald L. Klerman, 1984). In addition to this, both treatments require frequent patient-clinician interaction. Because of these similarities, the two treatments lend themselves well to comparison.

Before analyzing the treatments, it is important to delineate two key asymmetries between the two treatments. The first is a relatively simple one. IPT is a talk therapy, and thus does not need to be approved by the FDA. As a device, rTMS requires government certification before it can be applied as a generally available treatment. Because of this, early research on rTMS contained significant sections providing evidence to show that the treatment was safe, and was not harming patients (Kolbinger, Höflich, Hufnagel, Möller, & Kasper, 1995) (M S George et al., 1995) (M S George et al., 1997).

The second key difference between rTMS and IPT is the research arrangements in which they were designed and evolved. IPT was developed largely by a single laboratory group based in New Haven (John C Markowitz & Weissman, 2013). The primary creator of IPT was Gerald Klerman though Klerman worked extensively with collaborators Myrna Weissman, and John Markowitz. A critical feature of IPT was its publication form. IPT is based on a standard manual for treatment (John C Markowitz & Weissman, 2013). The treatment is standardized,
insuring that clinicians across different locations use uniform procedures. In contrast, rTMS was created by a number of different groups both in the United States and beyond. Because of the distributed nature of its development, there was no primary author whose work defined the technical or procedural doctrines of the technology and no manual to serve as doctrine. Thus, the creation and evolution of the two treatments cannot be described perfectly in parallel.

This chapter will compare the conceptions of and assumptions about depression underlying both rTMS and IPT, the functional structure of the two treatments, and finally the types of evidence provided by researchers working on the two treatments. Through these examinations, the chapter will explore the clear similarities between two seemingly dissimilar treatments.

**Conceptions of Depression**

**Interpersonal Psychotherapy**

Before beginning treatment, Klerman and colleagues suggested assessing patients using the Hamilton Depression Rating Scale or the Beck Depression inventory (Gerald L. Klerman, 1984). This assessment helped confirm the diagnosis of depression, and framed the clinicians approach to treatment. The interpersonal approach to depression acknowledges both the psychological and biological causes of depression (Gerald L. Klerman, 1984). Though it acknowledges both sources of problems, the manual for IPT stresses the therapist's ability to intervene in the psychological components of depression (Gerald L. Klerman, 1984). By outlining the causes of depression in a methodical, ordered way, Klerman positioned it as a clinical disorder with problems to be solved.
To present their conception of depression in the manual for IPT, Klerman and colleagues argued that depression is caused by three problematic processes that result in the characteristic symptoms of depression (Gerald L. Klerman, 1984). They described the processes in the following way: The first problematic component process of depression was symptom function. Defining symptom function as the neuro-vegetative processes and depressive affect that cause symptoms such as appetite and sleep disturbance, they noted that the symptom functions of depression have both biological and psychological causes (Gerald L. Klerman, 1984). Klerman listed problems in social and interpersonal relations as the second component process of depression (Gerald L. Klerman, 1984). These problems were rooted both in the childhood experiences that shape social skills, and in the current life circumstances that reinforce social skills. Their final component process of depression was personality and character problems (Gerald L. Klerman, 1984). These problems, including traits such as self esteem difficulties, problems with communication, and inhibited emotional expression were described as contributors to depression, yet were not targeted by IPT (Gerald L. Klerman, 1984). Instead, IPT was designed to disrupt the problem causing processes of symptom function and social and interpersonal deficits (Gerald L. Klerman, 1984). This focus had important ideological implications for IPT.

The creators of IPT described depression a set of problems that could be solved, and IPT was a means of solving those problems. This definite goal of resolving the problematic processes that created depression gave therapy a clear direction and endpoint, and thus facilitated the time-limited nature of the treatment.
rTMS

The functional imaging work cited to support the early work justifying rTMS, shows the conception of depression used by researchers using rTMS. Early reports on rTMS based their conception of depression on a body of literature that used PET scans to identify the dysfunctional brain areas at the root of depression (M S George et al., 1995). Based on the use of metabolically active radioactive tracers, PET scans are used to measure brain activity in different regions via blood flow. Thus, by analyzing the relative presence or absence of a radioactive tracer compound, researchers can make inferences about the relative activity or inactivity of different brain regions (Binder, Hirokawa, Windhorst, & SpringerLink, 2009). These techniques allowed the researchers to identify patterns of brain activity that they believe characterized depression and led them to focus on the left dorsolateral prefrontal cortex (lDLPFC) as their target (M S George et al., 1995).

Evidence linking DLPFC and depression was produced a number of ways, and produced results that were sometimes inconsistent. The initial PET scan studies that would be used as the basis for rTMS treatment used populations diagnosed with depression using the Hamilton Depression Rating Scale (Bench, Frackowiak, & Dolan, 1995). Activation studies, studies measuring brain activity during certain actions, showed that subjects' DLPFC activity increased when they were asked to think sad thoughts Evidence produced using a PET scan showed that individuals with depression had decreased activity in the left frontal cortex (M. S. George, Ketter, & Post, 1994). The more severe the depression, the more left frontal lobe activity was decreased. In addition to this, other studies specifically found that dorsolateral
prefrontal cortex activity increased upon recovery from depression (Bench et al., 1995) (Bench et al., 1992). Based on this body of evidence suggesting that abnormal activity in the dorsolateral prefrontal cortex was associated with depression, rTMS practitioners focused their efforts on it as a target for stimulation.

Comparing Models

The definition of depression in rTMS and IPT both draw from similar phenomenological descriptions of depression, and use similar tools for diagnosis. Consider the populations of patients from which the two definitions of depression arose. The PET scan studies underlying rTMS used the Hamilton Depression Rating Scale to measure depression. Depressed mood, declining interest in work and activities, and retardation are all measured by the Hamilton depression scale: the more severe the deficits in these areas, the more severe the depression (Max Hamilton). These characteristics are also part of the initial description Klerman and colleagues provided for depression. Writing, "non-verbal and behavioral features convey her depressed state", they described psychomotor retardation, disinterest in her dress and grooming, and depressive affect as characterizing features of depression (Gerald L. Klerman, 1984). In addition to this, the creators of IPT recommended the Hamilton Rating Scale for Depression as a useful tool for assessing the breadth and severity of the patient's depression (Gerald L. Klerman, 1984). Thus, rTMS and IPT include similar descriptions for the expression and diagnosis of depression. However, despite these similarities, the working assumptions used by IPT and rTMS reveal deep ontological differences in the two conceptions of depression.
rTMS and IPT both treat depression, and tools used to measure the effects of these treatments are discussed below. However, before examining the tools used to measure the effectiveness of the treatments, it is essential to consider what these tools measure. rTMS and IPT address different problems. rTMS modifies brain activity as its focal problem, while IPT focuses on problematic social functioning. Yet, because comparing treatments relies on evaluating the effects of treatment reflected in rating scales such as the Hamilton, the effectiveness of the treatments in solving the problems they address is not directly compared. The existence of uniform metrics such as the Hamilton does, in a sense, allow the comparison of these two treatments. However, comparing these two treatments presents a significant problem. IPT and rTMS present different accounts of the problems that cause depression. Comparing the two on the basis of uniform measurements such as the Hamilton Rating Scale does not reveal the extent to which the treatments solve the problems they seek to resolve, but rather measures the extent to which these problems result in a reduction of the symptoms of depression.

**Treatment**

This section will address the specific mechanisms, the means of intervention, and protocols, the structure of these interventions, of treatment for IPT and rTMS. IPT and rTMS approach treatment in a similar, time-limited way. Both treatments outline a set number of sessions during which the patient will receive treatment. Thus, the purpose of this section is to provide a clear description of the exact process of these two therapies.
Interpersonal Psychotherapy

In Klerman and his colleagues' words, "IPT has a dual focus: to reduce depressive symptoms and to deal with the social and interpersonal problems associated with the onset of the symptoms" (Gerald L. Klerman, 1984). To accomplish this, IPT approaches treatment in three stages. In the initial, diagnostic phase, the clinician evaluates the patient to determine the problem areas for focus in treatment. The intermediate sessions focuses on helping the patient cultivate healthy skills for coping with their problems. Finally, the terminal sessions for IPT help the patient use the lessons learned in therapy after the completion of the work with the therapist.

Problem identification is the primary focus of the beginning stages of IPT. To begin therapy, the therapist does a diagnostic evaluation of the patient using tools like the Hamilton Depression Rating Scale and Beck Depression Inventory, and works with them to take an interpersonal inventory, a structured itemization of life experiences (Gerald L. Klerman, 1984). Patients are asked about their relationships—at work, with family, with friends and with their significant other—and about major life events—such as whether anyone they know has died recently, and how they are working through the grief. As the inventory proceeds, the response format changes from binary "yes" or "no" answers to responses to open ended questions such as "were you having problems with friends?" to more in depth profiling questions about important personal relationships. Patients fill out a series of questions about each relationship that is important to them. Thus, they answer questions about several close acquaintances in their life, including friends and family.
These questions assess the way patients approach relationships, ranging from questions about their expectations from relationships to how they feel as they interact with the person. After the patient answers these questions, the patient and therapist work to build a complete picture of the patient's recent life history, and to produce textured descriptions of the important relationships in the patient's life. After the interpersonal evaluation, the therapist offers an "interpersonal formulation" to the patient by describing their problems as related to grief, interpersonal role disputes, role transitions or interpersonal deficits (Gerald L. Klerman, 1984). The therapist then presents a treatment plan to the patient, explaining their assessment of the patient's problem areas and lays out a clear schedule for treatment.

The beginning sessions of IPT offer an important incongruity with rTMS. As I will show later, there was no similar process in rTMS therapy in which the clinician acquainted themself with the circumstances of the patient's life. At the same time, it is useful to note how interpersonal psychotherapy developed in the wider context of standardized evaluation in clinical psychology. The systematized interpersonal inventory was a universal tool used by IPT therapists. Like the DSM, the HDRS, and the universal model of randomized control trials, the interpersonal inventory was standardized. The standardization of the interpersonal evaluation form highlights the unique space IPT occupies as a talk therapy. It is both distinctly personal and standardized; IPT was designed as a talk therapy well suited to make use of the evidence production system that was created after World War II. Following the completion of the beginning stages of IPT, therapists move on to the intermediate sessions of IPT.
Unlike the initial sessions, the intermediate sessions for interpersonal psychotherapy vary from patient to patient, depending on the particular problem area assessed by the therapist. The IPT manual, outlines treatment strategies for patients dealing with three different problem areas: grief, interpersonal role disputes and interpersonal deficits (Gerald L. Klerman, 1984).

Separate treatment plans are suggested for these different problem areas. For patients struggling with grief, the therapy has two goals: to help the patient mourn, and to help the patient regain interests and activities to help alleviate the loss (Gerald L. Klerman, 1984). For grief, IPT is premised on notion that poor social networks are the cause of deep problems with grief associated with death. Patients with poor social networks are unable to receive help while attempting to grieve, thus the therapist provided the benefits normally given by the social network. In their own words, the creators of IPT instructed therapists to encourage the patient to do three things "1) to think about the loss; (2) to discuss the sequence and consequences of events prior, during and after the death; and (3) to explore associated feelings" (Gerald L. Klerman, 1984). Through these steps, the clinician attempts to help the bereaved patient better deal with grief.

Role transition is the second problem area that IPT addresses. Patients are described as suffering from problems with role transition when they struggle with major changes in their lives. These changes can include life phase, such as the transition from adolescence to adulthood, the loss of a relationship or a job, or a significant change in life state caused by large financial changes (Gerald L. Klerman, 1984). To come to terms and better work through the difficulty that causes role
transitions, the therapist aims to help the patient give up the old role, express their emotions about losing their old role, work to learn new social skills for their new role and finally establish new relationships in their new role and identifying positive parts of their new role (Gerald L. Klerman, 1984). These processes are built around helping the patient to function normally in their new social role. This strategy is founded on the belief that learning healthy ways of expressing emotion is a crucial part of interpersonal relationships.

Before describing the typical treatment techniques for individuals with interpersonal deficits, Klerman and Weissman note that if a patient presents both interpersonal deficits and another problem area, the other problem area should be focused on first, underscoring the precedence of the interpersonal in their model. Klerman and Weissman describe individuals with interpersonal deficits as individuals who are either socially isolated, lacking social relationships, who are dissatisfied with their interpersonal relationships, or whose residual depressive symptoms interfere with their interpersonal relationships. Individuals with interpersonal deficits are counseled in interpersonal therapy to better recognize repeating themes in their personal relationships that contribute to their dissatisfaction. To accomplish this, the therapist and the patient work together to analyze the patient's problems with previous social relationships, and to look for parallels in their current relationships. In brief, they find predictable problems in the patient's life and work to help the patient find the source of their interpersonal problem.
After taking the same initial steps and designing treatment plans based on different problem areas, all interpersonal therapy ends with a common set of termination sessions.

Because interpersonal psychotherapy is time limited (and not open ended), the final stages of therapy are crucial to the process. The primary goal of the termination phase of treatment is to credit the patient for their individual successes: the therapist encourages the patient to take note of their own strong social network and the successes they have had throughout the course of therapy. Additionally, therapist and patient then discuss the potential for future depression and the need to identify the signs of depression are discussed so that the patient can proactively seek treatment should they experience symptoms of depression again.

**Repetitive Transcranial Magnetic Stimulation (rTMS)**

Because it was developed across a number of different labs, the treatment protocol for rTMS varies. While the basic outline of the procedure remains the same, the specific parameters of treatment vary. This variation includes different in the frequencies of the magnetic stimulation, the duration of each individual session, and the total length of treatment.

Understanding what rTMS treatment consists of requires first knowing what an rTMS stimulator is, its effect on the brain, and the procedure for targeting the area of stimulation. The first reliable transcranial magnetic stimulator was introduced in 1984 (Horvath, Perez, Forrow, Fregni, & Pascual-Leone, 2011). At first, TMS was used for research, rather than therapy. Initially TMS devices were used for single, non-repeated, bursts of magnetic stimulation. The advent of repeated TMS paradigms
begat a variety of new potential applications for the device. Depression research was one of the first areas researchers chose to investigate the possibilities of rTMS. Before clarifying on the great variety in rTMS protocols, it is instructive to describe exactly what rTMS treatment is, and how it is theorized to work.

A TMS machine consists of two parts, a main unit and a stimulating coil (Horvath et al., 2011). When electricity, regulated by the main unit, passes through the coil, a magnetic field is created that then is used to affect neural excitability. The resultant change in neural excitability is believed to cause the behavior changes seen after rTMS. Although the exact mechanism of action for rTMS remains largely unknown, different frequencies of activation have been shown to produce different effects on cortex excitability—the threshold of activation necessary for neural activity to occur. Low frequency rTMS typically produces decreases in cortex excitability, meaning a higher-than-normal level of activation is necessary for neural activity. Conversely, high frequency rTMS typically results in increased cortex excitability, lowering the threshold of activation for neural activity (Loo & Mitchell, 2005). These findings, coupled with the evidence supporting the dLPFC as the region of depressive dysfunction, form the basis of rTMS treatment.

While the specific parameters varied from study to study, the basic template of rTMS treatment is fairly standard. Patients receive a session of rTMS bursts on a regular basis for a set duration. To find the optimal target area for stimulation, many researchers follow a protocol originally described in a 1995 paper by Mark George, Eric Wasserman, Wendol Williams, Ann Callahan, Terence Ketter, Peter Basser, Mark Hallett and Robert Post. The initial step of protocol involves locating the area
of maximum inhibition of the patient's opposite thumb, for example, for left
dorsolateral prefrontal cortex stimulation, researchers observe the right thumb. After
finding this spot, the researchers move the rTMS stimulation coil 5cm closer to the
forehead and used this area as their target area for stimulation (Padberg & George,
2009). They chose the 5cm distance based on a tool called the Talairach Brain Atlas
(Padberg & George, 2009). Developed from the detailed analysis of a single brain, the
atlas is a standard neurological tool (Lazar, 2008). This technique has been criticized
for being inaccurate because for many patients, such as those with larger heads, the
standard 5cm distance used in traditional protocols is ineffective for locating the
dLPFC (Padberg & George, 2009). While the location of basic motor control areas
tends to be standard between subjects, the locations of areas controlling more
complex neurological functions tend to be much more variable (Padberg & George,
2009). Thus, the standardization included in the treatment became a source of error in
its application.

After locating the site for stimulation, patients receive short, repeated sessions
of magnetic stimulation. For instance, a patient might receive 20 two seconds burst of
rTMS over the course of 20 minutes. Patients receive regular treatment over varying
periods of time, generally between two and six weeks.

**Comparing rTMS and IPT**

The differences between IPT and rTMS as treatments are obvious and stark.
As a talk therapy, IPT focuses on life circumstance, and does not interfere directly
with the biological roots of depression. Because of this, the treatment is in many ways
based on patient circumstance. The initial stages of treatment involve the therapist
working to understand the patient's life circumstance while the patient works during the later stages to adapt to their life circumstance and exist in it without the need for constant therapy. In contrast, rTMS is designed to only treat the biological causes of depression. There is no therapeutic contact that is meant to act on the psychosocial precipitants of depression, instead rTMS is a therapy of neuromodulation. However, despite this difference between the two therapies, the two share more similarities than one would expect from two conceptually disparate treatments.

Despite their differences, standardization remains a critical binding similarity between IPT and rTMS. The first clear evidence of this similarity is in the structured protocol of the two treatments. IPT creates a clearly charted road map towards recovery. After three discrete phases of therapy that take place over a predefined period of time patients recover from depression. Parallel to this is the conceptual protocol for rTMS. Although the targeting and frequency of rTMS varies depending on the practitioner, the fundamental structure is the same. After a set number of sessions over a clearly defined, limited period of time, rTMS treats depression. Thus, both treatments are founded on the expectation that depression can be treated, and, recovered from over a set period of time. Both treatments use a degree of standardization, including the standardized interpersonal assessment for IPT and the standardized targeting protocol for rTMS. Both of these similarities lend themselves, in turn, well to testing using randomized control trials. Standard procedures can be used, and set periods of time for measurement can be created. Examination of the primary literature about rTMS and IPT shows that the intrinsic structural similarities of the two treatments manifest in two developmental histories that are quite similar.
Evidence

The presence of neural evidence is one of the principle justifications for the conception of depression used for rTMS. However, despite the underlying assumption that abnormal dorsolateral prefrontal cortex activity depression, early studies on rTMS did not use PET scans to prove the effects of the treatment. The absence of this form of evidence leaves two bodies of evidence that use similar types of support.

Interpersonal Psychotherapy

The first evidence for the efficacy of IPT came from the Boston-New Haven Collaborative Depression project, a large-scale depression study run by Klerman, Weissman and their colleagues (G. L. Klerman, Dimascio, Weissman, Prusoff, & Paykel, 1974). A precursor of Interpersonal psychotherapy was initially tested in a controlled trial with amitriptyline, an early antidepressant in 1974. Although this study did not formally use IPT, many of the features of the study would later be included in IPT. The 1974 collaborative depression study consisted of 278 depressed women as outpatients, and would ultimately include 150. Although Klerman and his colleagues used a form of interpersonal psychotherapy, it was not done with a formal manual, like later studies would be. Despite this, the initial 1974 study using interpersonal psychotherapy was notable for both its procedure and its tools of measurement. Using both a randomized control trial and a number of different measurement tools, the study would help define how IPT would be tested thereafter.

For the initial phase of treatment, 278 patients were treated with a tricyclic antidepressant, amitriptyline, for between four and six weeks. 150 subjects who responded significantly to the antidepressant were chosen for the experimental
portion of the maintenance phase (G. L. Klerman et al., 1974). Patients in the maintenance phase of the study were split into six experimental groups. Patients either had high levels of contact with a psychologist, meeting at least once a week for a session of interpersonal therapy, or low levels of contact, meeting just once a month for assessment scales and ratings. Each of these two experimental groups was split into three categories, receiving amitriptyline, a placebo, or no pill at all. Thus there were six different experimental groups containing 25 subjects each. Klerman and Weissman used a number of different evaluation scales over the course of the eight-month maintenance phase. The primary scale used for determining eligibility in the study was the Raskin Depression Scale. However Klerman used a number of other additional rating tools including a version of the Hamilton Depression Rating Scale, a social adjustment scale, and clinical judgments while patients used the Hopkins symptom checklist to self assess the severity of their depression. Later John Markowitz and Myrna Weissman, co-authors on the study, would say that using a wide range of measurements was one of the guiding principles of Klerman's work (John C Markowitz & Weissman, 2013).

Through the complex study design, the original 1974 study addressed a number of research questions. The study showed that talk therapy and amitriptyline were roughly equally successful as maintenance treatments for depression. The study also tested the "cocktail theory" of mental health care. Klerman described the theory saying, "Most psychiatric treatment is a variation of the cocktail principle—i.e., as with the martini, if a little gin is good, a lot of gin is better, and adding a little vermouth offers something more. In clinical practice most patients receive a cocktail
composed of a drug and psychotherapy" (G. L. Klerman et al., 1974) The study did not support the hypothesis cocktail approach resulted in a demonstrable effect on patient outcome, meaning it was no more successful than drug treatment or therapy. Although the 1974 study was influential in suggesting the possible efficacy of interpersonal therapy, the first study of codified interpersonal psychotherapy would not come for another 5 years.

A 1979 study used the same Boston-New Haven setup used in the 1974 study. Instead of using six study groups, the Klerman and Weissman used a 4-cell design. In the study patients either received just interpersonal psychotherapy, just amitriptyline, a combination of the two, or received "nonscheduled treatment" as a control condition. "non scheduled treatment" meant that patients did not come in for regular treatment for their depression. Instead, the patients in the control group were matched with a psychiatrist and were allowed to schedule meetings with them whenever their symptoms became sufficiently acute (Weissman et al., 1979). To measure outcome, researchers again used a clinical evaluation scale, the Raskin scale, and included incidents requiring active clinical intervention as unsuccessful treatments. Contrary to the 1974 finding, the 1979 study found that a combination of both therapy and medication was the most effective treatment for the patients.

After Klerman and his colleagues demonstrated the efficacy of IPT, the NIMH coordinated a large, multi-site, randomized control trial study of IPT and Cognitive Behavioral Therapy called the Treatment of Depression Collaborative Research Program (Elkin et al., 1989).
The study was designed for two purposes: to replicate the typical multi-site design of pharmacological studies for psychotherapy trials and to test the relative efficacies of cognitive behavioral therapy and interpersonal psychotherapy (Elkin et al., 1989). The two treatment options were chosen because of their short-term period of focus and were compared with an anti-depressant and a control condition over a period of 16 weeks (Elkin et al., 1989). Therapists for the study received additional training in IPT and their treatment techniques were monitored throughout the study. Previous studies of depression treatments used the treating therapists as the clinical evaluators. In contrast to this, the Treatment of Depression Research Program used independent clinical evaluators to assess patient outcome. To measure outcomes, the evaluators used four different scales—two from the evaluator's perspective and two from the patient's—to measure functioning and symptom severity. In addition to using the Hamilton Depression Rating Scale clinicians used the Global Assessment Scale, a more general, subjective scale describing patient welfare, symptomology and impairment level. Patients filled out the Beck Depression Inventory and the Hopkins Symptom Checklist (Elkin et al., 1989).

The Treatment of Depression Collaborative Research Program was significant for many reasons. Most notably, it was the first direct comparison of interpersonal psychotherapy and cognitive behavioral therapy. In addition to this, the program showed that interpersonal psychotherapy and cognitive behavioral therapy were as effective as antidepressants at treating depression over an extended period of time. Neither Interpersonal psychotherapy nor Cognitive behavioral therapy was shown to be more effective than the other. Although clinicians collected data using the Beck
Depression Inventory and the Hopkins Symptom Checklist, neither of these rating scales appeared in the results of the study. Instead, only data from the Hamilton Depression Rating Scale and the Global Assessment Scale were used to draw conclusions from the results of the study. These scales would also be the primary measurements used for rTMS.

rTMS

In order to fit rTMS into the model of a randomized control trial, researchers needed to create an effective control condition that was both convincing as a treatment useful as a non-therapeutic comparison. In this respect, the challenge of a control condition for rTMS was analogous to that of IPT. Both treatments required control conditions that superficially mimicked the actual treatment while providing no therapeutic benefit. The control condition for rTMS required the simulation of the noise and vibration of typical rTMS stimulation. During the early development of rTMS researchers primarily used a technique that would later be shown to be ineffective at isolating the patient entirely from the magnetic stimulation of the stimulator. The ideal tool for "sham stimulation" would first be used in 2007, however, the first rTMS study for depression was done in 1993.

Instead of using a fake stimulator, many early studies achieved a placebo condition by angling the stimulator away from the patients’ head to simulate the noise and vibration of active rTMS without the magnetic stimulation. Although this method is widely used, it has been criticized for being ineffective at totally shielding the patient from any stimulation, and may instead simply provide less stimulation than typical rTMS (Loo et al., 2000). The absence of a true "non-treatment" in the early
stages of the development of rTMS mirrors the struggles of talk therapies in randomized control trials. To provide a true control, the placebo condition must be an ineffective treatment. However, just as it is possible occasional interactions with a therapist providing "non-treatment", it was also possible that the slight stimulation provided by early sham conditions had an effect as well.

Despite the underlying assumption that inactivity in the dlPFC caused depression, early researchers did not provide neural data to prove the efficacy of the treatment. Gereon Höflich, Siegfried Kasper, Andreas Hufnagel, Hans-Jurgen Müller and Stephan Ruhrmann published the first study exploring the possible application of rTMS for depression research in 1993 (Hoflich, Kasper, Hufnagel, Ruhrmann, & Moler, 1993). In the initial paper, patients received both rTMS and electroconvulsive therapy as treatments for depression. The study used the Hamilton Depression Rating Scale as its measurement of effectiveness. In the study, one patient showed no response to the rTMS treatment, while one showed a mild response to the treatment. Both patients then improved significantly after receiving electroconvulsive therapy. Despite acknowledging that, "there was no clear-cut evidence for effectiveness of TMS as a treatment for patients with psychotic, therapy resistant depression" Höflich suggested that TMS deserved further study (Hoflich et al., 1993).

In Austria, following Höflich's successful demonstration that rTMS could be used to treat depression, a number of different research groups pursued different strategies for how rTMS could be applied. In open trials, Hans Martin Kolbinger, co-authoring with Höflich, tested different intensities of stimulation for both the effectiveness and safety (Kolbinger et al., 1995). Like Höflich's group, Kolbinger and
his colleagues used rater scales and assessments as their index for recovery, and did not measure the effectiveness of rTMS on the dlPFC (Kolbinger et al., 1995). As other groups attempted to further hone the specifications and protocols for rTMS, neurological data continued to be at best a secondary form of evidence, and was often absent from findings all together. A group working in Austria used open trials to test different target areas for rTMS therapy, testing both the right and left hemispheres and used the Hamilton scale to assess the effectiveness of their intervention (Conca, Koppi, Konig, Swoboda, & Krecke, 1996). In Spain, another group used both the Hamilton and the Beck scales to measure effectiveness, and did not use neural data (Pascual-Leone, Rubio, Pallardó, & Catalá, 1996).

Two early research groups were notable for their use of neurological data. In the United States, Mark George and colleagues were the only early group to use both PET scans and clinical assessments to measure the effect of rTMS (M S George et al., 1995). George's study was also notable as the first double blinded control trial on rTMS. To prove the safety of rTMS, and to justify the effectiveness of their placebo condition, an American research group led by Robert Berman used an electroencephalogram (EEG) to show the absence of negative effects on patients in the experimental group, and the absence of effects at all on patients in the control group (Berman et al., 2000).

Starting in 2001, a number of reviews of the single site control trials began to report similar findings about the effectiveness of rTMS, and based their conclusions on similar bases of data (Loo & Mitchell, 2005) (Burt, Lisanby, & Sackeim, 2002; Wassermann & Lisanby, 2001). While most reviews found that rTMS was a
potentially therapeutic technique, some claimed that the actual therapeutic benefit was relatively small meaning that while use of rTMS caused statistically significant improvements in depression ratings, the magnitude of this effect was relatively small (O’Reardon et al., 2007). In addition to this, the small sample sizes, short durations, and ineffective sham conditions were also criticized as weaknesses of the studies (O’Reardon et al., 2007).

The first multisite randomized control trial of rTMS was published in 2007 by a University of Pennsylvania research group. The study was notable for its comprehensive design: in addition to being the first multi-site randomized control trial for rTMS, the designers of the study used the first sham stimulator for rTMS and used a wide variety of evaluation scales to assess the efficacy of rTMS(O’Reardon et al., 2007). For sham stimulation, the experimenters used a new, previously unused technique. Instead of angling the magnetic stimulator away from the patient's head to shield from the magnetic stimulation, the experimenters used a coil with a built-in shield to prevent magnetic stimulation from affecting the patients (O’Reardon et al., 2007). In addition to employing two different versions of the Hamilton Depression Rating Scale, the study designers used the Montgomery-Åsberg Depression Rating Scale, Clinical Global Impression Severity of Illness Scale, and the self report Inventory of Depressive Symptoms to measure outcome results(O’Reardon et al., 2007). Despite the wide variety of clinical assessment measures used in the study, functional neuroimaging was not used as an assessment measure, or presented as evidence. The study simply produced comparable results to the studies that had already been done: subjects receiving active rTMS were twice as likely to go into
remission as subjects receiving sham stimulation (O’Reardon et al., 2007). In addition to this, a lower percentage of subjects dropped out of the study compared to a typical study on anti-depressants. Overall, the 2007 trial was the most clear and emphatic demonstration of the potential benefits of rTMS therapy.

Comparing Evidence

The overlap in the types of evidence presented to justify rTMS and IPT are striking. Both rTMS and IPT primarily use clinical assessment ratings such as the Hamilton Depression Rating Scale as proof of the effectiveness of their studies. This similarity is particularly interesting because of the theory of depression underlying rTMS. Although rTMS studies were based on a body of PET evidence implicating the left dorsolateral prefrontal cortex as the cause of depression, PET scan evidence was not used to prove the effectiveness of rTMS. Instead, the types of evidence used to justify its efficacy were very similar to IPT. PET scan evidence was used on occasion as support for the clinical assessments. Nonetheless, other than the infrequent, auxiliary use of neurological information, the bulk of rTMS was conducted using the same types of clinical assessments as IPT.

Reviews of IPT show it to be moderately to highly effective for the acute treatment of depression (Cuijpers et al., 2011) (de Mello, de Jesus Mari, Bacaltchuk, Verdeli, & Neugebauer, 2005). In these reviews, it is shown to be as effective as other forms of talk therapy. Meta-analyses and reviews of rTMS studies also show it to be a moderately effective treatment for depression (Burt et al., 2002; Padberg & George, 2009). Thus, in addition to the presenting similar types of proof for their efficacy, neither IPT nor rTMS proves itself to be a superior form of treatment.
Conclusion

Given the differences in the conceptions of depression underlying the two treatments, the methodological similarity between rTMS and IPT is surprising. After all, comparing a talk therapy with no physical mechanism of intervention and a brain-based treatment that does not use patient circumstance should be like comparing apples and oranges. Yet, despite these differences, the outcome assessments of the two treatments are remarkably similar. The Hamilton Depression Scale, Beck Depression Inventory and Clinical Global Impression are commonly used for the proof of both IPT and rTMS. Despite the implicit neurochemical explanation for depression used for rTMS research, neurochemical evidence such as PET scans were only occasionally used to test the effectiveness of the treatment.

This chapter compared two treatments that were justified using similar mechanisms and techniques. Both rTMS and IPT are structured treatments that were justified using comparable types of evidence. The similarity between the two treatments raises the question: why are neuroscientific, brain based treatments considered as radical shifts away from previous practices, and why are they seen as transformative? There are clear similarities in the way we measure the outcomes of IPT. Thus, the separation between brain-based treatments and talk therapies does not arise from the type of evidence presented by researchers of brain-based therapies or the structure of the therapies themselves. Instead, to understand how and why brain based treatments are regarded as essentially distinct from psychological ones and held to be superior to them, it is critical to examine both the cultural context of the brain and the social systems affecting neuroscientists.
Chapter 3: Neurochemical Selfhood and Recovery

Introduction

The last chapter compared the methodologies of two treatments for depression and examined the particular types of evidence offered as proofs for their efficacy. Despite their conceptually disparate descriptions of the causes of depression, both rTMS and IPT shared significant methodological similarities. The limited durations and strict procedural techniques of both treatments made them both well suited for rigorous scientific testing. The previous chapter showed that though neural data was used for the development of the underlying theory of rTMS, it was not used for the justification of its efficacy. Rather than relying upon PET scan data to show the effect of rTMS, rTMS researchers have used the same types of assessment scales as researchers for IPT. Thus, these two seemingly very distinct treatments for depression have been tested using the same tools of evidence production, and the results were demonstrated using similar types of measurements.

The similar types of evidence offered by the brain-based treatment of rTMS and the talk therapy IPT complicate the image of neuroscience as a fundamentally different technique of inquiry. During a 2013 speech introducing the BRAIN Initiative, Barack Obama remarked that the results of the BRAIN initiative would be "transformative" for understanding the way humans remember, learn and think (Obama, 2013). Obama's use of this language at the outset of a major funding campaign for neuroscience is telling. The optimism of his words resonates with the optimism of neuroscientists, both suggesting an expectation that the progress of neuroscience will reveal fundamentally new knowledge about both the self and the
world. Since the 1990s, a number of new "neuro-disciplines", such as neuroeconomics, neuroeducation and neuroaesthetics have emerged. One driving impetus for the development of these disciplines has been a desire to revolutionize human sciences by incorporating brain-based information. This attitude was captured by University College London professor of neuroaesthetics, Semir Zeki, who said, "my approach is dictated by a truth that I believe to be axiomatic—that all human activity is dictated by the organization and laws of the brain; that, therefore, there can be no real theory of art and aesthetics unless neurobiologically based" (Fernando Vidal & Ortega, 2010). In 2003, the author of a book about the progress and potential of transcranial magnetic stimulation research wrote "we find ourselves at a point in history where the techniques available have advanced to meet questions that have been awaiting them—and there is a burden on us to make good this opportunity" (Walsh & Pascual-Leone, 2003). However, contrary to this statement is the case study of rTMS and IPT, which finds no clear superiority in the types of evidence brought to bear by neuroscientists. Thus, if it is not the case that neuroscientists use novel techniques of inquiry to prove and justify new neuroscience technologies or generate stronger findings, from where does neuroscience derive its reputation as "transformative"?

The popular conception of neuroscience as "transformative" is premised on cultural conceptions of the brain, specifically, an image of the brain that is essentialist and progressive. Modern descriptions of the brain imply that "you are your brain", this description suggests both that brain activity can describe any personal experience, and that any personal experience manifests in observable brain activity. The notion of
the brain as an area for improvement stems from this essentialist view; if "you are your brain", then the progressive conception of the brain suggests that "your brain can be improved, and thus so can you".

This chapter considers some of the mechanisms that create this image of the brain and its determinative powers and will discuss some of the implications of this image. To begin, discuss "the cycle of hype", a model of science communication that promotes positive media coverage while de-emphasizing news coverage of the risks and drawbacks of new technologies. After describing "the cycle of hype", I examine coverage of the brain in the media. Media coverage of the brain typically reinforces notions of neuro-essentialism or "neurochemical selfhood", providing an exploratory framework of the brain as the critical locus for explaining human experiences. Finally, these considerations are illustrated through media studies of brain reports.

**The cycles of hype and hope**

To analyze the popular representation of the brain, it is important to delineate the incentivizing forces that shape it. Describing media representations of genetic technologies, legal scholar Timothy Caulfield writes, "social forces create a particular spin on popular representations of biotechnology, which is usually an optimistic picture that minimizes possible risks and limitations" (Caulfield, 2005). This inclination towards positive coverage can be viewed as the result of a feedback cycle between the media, the public, and scientists. From his research on media portrayals of genetic technologies, Caulfield identifies a "cycle of hype" that contributes to the exaggerated portrayal of genetic technologies in media: in the representation of biotechnologies, hope often accompanies hype. Sociologist of science Michael
Mulkay described "the rhetoric of hope" surrounding a protracted debate about the use of human embryos for research in Britain in the 1980s (Mulkay, 1993). Both Caulfield's and Mulkay's analysis offer useful tools for interpreting the rhetoric of biotechnologies and identifying some of the forces that influence it. Together, these themes of hype and hope offer a model of science communication that is structured to produce an optimistic view of biotechnology. In this model, positive media coverage is based on reports from scientists, who face procedural and social pressure to focus on the practical, applicable features of their work. This media coverage is then taken up by the public, who form the expectations that pressure the scientists, starting the cycle again.

For both genetic and neuro-technologies, most media coverage is either neutral or positive (Caulfield, 2005) (Racine, 2005). "Positive coverage" in this context typically means that the benefits, either real or potential, are emphasized over potential ethical issues or material risks associated with the new technology. Without a doubt, the pressures of contemporary media contribute to this phenomenon. Roger Highfield, science editor for the Daily Telegraph newspaper notes that there is intense competition for attention from readers (Highfield, 2000). Describing the culture surrounding genetic technology, Highfield writes that the need to attract viewer attention "encourages triumphalism, so that every gene is a milestone on that road to a cure" (Highfield, 2000). Such pressures of news media lead to a presentation of neuroscience in which every discovery in research is a destination: instead of reporting progress, discoveries in neuroscience are heralded as moments of arrival into a new future of deep insight.
Although it is commonly believed that media coverage distorts the information presented by scientists, Caulfield found that this is not the case. Of the 627 newspaper articles and 111 scientific papers used in his analysis, more newspaper articles (15%) than scientific articles (5%) focused on risk (Caulfield, 2005). This trend is consistently reported in media reports on biotechnologies (Caulfield, 2005). Thus, although current media coverage of new biotechnologies disproportionately emphasizes the positive effects and potential benefits of neuro-technologies, the reasons behind this phenomenon are more complex than simple media exaggeration.

Although many in the scientific community do not believe that the media is knowledgeable about their research, 80% of scientists reported that their work was translated accurately into the press (Caulfield, 2005; Gething, 2003) (Wilkes & Kravitz, 1992). This, combined with the unequal relationship between the amounts of risk described in scientific articles and the amount reported in the media, indicates that scientists have a significant role in the hype surrounding biotechnologies. Considering the pressures to secure and maintain funding for their work, scientists' hype surrounding biotechnologies is not particularly surprising. Caulfield and Mulkay both note the importance of emphasizing the practical benefits of research. According to Caulfield, "there is growing pressure to "sell" research in practical and exciting terms" (Caulfield, 2005). Likewise Mulkay notes, "research is presented as being worthy of support because it has already begun to pay off in practical ways and because it will, if allowed, continue to produce various highly-valued outcomes" (Mulkay, 1993). The effect of these pressures is evident when scientists advocate for policy, and when they seek funding.
In the 1980s, the British Parliament debated the potential benefits and ethical concerns of the use of human embryos in research in what came to be called "The Great Embryo Debate" (Mulkay, 1993). The debate contained strategic agendas used by advocates of embryo research to justify their work to a skeptical audience. Advocates of embryo research portrayed their work as forward looking and practical to secure approval (Mulkay, 1993). Scientists crafted an argument in which "embryo research is equated with hope for a better world because, like medical science more generally, it is conceived as the source of more effective techniques for controlling that world" (Mulkay, 1993). Therefore, to diminish the importance of the potential risks and ethical concerns surrounding the research, the supporters suggested that embryo research would allow scientists to better control the world and thus, effect positive change in it. Scientists working on the Human Genome Project used similar rhetorical techniques as the advocates for the use of human embryos. When the Human Genome Project was seeking funding from congress, researchers emphasized the potential benefits that genome sequencing would provide for the diagnosis and cure of genetic disease (Caulfield, 2005). Whether in the public or private sector, the effect of this incentivizing force is evident. Thus, industry supported research papers are typically biased towards reporting positive findings, meaning there is a pressure towards demonstrating the effectiveness of the research (Caulfield, 2005). Venture capitalists who fund research expect a return on their investment; not surprisingly, scientists tend to emphasize the potential benefits of their technology to assure these potential funders that their research will result in a return on the investor's investment (Caulfield, 2005).
The cycle of hype and hope arises from a combination of at least three factors, scientists, the media and the public. Although the media is involved in the cycle of hype, it is not solely responsible or the transmission of positive and fantastic information about science and biotechnology. Although there is a pressure to report things that are "newsworthy", and therefore are markers on the path of progress, much of the information they report stems from a systematic bias in science that emphasizes positive reports about science and biotechnology. The public is also not absent from the cycle of hype. As the consumers of the media about new biotechnologies, the public's view of developing biotechnologies is in large part shaped by the media. Nisbet and Lewenstein found that "with an increase in the amount of media coverage of biotechnology and a measured shift in the character of coverage [there was a] corresponding change in perceptions among the opinion leading public" (Nisbet & Lewenstein, 2002). Thus a feedback cycle is created in which the media, informed by the buoyant inclinations of scientists, conveys a generally hopeful view of biotechnology that is taken up by the public. The optimistic expectations of the public are then projected onto scientists as they seek funding their work, restarting the cycle of hype.

As found with neuroscience, the cycle of hype promotes the explanatory power of brain. Not all neuro-technologies are designed for explicitly medical purposes. Because of this, the justification of the practicality of brain research requires a different type of focus. Instead of explaining the potential cures for disease that neuroscience can offer, the brain becomes a means of explaining everyday life. Through understanding the brain, neuroscience seeks to explain a fundamental part of
humanity, and helps to explain day-to-day life. The cycle of hype helps perpetuate the idea of "neurochemical selfhood", the idea that the biological function of the brain provides a lens through which to interpret every facet of human experience. The cycle of hype serves to support a neuro-essentialist conception of selfhood, yet neurochemical selfhood is actually deeply historically rooted. Rather than creating and perpetuating a particular notion of the brain's relationship with the self, the cycle of hype serves to amplify notions of the brain that have been around for centuries.

Neuro-essentialism

Neurochemical selves

Historian of science Fernando Vidal argues that our "contemporary" conception of the brain as the home of the self is, in fact, not all that modern at all. Instead, our contemporary conceptions of brainhood and its connection with selfhood are rooted in a long history that has led us to a point in which neurochemical selfhood seems natural (F Vidal, 2009). Theories about the location of the self in the brain dates back to the 17th century, when John Locke wrote about thought experiments seeking to better understand the location of consciousness. Writing that nerves convey sensory information ‘to their audience in the Brain, the mind’s Presence-room’, Locke believed that the brain was location of the self. (F Vidal, 2009).

The historical localization of selfhood to the brain and the projection of "brain-based" information as a surrogate for self-knowledge continued with the advent of phrenology in the 19th century (F Vidal, 2009). Phrenology, the scientific practice based on the assumption that different characteristics of the self are reflected in the magnitude of different brain areas, would become outdated. However, its
popularity reflects the pervasive historical narrative of inferring deep character knowledge from information about the brain. The brain has continued to be a site for inquiry into the bases of selfhood and consciousness. In the 20th century, researchers dissected and examined the "elite" brains of famous individuals such as Albert Einstein and Vladimir Lenin (F Vidal, 2009). In these investigations, scientists searched for physical manifestations of the characteristics that differentiated these individuals. Characteristics such as cortical thickness, neuronal density and absolute size were said to distinguish these "elite brains" from others. The extended historical trend of using the brain as a stand in for consciousness is described in the contemporary era as the phenomenon of "neurochemical selfhood".

Sociologist and social theorist Nikolas Rose carefully noted that the legacy of neurochemical selfhood does not obligate its existence as the only cultural lens for identity (Rose, 2007). Other modes of explanation still exist, but have become increasingly secondary to the dominant explanatory model of neurochemical selfhood; in fact, Rose notes the increasing presence of the brain in domains previously interpreted through alternate explanations of the self (Rose, 2007). The brain appears to bridge the gap between experience and reality. The effects of life experiences can be demonstrated through observing their effects on the brain. Describing this phenomenon Rose writes, "environment plays its part, but unemployment, poverty, and the like have their effects only through impacting the brain" (Rose, 2007). Thus, in the contemporary era, the brain appears as the seat of the self, and the hub through which all experience passes. Through its positioning, the brain takes on a superlative, deterministic role in everyday life. Current media shows
this conception of the brain as a cultural artifact. The contemporary brain can be read to provide insight into the depths of a psyche, and can be used as evidence for claims about the essential bases of human life.

The brain in the media

Media representations of the brain shape public understanding of the brain, and reflect the ways that neurochemical selfhood permeates popular conceptions of the brain. Eric Racine, a neuroethicist, described the brain's appearance in newspaper reporting as "a secular equivalent to the soul" (Racine, 2010). This description of the brain captures an important facet of its modern portrayal, and by extension the portrayal of neuroscience. Neuroscience thus serves as the tool of exploration for the new neurochemical self, and its evidence is used in news media to allow insight into subjects ranging from the mysteries of one individual's mind, to gendered differences in life potential. In a 2010 analysis of newspaper paper articles published between 1995 and 2004, Racine and his colleagues found that media coverage of neuroscience articles trended towards reinforcing "neuro-essentialism" and "neuro-realism" (Racine, Waldman, Rosenberg, & Illes, 2010). Neuro-essentialism described as "interpretations that the brain is the self-defining essence of a person", is best demonstrated through example (Racine et al., 2010). Racine categorized a 1999 New York Times article by Stephen S. Hall titled “Journey to the Center of My Mind” as containing neuro-essentialist language. The article is notable both for what Hall "discovered" about himself through studies on his brain and his expectations for what neuroscience could teach him about himself.
In that article, journalist Stephen S. Hall worked with neuroscientists at Weill Medical College to take, in his words "a tour of my own brain" (Hall, 1999). Undergoing a battery of neuro-psychological tests in an fMRI machine, Hall hoped to get "a glimpse of that I -- my mind -- in the course of my travels [through the brain]" (Hall, 1999). Hall's expectations and hopes for his explorations reveal the cultural expectations projected onto the brain. Describing the series of tests as "almost autobiographical studies", Hall used the tests as an opportunity to explore the "things that might be unique to me as a writer and as a person" (Hall, 1999). Thus, Hall expected to gain deep personal insights into himself through his fMRI scans. At times, Hall supplanted his own consciousness with neural activity. He indicated that the fMRI revealed subconscious activity saying, "I didn't hear any of it. But, my brain did" followed by "It was almost as if I subconsciously filtered out the background noise and only heard what I needed to hear" (Hall, 1999). Given that he didn't consciously "hear" any of the sounds he reported on, Hall's personification of the brain and projection of agency onto it represent the extent to which selfhood is located in the brain. The brain in his article performed functions of the self that Hall was not aware of, positioning it as a more pure distillation of his intention and interaction with the world than his conscious self. The extent to which Hall created this image of the brain is evident in his final paragraphs, in which he wrote,

"I can imagine a day in the distant future when the M.R.I replaces the couch, when the therapist uses words or odors or pictures to excite and pinpoint circuitry and then the neuroanatomist translates the images into explanations of behavior."

(Hall, 1999)

Themes from Hall's writing regularly appear in other articles as well, as other journalists both distill selfhood into the brain, and project brain based conceptions of the self to events and truths outside of the neural world.
In a media analysis similar to Racine's, Marie O'Connor described the extrapolation of basic neuroscience findings far beyond the scope of their authority (O'Connor, Rees, & Joffe, 2012). One instance of this, from the British newspaper The Daily Telegraph reads,

“Superwoman has been rumbled. Juggling a career, a family and an active social life is quite literally a waste of time, according to scientists. A study reveals today that attempting several tasks at once is inefficient and could even be dangerous. The findings challenge the notion of women ‘having it all.’” (Daily Telegraph, August 6, 2001)

This excerpt represents the privileging of neural information over other types of information. The study being repeated did not consider gender, broad life decisions or work-life balance, instead focusing on the extent to which different models of executive function are supported by evidence (Rubinstein, Meyer, & Evans, 2001).

Thus, the claims made in the newspaper article take basic brain function and expand the jurisdiction of its relevance far outside the confines of the brain.

The brain also appears in newspaper reports as an index of difference through people can be separated and differentiated into types. The use of the brain in this way essentializes different people into different types of selves. One example of this, taken from the United Kingdom newspaper The Time, reads,

“Addiction is viewed as a mental disorder, and gays are known to be at higher risk of anxiety, depression, self-harm, suicide and drug abuse. Most studies suggest that these problems are brought on by years of discrimination and bullying. But there is another controversial thesis—that gays lead inherently riskier lives. Gambling stimulates the dopamine system in the brain; illicit drugs pep up the same system. Are gays dopamine junkies?” (Times, December 18, 2006)

Such reporting presumes that homosexuality is rooted in the brain, and that a neural account of homosexuality provides insight into its fundamental causes. Such deterministic descriptions of the brain capture the extent to which the complicated mysteries of life are portrayed to be crystallized in the brain (O'Connor et al., 2012).
The Modern, Progressive Brain

The previous section described the cultural idea that "you are your brain", yet, a logical implication of that trajectory is that, "your brain can be improved and thus so can you". The brain has become a site not only for situating selfhood, but also a locus for improvement that yields benefits across numerous domains of life. The influence of the rise of neurochemical selfhood can be seen in the extent to which brain-based explanations pervade cultural descriptions of improvement and betterment.

Self-help books offer a starting place for examining the extent to which the brain is identified as a site for improvement. Self-help books are written in informal, easily understood language, and their intended use is problem solving (Thornton, 2011). Given this style, they are an ideal way of analyzing how neuroscience is presented to the public. Further, their audience must grasp what is written in order to mobilize it for use (Thornton, 2011). These features make self-help books prime cultural artifacts to examine how neuroscience and the brain are thought to provide avenues for self-improvement.

Daniel Amen is a neuroscientist specializing in SPECT imaging (a functional imaging technique similar to PET scans or FMRI) and is the author of multiple best-selling self-help books. Amen's Making a Good Brain Great is a self-help book premised on the idea that the brain based suggestions Amen offers confer a degree of authority and certainty to them. SPECT scans are not universally accepted in the neuroscience community as a useful, effective tool in clinical settings (Thornton, 2011). However, much of Amen's work is based on the use of this SPECT tool.
Amen's descriptions of the use of SPECT imaging claim that at times, the viewing of the image itself is intrinsically therapeutic (Thornton, 2011). Writing about an Amen client who viewed a SPECT scan as the beginning step for treatment, Davi Johnson Thornton writes, "Through her encounter with the visual evidence of her scan, Josey was convinced that her problems were not the result of an immoral or defective character, but rather were medical problems demanding scientifically validated treatments" (Thornton, 2011). SPECT scans, and a brain based self-conception, help to actualize problems previously conceived as ephemeral in nature.

In his self-help books, Amen uses this brain-based ideology to provide readers with varied types of advice. Amen's book covers a number of standard topics for self-help books, including diet, exercise, social interaction, and stress management (Thornton, 2011). However, despite the brain based nature of the suggestions Amen offers, the suggestions themselves are not particularly novel. For instance, regarding diet, Amen denounces foods that are "laden with calorie, carbohydrates and damaged fats", and includes a collection of healthy recipes in his chapter (Thornton, 2011). Fine advice, but it is Amen's framing of the tips that separate it from other framings of self-help. Amen's arguments are not aimed at the health of the person, but rather the health of the brain. Writing about Amen's book, Davi Johnson Thornton writes, "Food is a 'powerful brain medicine' and the suggestions are 'brain promoting nutritional tips' (Amen, 2005). Calorie restriction is 'helpful for the brain' and the recipes are 'brain-healthy' (Amen, 2005). Thus, Amen's influence and rhetorical strength do not come from the original or innovative nature of his advice, but instead come from the already accepted authority of his brain-based explanations.
Brain health, and by extension, the health of the self, is also of great concern in discourses surrounding child development. The idea of critical periods, periods of time during which a baby's brain are "wired", creates a narrative of child development that fits neatly into the historical trend of neuro-essentialism previously described. "Wiring" and the figurative use of computerized language reinforce deterministic notions of neurochemical selfhood (Thornton, 2011). At birth, certain parts of a baby's brain are "hardwired" while others remain undetermined and are shaped by the life experience of the developing child (Thornton, 2011). However, life experience does not have equal impact during all parts of a child's development. Instead, the first three years of a baby's development are emphasized as a part of the "zero to three phenomenon", what Thornton describes as "a loose affiliation of scientists, child advocates, celebrities and politicians who insist that the first three years of an infant's life are crucial for the child's brain development and thus their future identity and behavior." (Thornton, 2011).

Specifying a particular window for brain development creates a set of pressures and anxieties during that period. Social interaction and emotional development take on greater importance because of the greater malleability of the baby's brain. During this time, parental errors can be made up and mistakes can be repaired (Thornton, 2011). Describing studies done about the effect of maternal depression Thornton writes that,

The studies found that "mothers who were disengaged, irritable, or impatient had babies with sad brains." Timing is everything: for a short period, the baby's brain is "forgiving" and emotional damage can be repaired. "If a mother snaps out of her depression before her child is a year old," brain activity picks up. If the mother remains depressed, the window is lost. (Thornton, 2011)
Thus, these cultural anxieties are rooted in brain-based knowledge. The brain's presence in this theory of child development reinforces both essentialist and deterministic models of the interaction between the brain and the child. Claiming that after a certain age, the brain is no longer as sensitive to environmental stimuli, the "zero to three" movement implicitly reduces the totality of child development to the brain and reinforces notions of the brain as an object that can be modified for life improvement. This notion of a modern, progressive brain is also seen in rhetoric surrounding recovery from mental illnesses.

Understanding how the brain is perceived as a site for recovery requires analyzing how it is seen as a space for dysfunction. This type of portrayal of the brain happens in multiple rhetorical spaces. For instance, a 2006 report, *The State of Depression in America*, published by an advocacy group for mental health care policy reform, emphasized that "depression is a real illness" (Frank et al., 2006). This need to classify and justify depression as a tangible, material illness leads to a particular descriptive method. After writing, "depression is a real illness" the authors of *The State of Depression in America* include PET scan images of "a depressed and normal brain" (Frank et al., 2006). The two brains show clear aesthetic differences. The normal brain is lit up, showing activity throughout many different areas, in contrast, the depressed brain is mostly dark, devoid of the
bright spots associated with active brain regions (Frank et al., 2006). Thus, the depressed brain is an object with distinct and clear room for improvement. This type of rhetoric in mental health showing the brain as a primary area for improvement is echoed in direct-to-consumer advertising for anti-depressants.

Similar to self-help books, direct-to-consumer advertising helps provide insight into how neuroscience is presented to the general public. In 1997, the FDA changed its policies regarding direct-to-consumer advertising for prescription pharmaceuticals (Thornton, 2011). As a result, many consumers go to doctors seeking specific medications (Thornton, 2011). For pharmaceutical companies, the marketing of these medications requires the advancement of a particular framework for explaining mental health. Thornton writes "In order to purchase this product, a consumer must identify personal distress, recognize this distress as a potential disease rooted in biology" (Thornton, 2011). Thus, pharmaceutical companies have a vested interest in promoting the brain as the object of modification for recovering from mental illnesses. When consumers believe that the brain must be targeted, anti-depressants and other psycho-pharmaceuticals are an obvious choice for modifying the root causes of mental illness. Thornton summarizes the advertising of the pharmaceutical companies saying they are "epitomized by the ubiquitous sketches comparing the quantities of neurotransmitters between neurons in "healthy" and "depressed" (or otherwise afflicted) brains" (Thornton, 2011). The result of these advertising campaigns can is evident in the vernacular surrounding depression. Expressions like "my serotonin levels are low today" or "he must have a chemical imbalance" that are used to describe mental illness and everyday life underscore the
extent to which the brain has become a lens to interpret everyday life (Thornton, 2011). These expressions reflect a conception of selfhood that is intimately linked to the brain, its chemicals, and their impact on every day life. As a result, the brain becomes a space for self-improvement, an arena in which chemicals can be altered, changing the experience of the self.

In summary, the current era of neurochemical selfhood, the brain has become a target for self-improvement. This targeting spans many topics ranging from advice on diet, to advice on child raising to descriptions of the causes of mental health problems. Self-help books show that the brain is a hub through which advice on many, seemingly unrelated topics, must pass. Similarly, the brain has become an important focus for improvement in child development. Neuroplasticity, or the lack of neuroplasticity, has become a focal point for parents seeking to give their children the best possible start to life. Finally, the brain is an important image in mental health care to visualize both dysfunction and recovery. The brain is presented as a target for improvement. Because the brain is used in advice ranging from diet, to child-raising to mental health, technologies that act on the brain take on a special precedence. By directly modifying brain activity, neuro-technologies are able to directly modify "neurochemical selves".

**Conclusion**

This chapter examines popular representations of the brain and the forces in the communication of science that shape them, analyzing both the content of these representations, and the mechanisms that influence their presentation. The pressures of funding and policy approval incentivize scientists to focus on the positive elements
of their work, often times emphasizing the practical applications of their research. For neuroscience, the practical is both biomedical application of neuro-technologies, and the use of neurochemical framings of selfhood to describe the everyday experience of life. For neuroscience, the cycle of hype serves to amplify the idea of neuroscience as a central means of interpreting everyday life.

Touting neuroscience as a lens to the everyday life fosters an essentialist image of the brain, forwarding a belief that that all human activity can be understood using the brain as a primary explanatory tool. Consequently, the brain becomes a space of self-improvement. The brain's role as a space for self-improvement helps to explain the cultural power of "brain-based" treatments for mental health problems.

Given the media presentation of the brain, the reasons neuroscience is described as a “transformative” discipline are clear. Neuroscience acts as a tool through which we can directly monitor and modify our selves. Thus, the substance of how neuroscience justifies its discoveries is less important than what the discoveries represent. Neuroscience is viewed as a collection of techniques for direct, unmediated contact with the self and derives its rhetorical strength from the possibilities this ability offers.
Conclusion

This thesis analyzed the contemporary cultural place of neuroscience by situating it historically, comparing it with non-brain-based treatments, and examining the social and cultural forces that affect its public perception. This analysis complicates the notion of neuroscience as a "transformative" discipline. Although neuroscience is often presented in the media as a tool for deep, meaningful insight into the basis of the self, the actual evidence presented for rTMS, a brain-based treatment was very similar to the evidence presented for IPT, a talk therapy with a similar structure of treatment. Because of this similarity, we must ask, how has neuroscience come to be regarded as "transformative", and what are the implications of this cultural image?

Neuroscience emerged during a period of significant changes in clinical psychology as new techniques and treatments arose, and a more standardized, quantified discipline arose. Scientific tools such as the DSM, the Hamilton Depression Rating Scale and randomized control trials were used as means to compare treatments, regardless of their conceptual background. Coincident with this, disorders came to be defined by their symptoms rather than their causes. This transition in clinical psychology produced disciplinary standards that make a comparison between different treatments and their efficacy possible.

Comparing rTMS and IPT reveals few differences in the structure of the treatments or types of evidence presented for their efficacy, despite the conceptual differences in their underlying theories of depression. Both rTMS and IPT use measurements such as the Hamilton scale to diagnose and assess the severity of
depression, rTMS frames depression as an entirely brain based disorder while IPT acknowledges and emphasizes psychosocial progenitors of depression in addition to the biological causes. In spite of these discordant theories of depression, both rTMS and IPT function in a similar way; they are both time-limited treatments with predefined treatment structures. Furthermore, the two present proof of their efficacy in similar ways. Although rTMS is based on PET scan evidence implicating the left dorsolateral prefrontal cortex as the causal locus of depression, PET scan data was rarely used to show the effectiveness of it as a treatment. Instead, rTMS and IPT both use clinical assessment scales such as the Hamilton Depression Rating Scale and the Beck Depression inventory to demonstrate their efficacy.

The distinct similarities between the structure and scientific justification of rTMS and IPT complicate the standard cultural image of neuroscience. As talk therapy falls to the wayside, neuroscience has come to be considered a superior tool for inquiry, offering seemingly objective accounts of a crystalized self. Examining media reveals both how neuroscience is presented to the general public, and thus what narrative of neuroscience is transmitted out of the lab. Popular portrayals of neuroscience reinforce an essentialist historical notion of the brain, and position the neuroscience as a tool for self-exploration. The media emphasizes the potential of neuroscience to offer deep insights into the new neurochemical self. Because of this, the brain is presented as a target for self-improvement in advertising and consumer targeted media such as self-help books. Brain based approaches to self-improvement, including mental health care treatments, benefit from a cultural conception of the
brain that asserts that these brain based approaches offer a more direct means of self-
modification.

This brain based, multifaceted cultural image of the brain, and the story of its rise to precedence help explain the trends my mom observed in talk therapy, but it does not provide a comprehensive explanation. It would be reductionist to frame the decline of talk therapy as purely the result of a conceptual shift toward a culture of the brain. Conceptual shifts towards somatic theories of mental illness, the success of the pharmaceutical industry, and other forces contributed as well. Economic forces have strongly influenced clinical practice. The use of sustained, systematic approaches to talk therapy such as IPT has declined as traditional talk therapists struggle to operate financially sustainable practices; instead of hour-long sessions devoted to particular issues, many psychiatrists previously trained as talk therapists now devote much of their time to brief consultations with clients, mostly for the purpose of recommending medications. The financial incentives for these arrangements make the choice to transition away from talk therapy clear. According to a 2011 *New York Times* article, a therapist can make $150 for three 15-minute medication sessions compared to $90 for a 45-minute talk therapy session (Gardiner, 2011). These brief session practices do not serve as therapy sessions meant to advance a non-pharmaceutical treatment plan, but rather as opportunities for the clinician to ensure that the dosage of the prescribed medications does not need to be adjusted.

Neuroscience has rapidly become an extensive field with far reaching influence, yet we must ask, what are the boundaries of its authority? As neuroscience develops and becomes increasingly intertwined with daily life, its ascendance
challenges older perspectives of personhood. The perspective neuroscience offers is both determinist and limited. By using the confines of biology as its scope for inquiry, neuroscience presents a blurry representation of personhood, lacking in the history and depth provided by the descriptive techniques of previous models. Thus, as neuroscience grows, critical consumers it produces need constantly question the extent to which neuroscience provides a superior lens for understanding the self and the world. Although there is a vast amount of rhetoric supporting notions that neuroscience provides more definitive and scientific truths than previous models of understanding personhood, careful examination of the evidence produced by neuroscience complicates those notions. Careful consideration of neuroscience and its claims reveals this: the cultural image of neuroscience does not arise from evidence alone. Instead, many of the essential techniques of neuroscience rely on the same structures of scientific knowledge production as those using of older, supposedly inferior methods of inquiry. Because of this, we must constantly question the extent to which neuroscience provides an account of our selves that is novel, nuanced, and descriptive.


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